Progress®

Corticon Studio:
Rule Language Guide

Progress® Corticon®

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1

Introduction to Corticon Rule Language

Graphical modeling languages and tools (UML, ER, ORM, for example) are not sufficiently precise for specifications. Additional constraints on the objects in the model must also be defined. While natural languages are easily used by individuals without a programming background, they are often ambiguous. On the other hand, formal programming languages are precise, but not easily used by business analysts and other non-programmers.

The Corticon Rule Language has been developed to resolve this dilemma. Based on the Object Constraint Language (OCL, an extension of the Universal Modeling Language specification 1.1), the *Corticon Rule Language* (CRL) is designed to enable non-programmers to express rules clearly and precisely without the use of procedural programming languages. More information on OCL may be found at www.uml.org.

For details, see the following topics:

- Rule structure
- Basic data types
- Truth values
- Collection operators
- Language operators
- Vocabulary used in this Language Guide

Rule structure

In traditional programming languages (or logic systems), most rules are expressed via IF/THEN structures. The IF clause contains a conditional expression and the THEN clause contains actions the rule should perform if all conditions have been met. This IF/THEN structure is expressed as Conditions and Actions in the Rulesheet user interface of Corticon Studio. For more information on building and organizing rules in Corticon Studio, see the *Corticon Studio Tutorial: Basic Rule Modeling*.

Basic data types

The proper expression and execution of rules in Corticon Studio is dependent on the type of data involved. Each attribute in the Corticon Studio Business Vocabulary has a data type, meaning that it has restrictions on the type of data it may contain. Corticon standard data types as listed and described in the following table:

Data Type	Description
String	Any combination of alphanumeric characters, of any length
Integer	A whole number, including zero and negative numbers, of any length
Decimal	A number containing a decimal point, including zero and negative numbers, of any length
Boolean	Values are `true` and `false`. `T` and `F` may also be used.
DateTime	Values must be entered for both date and time.
Date	A value with only date information. No Time information is allowed.
Time	Value with only time information. No Date information is allowed.

In this guide, the data types Integer and Decimal are often referred to by the generic term <`Number`>. Wherever <`Number`> is used, either Integer or Decimal data types may be used.

Syntax such as <`DateTime`> indicates that data must conform to the data type shown in angle brackets (<`..`>). For this example, you might enter `9/13/2013 2:00:00 PM EST`. Do not type the angle brackets themselves.

See Formatting Date, Time, and DateTime properties on page 197 for further details on formatting DateTime, Date, and Time information.

Truth values

This guide uses the notation <`Expression`> to refer to some combination of terms from the Vocabulary that resolves or evaluates to a single “truth value”. A truth value is the Boolean value (`true` or `false`) assigned to an expression upon evaluation by the rule engine. For example, the expression `Patient.name='John'` has a truth value of `true` whenever the patient's name is John. If it is not `John`, then the truth value of this expression is `false`.

Collection operators

Many of the operators provided in the Corticon Rule Language deal exclusively with collections of entities. When using collection operators, the expression **must** use aliases to represent the collection(s) operated on by the collection operator(s). A complete discussion of aliases is included in the *Rule Modeling Guide*. Reminders are included throughout this manual wherever collection operators are referenced.

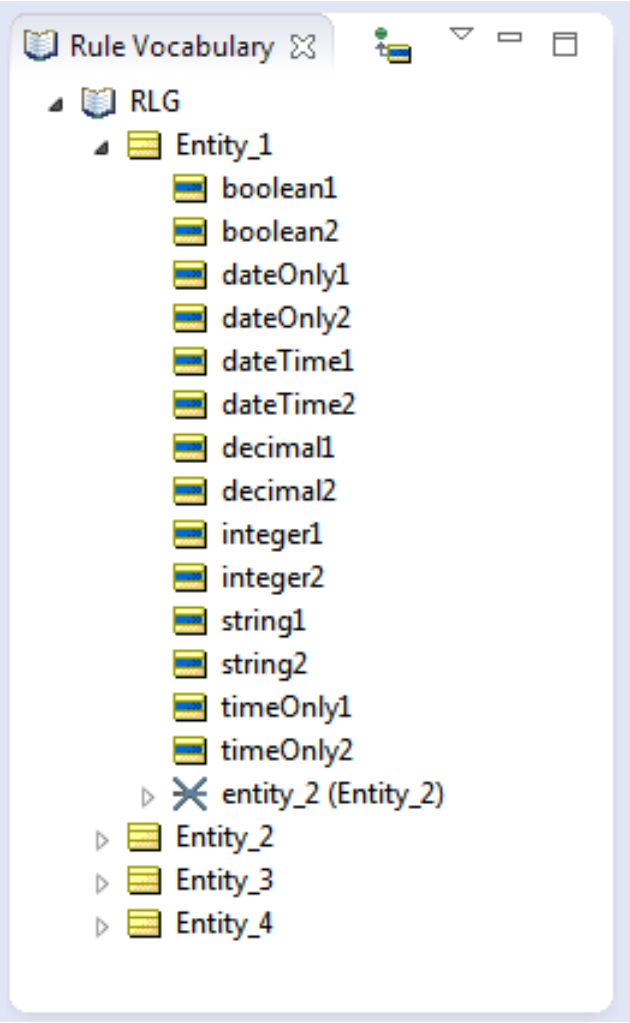
Language operators

The Corticon Rule Language operators can be grouped into various classifications as shown in the following tables. Each operator is subsequently described in detail in the Language Reference section of this document. This section includes a detailed description of the operator, its syntax, usage restrictions, and an example in a Corticon Rulesheet.

Vocabulary used in this Language Guide

This guide uses a generic Vocabulary in all its examples. The Vocabulary contains four entities, each of which contains the same attribute names and types. Attribute names reflect their data types. For example, `integer1` has a data type of Integer. This generic Vocabulary provides sufficient flexibility to create examples using all operators and functions in the Corticon Rule Language. `Entity1` is shown expanded in the following figure:

Figure 1: Vocabulary used in Corticon Language Guide examples



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Rule operators

This chapter describes the toolset for accessing and using operators.

For details, see the following topics:

- Icons
- Tool tips
- Usage restrictions

Icons

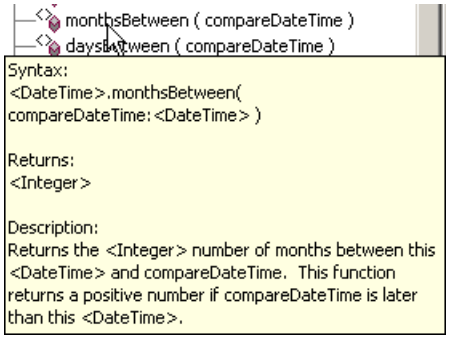
Rule Operators are assigned icons which provide the user with information about their usage. The following table describes these icons:

Icon	Where Found	Purpose	Examples
	General, Literals category	indicates special values or constants	null, true, other
	General, Functions category	indicates system values that are automatically retrieved upon rule execution.	now, today
	Operators, Boolean category	this special “unary” operator icon is used only with not	not
	Operators, all categories	indicates the operator uses a period “.” to attach to its operand. Most operators with this icon typically fell into the previous “function” category.	day, round, contains
	Operators, all categories	indicates the operator is used between two operands. Most operators with this icon typically fell into the previous “comparison” category.	equals, multiply
	Operators, Collection & Sequence categories	indicates the operator is used with collections or sequences. Also indicates an alias must be used to represent the collection operated on.	sum, size
	Extended Operators	indicates the operator has been added to the Vocabulary using the extension framework described in *Corticon Extensions Guide*.	-

Tool tips

In Corticon Studio, moving the mouse over a Vocabulary operator and pausing, or “hovering” for a moment, will cause a dynamic “tool tip” text box to display. This tool tip contains information about operator syntax, return data type, and description, all of which are supplied in more detail in this Guide. For questions not answered by the tool tip, refer to the detailed operator descriptions in this Guide. The following figure shows a typical tool tip for the date operator `.monthsBetween`:

Figure 2: Typical Rule Operator Tool Tip



Usage restrictions

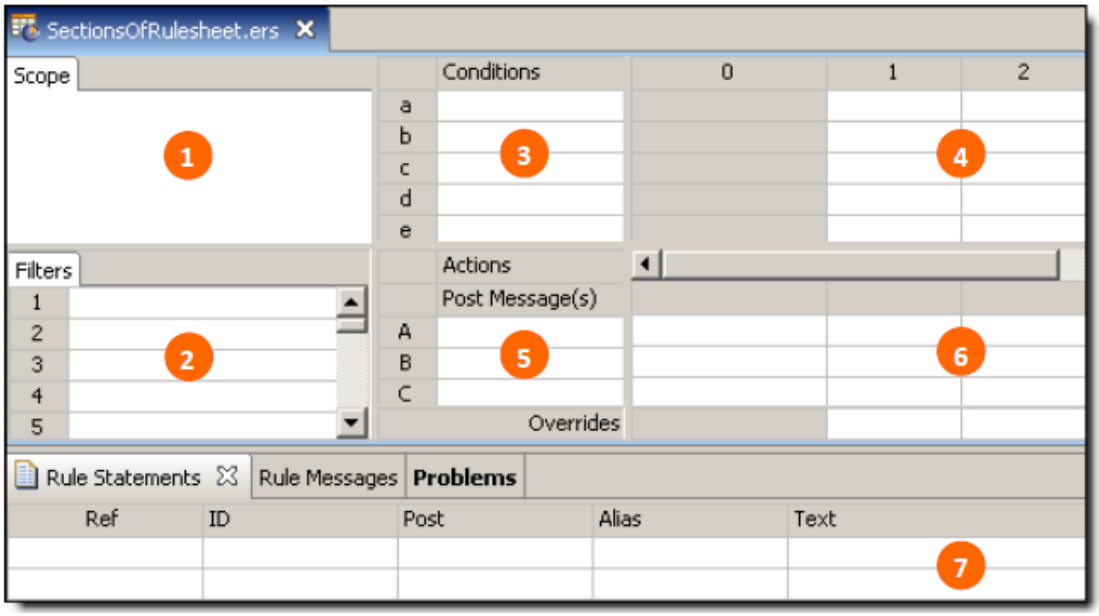
The following illustrations show the general usage restrictions for the various types of Vocabulary terms depending on where they are used in a Rulesheet. This table indicates, for example, that entities (terms from the Vocabulary) may be used in any section of the Rulesheet. Rule Operators, however, are restricted to only three sections.

Note: Some operators have specific restrictions that vary from this general table – see each operator's usage restrictions for details of these exceptions.

Figure 3: Vocabulary usage restrictions in Rulesheet sections

Rulesheet Section Name		Scope	Filter Rows	Condition Rows	Condition Cells	Actions Rows	Action Cells	Rule Statements
Rulesheet Section #		1	2	3	4	5	6	7
Literals			☑	☑	☑	☑	☑	
Functions			☑	☑	☑	☑	☑	☑
Operators			☑	☑		☑		
Data	Values		☑	☑	☑	☑	☑	☑
	Terms	☑	☑	☑	☑	☑	☑	☑

Figure 4: Sections of Rulesheet that correlate with usage restrictions



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Categories of rule operators

Corticon Studio presents its rule operators in logical groups.

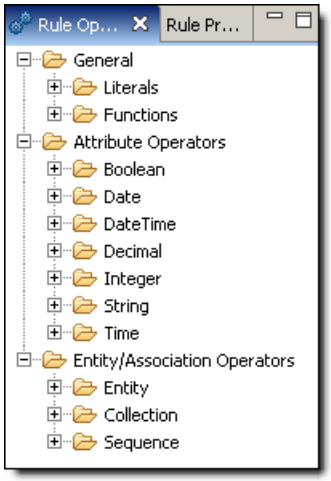
For details, see the following topics:

- Organization
- General terms
- Attribute operators
- Entity/Association operators
- Extended Operators

Organization

Rule Operators are classified based on the data type(s) of the terms *to which the operator may be applied* (known as the “operand”), as shown:

Figure 5: Rule Operator categories



General terms

Corticon's **General** operators are categorized as **Literals** and **Functions**.

Literals

Literal Terms can be used in any section of the Rulesheet, except **Scope** and **Rule Statements**. Exceptions to this general statement exist – see individual literals for detailed usage restrictions.

Corticon's **Literals** operators are as follows:

Name and Syntax	Returns	Description
Null		
`null`	*none*	The null value corresponds to one of three different scenarios: • the absence of an attribute in a Ruletest scenario • the absence of data for an attribute in a Ruletest scenario • an object that has a value of null
True		
`true` or `T`	Boolean	Represents Boolean value true

Name and Syntax	Returns	Description
False		
`false` or `F`	Boolean	Represents the Boolean value false
Other		
`other`	*any*	When included in a condition's Values set, other represents any value not explicitly included in the set, including null.
CellValue		
`cellValue`	*any*	cellValue is a variable whose value is determined by the rule Column that executes

Functions

Corticon's Functions operators are as follows:

Name and Syntax	Returns	Description
Now		
`now`	Date	Returns the current system date and time when the rule is executed.
Today		
`today`	Date	Returns the current system date when the rule is executed.

Attribute operators

The Corticon Rule Language supports attribute operators categorized as Boolean, DateTime, Date, Time, Decimal, Integer, and String.

Boolean

Corticon's **Boolean** attribute operators are as follows:

Name and Syntax	Returns	Description
Equals (used as a comparison)		
`<Expression1> = <Expression2>`	Boolean	Returns a value of true if `<Expression1>` has the same value as `<Expression2>`.

Name and Syntax	Returns	Description
Equals (used as an assignment)		
<Boolean1> = <Expression1>	Boolean	Assigns the truth value of <Expression1> to <Boolean1>
Not Equal To		
<Expression1> <> <Expression2>	Boolean	Returns a value of true if <Expression1> does not have the same truth value as <Expression2>
Or		
<Expression1> or <Expression2> or …	Boolean	Returns a value of true if either <Expression1> or <Expression2> evaluates to true.
And		
<<Boolean1> and <Boolean2>	Boolean	Returns a value of true if both <<Boolean1> and <Boolean2 are true. NOTE: This operator can be used only in Preconditions/Filters section of the Rulesheet.
Not		
not <Expression>	Boolean	Returns the negation of the truth value of <Expression>

DateTime

Note: A DateTime data type **must contain both** date information **and** time information. Applying a DateTime operator to a DateTime attribute should always produce a result. Be sure to use the data type that suits your needs.

Corticon's **DateTime** attribute operators are as follows:

Name and Syntax	Returns	Description
Equals (used as a comparison)		
<DateTime1> = <DateTime2>	Boolean	Returns a value of true if <DateTime1> is the same as <DateTime2>, including both the Date and the Time portions
Equals (used as an assignment)		
<DateTime1> = <DateTime2>	DateTime	Assigns the value of <DateTime2> to <DateTime1>

Name and Syntax	Returns	Description
Not Equal To		
<DateTime1> <> <DateTime2>	Boolean	Returns a value of true if <DateTime1> does not equal <DateTime2>
Less than		
<DateTime1> < <DateTime2>	Boolean	Returns a value of true if <Date1> is less than <Date2>
Greater than		
<DateTime1> > <DateTime2>	Boolean	Returns a value of true if <DateTime1> is greater than or equal to <DateTime2>
Less than or Equal to		
<DateTime1> <= <DateTime2>	Boolean	Returns a value of true if <DateTime1> is less than or equal to <DateTime2>
Greater than or Equal to		
<DateTime1> >= <DateTime2>	Boolean	Returns a value of true if <DateTime1> is greater than or equal to <DateTime2>
In (Range)		
attributeReference in [|(rangeExpression)|]	Boolean	Returns a value of true if attributeReference is in the range of DateTime values *from..to*, and where opening and closing parentheses ( ) indicate exclusion of that limit and square brackets [ ] indicate inclusion of that limit.
In (List)		
attributeReference in {listExpression}	Boolean	Returns a value of true if attributeReference is in the comma-delimited list of literal values, defined enumeration values, or - if in use - enumeration labels.
Year		
<DateTime>.year	Integer	Returns the century/year portion of <DateTime> as a four digit Integer
Month		
<DateTime>.month	Integer	Returns the month in <DateTime> as an Integer between 1 and 12
Day		

Name and Syntax	Returns	Description
<DateTime>.day	Integer	Returns the day portion of <DateTime> as an Integer between 1 and 31
Hour		
<DateTime>.hour	Integer	Returns the hour portion of <DateTime>. The returned value is based on a 24-hour clock.
Minute		
<DateTime>.min	Integer	Returns the minute portion of <DateTime> as an Integer between 0 and 59
Second		
<DateTime>.sec	Integer	Returns the seconds portion of <DateTime> as an Integer between 0 and 59
Add years		
<DateTime>.addYears (<Integer>)	Date	Adds the number of years in <Integer> to the number of years in <DateTime>
Add months		
<DateTime>.addMonths (<Integer>)	Date	Adds the number of months in <Integer> to the number of months in <DateTime>
Add days		
<DateTime>.addDays (<Integer>)	Date	Adds the number of days in <Integer> to the number of days in <DateTime>
Add hours		
<DateTime>.addHours (<Integer>)	Date	Adds the number of hours in <Integer> to the number of hours in the Time portion of <DateTime>
Add minutes		
<DateTime>.addMinutes (<Integer>)	Date	Adds the number of minutes in <Integer> to the number of minutes in the Time portion of <DateTime>
Add seconds		
<DateTime>.addSeconds (<Integer>)	Date	Adds the number of seconds in <Integer> to the number of seconds in the Time portion of <DateTime>

Name and Syntax	Returns	Description
Years between		
<DateTime1>.yearsBetween (<DateTime2>)	Integer	Returns the Integer number of years between <DateTime1> and <Date2>. This function returns a positive number if <DateTime2> is later than <DateTime1>.
Months between		
<DateTime1>.monthsBetween (<DateTime2>)	Integer	Returns the Integer number of months between <DateTime1> and <DateTime2>. If the month and year portions of <DateTime1> and <DateTime2> are the same, the result is zero. This function returns a positive number if <DateTime2> is later than <DateTime1>.
Days between		
<DateTime1>.daysBetween (<DateTime2>)	Integer	Returns the Integer number of days between <DateTime1> and <DateTime2>. If the two dates differ by less than a full 24-hour period, the value is zero. This function returns a positive number if <DateTime2> is later than <DateTime1>.
Hours between		
<DateTime1>.hoursBetween (<DateTime2>)	Integer	Returns the Integer number of hours between <DateTime1> and <DateTime2>. If the two dates differ by less than a full hour, the value is zero. This function returns a positive number if <DateTime2> is later than <DateTime1>.
Minutes between		
<DateTime1>.minsBetween (<DateTime2>)	Integer	Returns the Integer number of minutes between <DateTime1> and <DateTime2>. This function returns a positive number if <DateTime2> is later than <DateTime1>.
Seconds between		
<DateTime1>.secsBetween (<DateTime2>)	Integer	Returns the Integer number of seconds between <DateTime1> and <DateTime2>. This function returns a positive number if <DateTime2> is later than <DateTime1>.
Day of Week		
<DateTime>.dayOfWeek	Integer	Returns an Integer corresponding to day of the week, with Sunday equal to 1, in <DateTime>.

Name and Syntax	Returns	Description
Week of Year		
<DateTime>.weekOfYear	Integer	Returns an Integer from 1 to 52, equal to the week number within the year in <DateTime>
Day of Year		
<DateTime>.dayOfYear	Integer	Returns an Integer from 1 to 366, equal to the day number within the year in <DateTime>
Week of Month		
<DateTime>.weekOfMonth	Integer	Returns an Integer from 1 to 6, equal to the week number within the month in <DateTime> or <Date>. A week begins on Sunday and ends on Saturday.
To Date		
<DateTime>.toDate	Date	Returns the date portion only of DateTime
To Time		
<DateTime>.toTime	Time	Returns the time portion only of DateTime
To String		
<DateTime>.toString	String	Converts DateTime to a String with date and time information
getMilliseconds		
<DateTime>.getMilliseconds	Integer	Returns the internal date/time, namely the number of milliseconds that have transpired since the epoch 1/1/1970 00:00:00 GMT.
toString		
<DateTime>.toString	Integer	Converts the value of <DateTime> to data type <String>.
toZulu		
<DateTime>.toZulu	String	Returns an ISO-8601-compliant date-time as a String.

Date

Corticon's **Date** attribute operators are as follows:

Name and Syntax	Returns	Description
Equals (used as a comparison)		
<Date1> = <Date2>	Boolean	Returns a value of true if <Date1> is the same as <Date2>.
Equals (used as an assignment)		
<Date1> = <Date2>	DateTime	Assigns the value of <Date2> to <Date1>
Not Equal To		
<Date1> <> <Date2>	Boolean	Returns a value of true if <Date1> does not equal <Date2>
Less than		
<Date1> < <Date2>	Boolean	Returns a value of true if <Date1> is less than <Date2>
Greater than		
<Date1> > <Date2>	Boolean	Returns a value of true if <Date1> is greater than or equal to <Date2>
Less than or Equal to		
<Date1> <= <Date2>	Boolean	Returns a value of true if <Date1> is less than or equal to <Date2>
Greater than or Equal to		
<Date1> >= <Date2>	Boolean	Returns a value of true if <Date1> is greater than or equal to <Date2>
In (Range)		
attributeReference in [|(rangeExpression)|]	Boolean	Returns a value of true if attributeReference is in the range of Date values *from..to*, and where opening and closing parentheses ( ) indicate exclusion of that limit and square brackets [ ] indicate inclusion of that limit.
In (List)		
attributeReference in {listExpression}	Boolean	Returns a value of true if attributeReference is in the comma-delimited list of literal values, defined enumeration values, or - if in use - enumeration labels.
Year		

Name and Syntax	Returns	Description
<Date>.year	Integer	Returns the century/year portion of <Date> as a four digit Integer
Month		
<Date>.month	Integer	Returns the month in <Date> as an Integer between 1 and 12
Day		
<Date>.day	Integer	Returns the day portion of <Date> as an Integer between 1 and 31
Add years		
<Date>.addYears(<Integer>)	Date	Adds the number of years in <Integer> to the number of years in <Date>
Add months		
<Date>.addMonth(<Integer>)	Date	Adds the number of months in <Integer> to the number of months in <DateTime>
Add days		
<Date>.addDays(<Integer>)	Date	Adds the number of days in <Integer> to the number of days in <Date>
Years between		
<Date1>.yearsBetween(<Date2>)	Integer	Returns the Integer number of years between <Date1> and <Date2>. This function returns a positive number if <Date2> is later than <Date1>.
Months between		
<Date1>.monthsBetween(<Date2>)	Integer	Returns the Integer number of months between <Date1> and <Date2>. If the month and year portions of <Date1> and <Date2> are the same, the result is zero. This function returns a positive number if <Date2> is later than <Date1>.
Days between		
<Date1>.daysBetween(<Date2>)	Integer	Returns the Integer number of days between <Date1> and <Date2>. If the two dates differ by less than a full 24-hour period, the value is zero. This function returns a positive number if <Date2> is later than <Date1>.
Day of Week		

Name and Syntax	Returns	Description
<Date>.dayOfWeek	Integer	Returns an Integer corresponding to day of the week, with Sunday equal to 1, in <Date>.
Week of Year		
<Date>.weekOfYear	Integer	Returns an Integer from 1 to 52, equal to the week number within the year in <Date>
Day of Year		
<Date>.dayOfYear	Integer	Returns an Integer from 1 to 366, equal to the day number within the year in <Date>
Week of Month		
<Date>.weekOfMonth	Integer	Returns an Integer from 1 to 6, equal to the week number within the month in <DateTime> or <Date>. A week begins on Sunday and ends on Saturday.
To String		
<Date>.toString	String	Converts DateTime to a String with date and time information
To DateTime		
<Date>.toDateTime	DateTime	Returns a DateTime where the date portion is equal to the value of <Date> and the time portion is equal to 00:00:00 in the system's local timezone
To DateTime with Timezone Offset		
<Date>.toDateTime (<string>)	DateTime	Returns a DateTime where the date portion is equal to the value of <Date> and the time portion is equal to 00:00:00 in the timezone specified by the value of <string>
getMilliseconds		
toString		
<Date>.toString	Integer	Converts the value of <Date> to data type <String>.
<Date>.getMilliseconds	Integer	Returns the internal date/time, namely the number of milliseconds that have transpired since the epoch 1/1/1970 00:00:00 GMT.

Name and Syntax	Returns	Description
nextDay		
<Date>.nextDay	Date	Returns the Date that represents the date that follows this Date instance.

Time

Corticon's **Time** attribute operators are as follows:

Name and Syntax	Returns	Description
Equals (used as a comparison)		
<Time1> = <Time2>	Boolean	Returns a value of true if <Time1> is the same as <Time2>, including both the Date and the Time portions
Equals (used as an assignment)		
<Time1> = <Time2>	DateTime	Assigns the value of <Time2> to <Time1>
Not Equal To		
<Time1> <> <Time2>	Boolean	Returns a value of true if <Time1> does not equal <Time2>
Less than		
<Time1> < <Time2>	Boolean	Returns a value of true if <Time1> is less than <Time2>
Greater than		
<Time1> > <Time2>	Boolean	Returns a value of true if <Time1> is greater than <Time2>
Less than or Equal to		
<Time1> <= <Time2>	Boolean	Returns a value of true if <Time1> is less than or equal to <Time2>
Greater than or Equal to		
<Time1> >= <Time2>	Boolean	Returns a value of true if <Time1> is greater than or equal to <Time2>
In (Range)		

Name and Syntax	Returns	Description
`attributeReference` in `[` `|(rangeExpression)|]`	Boolean	Returns a value of true if `attributeReference` is in the range of Time values *`from..to`*, and where opening and closing parentheses `(` `)` indicate exclusion of that limit and square brackets `[ ]` indicate inclusion of that limit.
In (List)		
`attributeReference` in `{listExpression}`	Boolean	Returns a value of true if `attributeReference` is in the comma-delimited list of literal values, defined enumeration values, or - if in use - enumeration labels.
Hour		
<`Time`>.hour	Integer	Returns the hour portion of <`Time`>. The returned value is based on a 24-hour clock.
Minute		
<`Time`>.min	Integer	Returns the minute portion of <`Time`> as an Integer between 0 and 59
Second		
<`Time`>.sec	Integer	Returns the seconds portion of <`Time`> as an Integer between 0 and 59
<`Time`>.addDays (<`Integer`>)	Date	Adds the number of days in <`Integer`> to the number of days in <`Time`>
Add hours		
<`Time`>.addHours (<`Integer`>)	Date	Adds the number of hours in <`Integer`> to the number of hours in the Time portion of <`Time`>
Add minutes		
<`Time`>.addMinutes (<`Integer`>)	Date	Adds the number of minutes in <`Integer`> to the number of minutes in the Time portion of <`Time`>
Add seconds		
<`Time`>.addSeconds (<`Integer`>)	Date	Adds the number of seconds in <`Integer`> to the number of seconds in the Time portion of <`Time`>
Hours between		

Name and Syntax	Returns	Description
<Time1>.hoursBetween (<Time2>)	Integer	Returns the Integer number of hours between <Time1> and <Time2>. If the two times differ by less than a full hour, the value is zero. This function returns a positive number if <Time2> is later than <Time1>.
Minutes between		
<Time1>.minsBetween (<Time2>)	Integer	Returns the Integer number of minutes between <Time1> and <Time2>. This function returns a positive number if <Time2> is later than <Time1>.
Seconds between		
<Time1>.secsBetween (<Time2>)	Integer	Returns the Integer number of seconds between <Time1> and <Time2>. This function returns a positive number if <Time2> is later than <Time1>.
To String		
<Time>.toString	String	Converts <Time> to a String with date and time information
To DateTime		
<Time>.toDateTime	DateTime	Returns a DateTime where the time portion is equal to the value of <Time> and the date portion is equal to the epoch.
toString		
<Time>.toString	Integer	Converts the value of <Time> to data type <String>.
getMilliseconds		
<Time>.getMilliseconds	Integer	Returns the internal date/time, namely the number of milliseconds that have transpired since the epoch 1/1/1970 00:00:00 GMT.
toString		
<Time>.toString	Integer	Converts the value of <Time> to data type <String>.
getTimeName		
<Time>.getTimeName	String	Returns a String that states whether the time is morning, afternoon, or evening.

Decimal

In this section, wherever the syntax includes <Number>, either Integer or Decimal data types may be used.

Corticon's **Decimal** attribute operators are as follows:

Name and Syntax	Returns	Description
Equals (used as a comparison)		
<Number1> = <Number2>	Boolean	Returns a value of true if <Number1> is the same as <Number2>.
Equals (used as an assignment)		
<Number1> = <Number2>	Number	Assigns the value of <Number2> to the value of <Number1>.
Not Equal To		
<Number1> <> <Number2>	Boolean	Returns a value of true if <Number1> is not equal to <Number2>.
Less than		
<Number1> < <Number2>	Boolean	Returns a value of true if <Number1> is less than <Number2>.
Greater than		
<Number1> > <Number2>	Boolean	Returns a value of true if <Number1> is greater than <Number2>.
Less than or Equal to		
<Number1> <= <Number2>	Boolean	Returns a value of true if <Number1> is less than or equal to <Number2>.
Greater than or Equal to		
<Number1> >= <Number2>	Boolean	Returns a value of true if <Number1> is greater than or equal to <Number2>.
In (Range)		
attributeReference in [|(rangeExpression)|]	Boolean	Returns a value of true if attributeReference is in the range of Decimal values *from..to*, and where opening and closing parentheses ( ) indicate exclusion of that limit and square brackets [ ] indicate inclusion of that limit.
In (List)		

Name and Syntax	Returns	Description
attributeReference in {listExpression}	Boolean	Returns a value of true if attributeReference is in the comma-delimited list of literal values, defined enumeration values, or - if in use - enumeration labels.
Add		
<Number1> + <Number2>	Number	Returns the sum of <Number1> and <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. For example, if an Integer value is added to a Decimal value, the resulting value will be a Decimal. See Precedence of rule operators on page 193.
Subtract		
<Number1> - <Number2>	Number	Subtracts <Number2> from <Number1>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Multiply		
<Number1> * <Number2>	Number	Returns the product of <Number1> and <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Divide		
<Number1> / <Number2>	Number	Divides <Number1> by <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Exponent		
<Number1> ** <Number2>	Number	Raises <Number1> to the power of <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Increment		
<Number1> += <Number2>	Number	Increments <Number1> by <Number2>. The data type of <Number1> must accommodate the addition of <Number2>. See Precedence of rule operators on page 193.
Decrement		

Name and Syntax	Returns	Description
<Number1> -= <Number2>	Number	Decrements <Number1> by the value of <Number2>. The data type of <Number1> must accommodate the addition of <Number2>. See Precedence of rule operators on page 193.
Absolute Value		
<Decimal>.absVal	Decimal	Returns the absolute value of <Number>. If the <Number> is positive, <Number> itself is returned; if <Number> is negative, the negation of <Number> is returned.
Floor		
<Decimal>.floor	Integer	Returns the largest (closest to positive infinity) Integer that is not greater than <Number>.
Round		
<Decimal>.round	Decimal	Rounds <Decimal> to the nearest Integer.
Round(n)		
<Decimal>.round(<Integer>)	Decimal	Rounds <Decimal> to the number of decimal places specified by <Integer>.
To Integer		
<Decimal>.toInteger	Integer	Converts an attribute of type Decimal to type Integer. Decimals will have the decimal point and fraction (those digits to the right of the decimal point) truncated.
To String		
<Decimal>.toString	String	Converts an attribute of type Decimal to type string
Maximum Value		
<Decimal>.max(<Number>)	Number	Returns the greater of <Decimal> and <Number>.
Minimum Value		
<Decimal>.min(<Number>)	Number	Returns the lesser of <Decimal> and <Number>.
Logarithm (base 10)		
<Decimal>.log	Decimal	Returns the logarithm (base 10) of <Decimal>. <Decimal> may not be zero.
Logarithm (base x)		

Name and Syntax	Returns	Description
<Decimal1>.log(<Decimal2>)	Decimal	Returns the logarithm (base <Decimal2>) of <Decimal1>. <Decimal1> may not be zero.
Natural Logarithm		
<Decimal>.ln	Decimal	Returns the logarithm (base e) of <Decimal>.<Decimal> may not be zero.
truncate		
<Decimal>.truncate	Integer	Truncates "this" Decimal value to an integer by removing the fractional portion.
toString		
<Decimal>.fraction	Decimal	Extracts the fraction portion of "this" Decimal.
movePoint(places)		
<Decimal>.movePoint (places:Integer)	Decimal	Moves the Decimal value's point moved n places where n can be a positive (moves right) or negative (moves left) value.

Integer

In this section, wherever the syntax includes <Number>, either Integer or Decimal data types may be used.

Corticon's **Integer** attribute operators are as follows:

Name and Syntax	Returns	Description
Equals (used as a comparison)		
<Number1> = <Number2>	Boolean	Returns a value of true if <Number1> is the same as <Number2>.
Equals (used as an assignment)		
<Number1> = <Number2>	Number	Assigns the value of <Number2> to the value of <Number1>. The data type of <Number1> must be expansive enough to accommodate <Number2>.
Not Equal To		
<Number1> <> <Number2>	Boolean	Returns a value of true if <Number1> is not equal to <Number2>.
Less than		

Name and Syntax	Returns	Description
<Number1> < <Number2>	Boolean	Returns a value of true if <Number1> is less than <Number2>.
Greater than		
<Number1> > <Number2>	Boolean	Returns a value of true if <Number1> is greater than <Number2>.
Less than or Equal to		
<Number1> <= <Number2>	Boolean	Returns a value of true if <Number1> is less than or equal to <Number2>.
Greater than or Equal to		
<Number1> >= <Number2>	Boolean	Returns a value of true if <Number1> is greater than or equal to <Number2>.
In (Range)		
attributeReference in [|(rangeExpression)|]	Boolean	Returns a value of true if attributeReference is in the range of Integer values *from..to*, and where opening and closing parentheses ( ) indicate exclusion of that limit and square brackets [ ] indicate inclusion of that limit.
In (List)		
attributeReference in {listExpression}	Boolean	Returns a value of true if attributeReference is in the comma-delimited list of literal values, defined enumeration values, or - if in use - enumeration labels.
Add		
<Number1> + <Number2>	Number	Returns the sum of <Number1> and <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. For example, if an Integer value is added to a Decimal value, the resulting value will be a Decimal. See Precedence of rule operators on page 193.
Subtract		
<Number1> - <Number2>	Number	Subtracts <Number2> from <Number1>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Multiply		

Name and Syntax	Returns	Description
<Number1> * <Number2>	Number	Returns the product of <Number1> and <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Divide		
<Number1> / <Number2>	Number	Divides <Number1> by <Number2>. The resulting data type is the more expansive of either <Number1> or <Number2>. See Precedence of rule operators on page 193.
Increment		
<Number1> += <Number2>	Number	Increments <Number1> by <Number2>. The data type of <Number1> must accommodate the addition of <Number2>. See Precedence of rule operators on page 193.
Decrement		
<Number1> -= <Number2>	Number	Decrements <Number1> by the value of <Number2>. The data type of <Number1> must accommodate the addition of <Number2>. See Precedence of rule operators on page 193.
Absolute value on page 53.		
<Integer>.absVal	Number	Returns the absolute value of <Integer>. If the <Integer> is positive, <Integer> itself is returned; if <Integer> is negative, the negation of <Integer> is returned.
To Decimal		
<Integer>.toDecimal	Decimal	Converts an attribute of type Integer to type Decimal.
To String		
<Integer>.toString	String	Converts an attribute of type Integer to type String.
Maximum Value		
<Integer1>.max(<Integer2>)	Integer	Returns the greater of <Integer1> and <Integer2>.
Minimum Value		

Name and Syntax	Returns	Description
<Integer1>.min(<Integer2>)	Integer	Returns the lesser of <Integer1> and <Integer2>.
Div		
<Integer1>.div(<Integer2>)	Integer	Returns the whole number of times that <Integer2> fits within <Integer1> - any remainder is discarded.
Mod		
<Integer1>.mod(<Integer2>)	Integer	Returns the whole number remainder that results from dividing <Integer1> by <Integer2>. If the remainder is a fraction, then zero is returned.
Logarithm (base 10)		
<Integer>.log	Decimal	Returns the logarithm (base 10) of <Integer>. <Integer> may not be zero.
Logarithm (base x)		
<Integer>.log(<Decimal>)	Decimal	Returns the logarithm (base <Decimal>) of <Integer>. <Integer> may not be zero.
Natural Logarithm		
<Integer>.ln	Decimal	Returns the natural logarithm (base e) of <Number>. <Integer> may not be zero.
isProbablePrime(certainty)		
<Integer>.isProbablePrime (certainty:Integer)	Boolean	Returns true if this Integer is probably prime; false if definitely is not prime.
gcd(val)		
<Integer>.gcd(val:Integer)	Integer	Returns the greatest common divisor of the absolute value of this and the absolute value of val.
negate		
<Integer>.negate	Integer	Returns the negative value of this integer.

String

Corticon's **String** attribute operators are as follows:

	Name and Syntax	Returns	Description
Equals (used as a comparison)			
	<String1> = <String2>	Boolean	Returns a value of true if <String1> exactly matches <String2>. Both case and length are examined to determine equality. See Character precedence: Unicode and Java Collator on page 189 for character precedence.
Equals (used as an assignment)			
	<String1> = <String2>	String	Assigns the value of <String2> to the value of <String1>.
Not Equal to			
	<String1> <> <String2>	Boolean	Returns a value of true if <String1> is not equal to <String2>.
Less than			
	<String1> < <String2>	Boolean	Returns a value of true if <String1> is less than <String2>. See Character precedence: Unicode and Java Collator on page 189 for character precedence.
Greater than on page 97			
	<String1> > <String2>	Boolean	Returns a value of true if <String1> is greater than <String2>. See Character precedence: Unicode and Java Collator on page 189 for character precedence.
Less than or Equal to			
	<String1> <= <String2>	Boolean	Returns a value of true if <String1> is less than or equal to <String2>. See Character precedence: Unicode and Java Collator on page 189 for character precedence.
Greater than or Equal to			
	<String1> >= <String2>	Boolean	Returns a value of true if <String1> is greater than or equal to <String2>. See Character precedence: Unicode and Java Collator on page 189 for character precedence.
In (Range)			

	Name and Syntax	Returns	Description
	`attributeReference` in `[` `|(rangeExpression)|]`	Boolean	Returns a value of true if `attributeReference` is in the range of String values *`from..to`*, and where opening and closing parentheses `(` `)` indicate exclusion of that limit and square brackets `[ ]` indicate inclusion of that limit.
In (List)			
	`attributeReference` in `{listExpression}`	Boolean	Returns a value of true if `attributeReference` is in the comma-delimited list of literal values, defined enumeration values, or - if in use - enumeration labels.
Adding Strings			
	<`String1`> + <`String2`>	String	Concatenates <`String1`> to <`String2`>. Alternative syntax.
Size			
	<`String`>.size	String	Returns the number of characters in <`String`>.
Concatenate			
	<`String1`>.concat(<`String2`>)	String	Concatenates <`String1`> to <`String2`>.
Uppercase			
	<`String`>.toUpper	String	Converts all characters <`String`> to uppercase.
Lowercase			
	<`String`>.toLower	String	Converts all characters in <`String`> to lowercase.
To DateTime			
	<`String`>.toDateTime	DateTime	Converts the value in <`String`> to data type DateTime ONLY if all characters in <`String`> correspond to a valid DateTime mask (format)
To Decimal			
	<`String`>.toDecimal	Decimal	Converts an attribute of type String to data type Decimal ONLY if all characters in <`String`> are numeric and contain not more than one decimal point. If any non-numeric characters are present (other than a single decimal point or leading minus sign), no value is returned.
To Integer			

	Name and Syntax	Returns	Description
	<String>.toInteger	Integer	Converts an attribute of type String to type Integer ONLY if all characters in <String> are numeric. If any non-numeric characters are present, no value is returned.
Substring			
	<String>.substring (<Integer1>,<Integer2>)	String	Returns that portion of <String> between character positions <Integer1> and Integer2>.
Equals Ignoring Case			
	<String1>.equalsIgnoreCase (<String2>)	Boolean	Returns a value of true if <String1> is the same as <String2>, irrespective of case.
Starts with			
	<String1>.startsWith (<String2>)	Boolean	Returns a value of true if the <String1> begins with the characters specified in <String2>.
Ends with			
	<String1>.endsWith (<String2>)	Boolean	Evaluates the contents of <String1> and returns a value of true if the String ends with the characters specified in <String2>.
Contains			
	<String1>.contains (<String2>)	Boolean	Evaluates the contents of <String1> and returns a value of true if it contains the exact characters defined by <String2>
Equals			
	<String1>.equals (<String2>)	Boolean	Returns a value of true if <String1> is the same as <String2>.
Index Of			
	<String1>.indexOf (<String2)	Integer	Returns the beginning character position number of <String2> within <String1>, if <String1> contains <String2>. If it does not, the function returns a value of zero.
containsBlanks			
	<String>.containsBlanks	Boolean	Determines whether the specified String contains any blanks.
characterAt(index)			

	Name and Syntax	Returns	Description
	`<String>.characterAt(index:Integer)`	String	Returns the character at the specified position in the String.
isInteger			
	`<String>.isInteger`	Boolean	Determines whether "this" String contains only integer digits. **Note:** This operator examines each character in a string to determine whether it is in the range 0 to 9. Therefore, the operator returns `true` when the entire string evaluates as a positive integer, and `false` when a minus sign is the first character of a string that would evaluate as a negative integer. A new extended operator could be created if the string as a whole is to be evaluated as `true` whether positive or negative (for example, by allowing the first character to be a minus sign.)
trimSpaces			
	`<String>.trimSpaces`	String	Trims leading and trailing spaces from "this" String.
charsIn(validSet)			
	`<String>.charsIn(validSet:String)`	Boolean	Determines whether "this" String contains only characters specified in the validSet.

Entity/Association operators

The Corticon rule language supports Entity and Association operators categorized as Entity, Collection, and Sequence.

Entity

Corticon's **Entity** operators are as follows:

Name and Syntax	Returns	Description
New		

Name and Syntax	Returns	Description
<Entity> .new [<Expression1>,...]	Entity	Creates a new instance of <Entity>. Expressions (optional to assign attribute values) in square brackets [..] must be written in the form: *attribute* = *value*.
New Unique		
<Entity> .newUnique [<Expression1>,...]	Entity	Creates a new instance of <Entity> only if the instance created is unique as defined by optional <Expression1>,...
Clone		
<Entity>.clone [<Expression1>,...]	Entity	Creates a new instance of <Entity> with the same attributes and their respective values. Expressions (optional to override attribute values) in square brackets [..] must be written in the form: *attribute* = *value*.
Remove		
< Entity>.remove [(true)|(false)]	Entity	Deletes the entity from memory and from the resultant XML document. Children can be removed as well when set to (true, or retained after moving to root (false). Blank or no value defaults to true.

Collection

Corticon's **Collection** operators are as follows:

Name and Syntax	Returns	Description
Replace element(s)		
<Collection1> = <Collection2> <Collection1> = <Entity>	*modifies a collection*	replaces all elements in <Collection1> with elements of <Collection2> or with <Entity>, provided the new associations are allowed by the Business Vocabulary.
Associate element(s)		
<Collection1> += <Collection2> <Collection1> += <Entity>	*modifies a collection*	Associates all elements of <Collection2> or <Entity> with <Collection1>. Every <Collection> must be expressed as a unique alias.
Disassociate element(s)		

Name and Syntax	Returns	Description
<Collection1> -= <Collection2>	*modifies a collection*	Disassociates all elements of <Collection2> from <Collection1>. Does not delete the disassociated elements. Every <Collection> must be expressed as a unique alias.
Is empty		
<Collection> ->isEmpty	Boolean	Returns a value of true if <Collection> contains *no* elements
Not empty		
<Collection> ->notEmpty	Boolean	Returns a value of true if <Collection> contains *at least one* element.
Exists		
<Collection> ->exists (<Expression>)	Boolean	Returns a value of true if <Expression> holds true for *at least one* element of <Collection>
For all		
<Collection> ->forAll (<Expression>)	Boolean	Returns a value of true if *every* <Expression> holds true for *every* element of <Collection>
Sorted by		
<Collection> ->sortedBy (<Attribute>)	*converts a collection into a sequence*	Sequences the elements of <Collection> in ascending order, using the value of <Attribute> as the index. <Collection> must be expressed as a unique alias.
Sorted by descending		
<Collection> ->sortedByDesc (<Attribute>)	*converts a collection into a sequence*	Sequences the elements of <Collection> in descending order, using the value of <Attribute> as the index. <Collection> must be expressed as a unique alias.
Iterate		
<Collection> ->iterate(<Expression>)		Executes <Expression> for every element in <Collection>. <Collection> must be expressed as a unique alias.
Size of collection		
<Collection> ->size	Integer	Returns the number of elements in <Collection>. <Collection> must be expressed as a unique alias.

Name and Syntax	Returns	Description
Sum		
<Collection.attribute> ->sum	Number	Sums the values of the specified <attribute> for all elements in <Collection>. <attribute> must be a numeric data type.
Average		
<Collection.attribute> ->avg	Number	Averages all of the specified attributes in <Collection>. <Collection> must be expressed as a unique alias. <attribute> must be a numeric data type
Minimum		
<Collection.attribute> ->min	Number	Returns the lowest value of <attribute> for all elements in <Collection>. <attribute> must be a numeric data type
Maximum		
<Collection.attribute> ->max	Number	Returns the highest value of <attribute> for all elements in <Collection>. <attribute> must be a numeric data type
toSet		
Collection.toSet	String	Returns a single String that is the set of Strings in this collection.
allContain(lookFor)		
Collection.allContain (lookFor:String)	Boolean	Determines whether all the strings in this collection contain the lookFor String
uniqueCount		
Collection.uniqueCount	Integer	Returns the count of the unique Strings in this collection.

Sequence

Sequence operators act on collections that have *already* been ordered by a sorting operator (see sortedBy and sortedByDesc). In other words, sequence operators operate on collections that have been turned into sequences. The notation <Sequence> used below, is shorthand for a completed sorting operation. For example:

<Collection> -> sortedBy(<Attribute>)

produces a <Sequence>, in this case the elements of <Collection> arranged in ascending order using <Attribute> as the index. This <Sequence> can then be used with one of the sequence operators described below. The design of the Object Constraint Language (upon which the Corticon Rule Language is based), allows for the “chaining” of operators, so a collection operator and a sequence operator can be used in the same expression to produce a sequence and identify a particular element of that sequence in the same step. For example:

<Entity.attribute1> = <Collection> ->sortedBy(<Attribute3>) ->first.<Attribute2>

performs the following:

1. Sorts <Collection> in ascending order according to <Attribute3>, turning it into a <Sequence>
2. Locates the first element of <Sequence>
3. Reads the value of <Attribute2> of the first element
4. Assigns the value of <Attribute2> of the first element to <Entity.attribute1>

Corticon's **Sequence** operators are as follows:

	Name and Syntax	Returns	Description
At			
	<Sequence> ->at(<Integer>)	Entity	Returns the element at position <Integer>. <Sequence> must be expressed as a unique alias.
First			
	<Sequence> ->first	Entity	Returns the first element of <Sequence>. <Sequence> must be expressed as a unique alias.
Last			
	<Sequence> ->last	Entity	Returns the last element of <Sequence>. <Sequence> must be expressed as a unique alias.
SubSequence			
	<Sequence> ->subSequence(*integer1*,*integer2*)	Entity	Returns a Sequence containing all elements of <Sequence> between the positions *integer1* and *integer2*.
First(number)			
	<Sequence> ->first(*integer*)	Entity	Returns a Sequence containing elements of <Sequence> from the first element to *integer*; in other words, ->first(x) is effectively >subSequence(1,*x*)
Last(number)			

	Name and Syntax	Returns	Description
	`<Sequence> ->last(integer)`	Entity	Returns a Sequence containing elements of `<Sequence>` between the end position of the collection and *integer*; in other words, in a sequence of n elements, `->last(x)` is effectively `>subSequence(n-x+1,n)`
Trend			
	`<Attribute>` -> `<Sequence>`.trend	String	Returns a 4-character string, INCR, DECR, CNST, or NONE depending on the trend of `<Attribute>` within `<Sequence>`.
mavg(elements)			
	`<Sequence.decimal> .mavg(elements:Integer)`	Decimal	Returns a single decimal value that is the average of the number of elements specified.
Sorted Alias: next			
	`->next`		Operates against a Sorted Alias (a special cached Sequence) inside a filter expression. The Rulesheet is set into a Ruleflow that iterates to bind the alias in each successive invocation to the next element in the sequence. For more information, see the topic *"Sorted Alias" in the Collections chapter of the Corticon Studio: Rule Modeling Guide.*.

Extended Operators

Corticon's **Extended** operators are categorized as **RandomGenerator** and **SeMath**.

RandomGenerator

RandomGenerator does just what it says: it generates -- and then returns -- a random number.

Corticon's **RandomGenerator** operator is as follows:

Name and Syntax	Returns	Description
getRandomNumber		
`RandomGenerator. getRandomNumber`	Decimal	Returns the next random number out of the current static Random object.

SeMath

Corticon's **SeMath** operators are as follows:

Name and Syntax	Returns	Description
getCircumference		
`SeMath.getCircumference (radius:<Decimal>)`	Decimal	Converts the specified radius to circumference.
getFahrenheit		
`SeMath.getFahrenheit (centigrade:<Decimal>)`	Decimal	Converts the specified Centigrade temperature to Fahrenheit.
replaceString		
`SeMath.replaceString (lookin:<String>,lookfor:<String> ,replacewith:<String>)`	String	Replaces all occurences of a specified string with another string.

4

Rule operator details and examples

The following pages describe each operator in greater detail. Each Rule Operator has the following sections

1. **Syntax** – Describes the standard syntax used with this operator. In this section, as in the previous summary tables, the angle bracket convention < . . > is used to indicate what types of terms and their data types can be used with the operator. When using the operator with real terms from the Vocabulary, do not include the angle brackets.
2. **Description** – Provides a plain-language description of the operator's purpose and details of its use. Important reminders, tips, or cautions are included in this section.
3. **Usage Restrictions** – Describes what limitations exist for this operator, and where an operator may not be used in a Rulesheet. Such limitations are rare, but important to a good understanding of Corticon Studio.
4. **Example** – Shows an example of each operator in a Rulesheet. A screenshot of the example Rulesheet is provided, with portions of the Rulesheet not used by the example collapsed or truncated for clarity. The example also includes sample input and output data for Ruletest scenarios run against the Rulesheet.

The entire list of operators is presented in alphabetic order.

For details, see the following topics:

- Absolute value
- Add numbers
- Add strings
- Add days
- Add hours
- Add minutes

- Add months
- Add seconds
- Add years
- Associate element(s)
- At
- Average
- CellValue
- Clone
- Concatenate
- Contains
- Day
- Days between
- Day of week
- Day of year
- Decrement
- Disassociate element(s)
- Divide
- Div
- Ends with
- Equals when used as an assignment
- Equals when used as a comparison
- Equals ignoring case
- Equals when using Strings
- Exists
- Exponent
- False
- First
- First (number)
- Floor
- For all
- Greater than
- Greater than or equal to
- Hour

- Hour between
- In {List}
- In (Range)
- Increment
- Index of
- Is empty
- Iterate
- Last
- Last (number)
- Less than
- Less than or equal to
- Logarithm (Base 10)
- Logarithm (Base x)
- Lowercase
- Maximum value
- Maximum value (Collection)
- Minimum value
- Minimum value (Collection)
- Minute
- Minutes between
- Mod
- Month
- Months between
- Multiply
- Natural logarithm
- New
- New unique
- Not
- Not empty
- Not equal to
- Now
- Null
- Other

- Or
- Remove element
- Replace element(s)
- Round
- Second
- Seconds between
- Size of string
- Size of collection
- Sorted by
- Sorted by descending
- Starts with
- SubSequence
- Substring
- Subtract
- Sum
- Today
- To date: Casting a dateTime to a date
- To dateTime: Casting a string to a dateTime
- To dateTime: Casting a date to a dateTime
- To dateTime: Casting a time to a dateTime
- To dateTime: Timezone offset
- To decimal
- To integer
- To string
- To time: Casting a dateTime to a time
- Trend
- True
- Uppercase
- Week of month
- Week of year
- Year
- Years between

Absolute value

SYNTAX

`<Number>.absVal`

DESCRIPTION

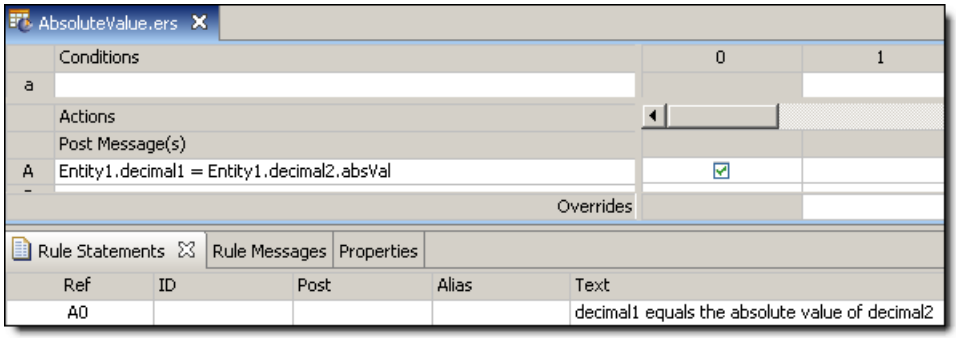
Returns the absolute value of `<Number>`. If the `<Number>` is positive, `<Number>` itself is returned; if `<Number>` is negative, the negation of `<Number>` is returned.

USAGE RESTRICTIONS

The Operators row in the table of Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

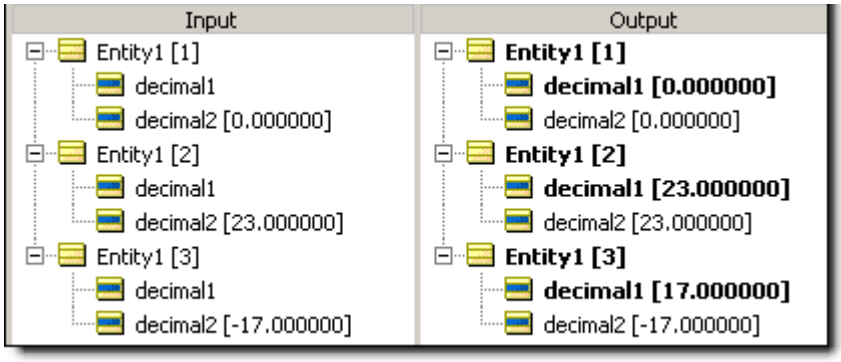
RULESHEET EXAMPLE

This sample Rulesheet uses **.absVal** to produce the absolute value of `decimal2` and assign it to `decimal1`



SAMPLE RULETEST

A sample Ruletest provides `decimal2` values for three different scenarios of `Entity1`. Input and Output panels are shown below.



Add numbers

SYNTAX

<Number1> + <Number2>

DESCRIPTION

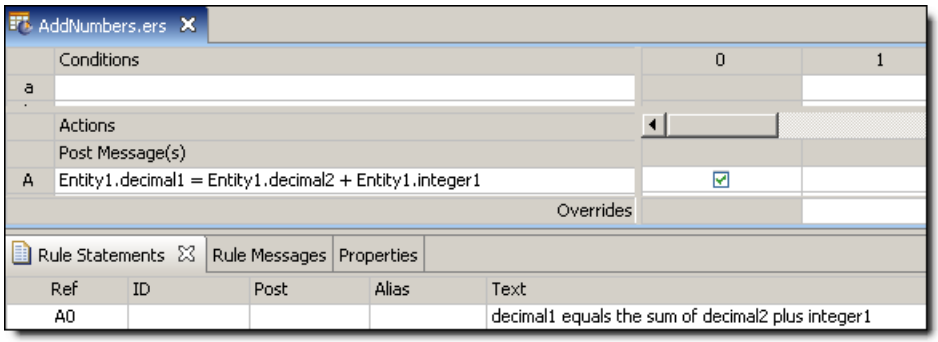
Adds <Number1> to <Number2>. The resulting data type is the more expansive of those of <Number1> and <Number2>. For example, if you are adding an Integer value and a Decimal value, the resulting value will be a Decimal. See Precedence of rule operators on page 193.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

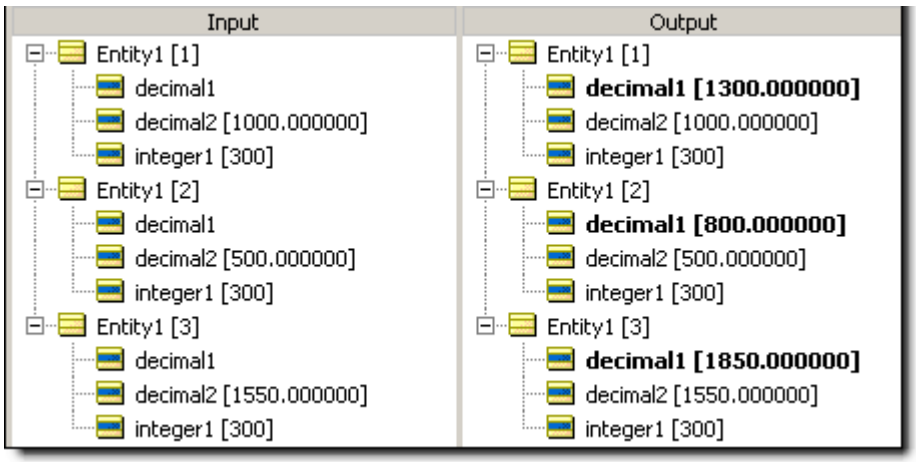
RULESHEET EXAMPLE

This sample Rulesheet uses the **add numbers** operation to add the value of `decimal2` to the value of `integer1` and assign the result to `decimal1`



SAMPLE RULETEST

A sample Ruletest provides an `integer1` value of `300` which is added to the value of `decimal2` and assigned to the value of `decimal1` for three instances of `Entity1`. Input and Output panels are shown below.



Add strings

SYNTAX

`<String1>` + `<String2>`

DESCRIPTION

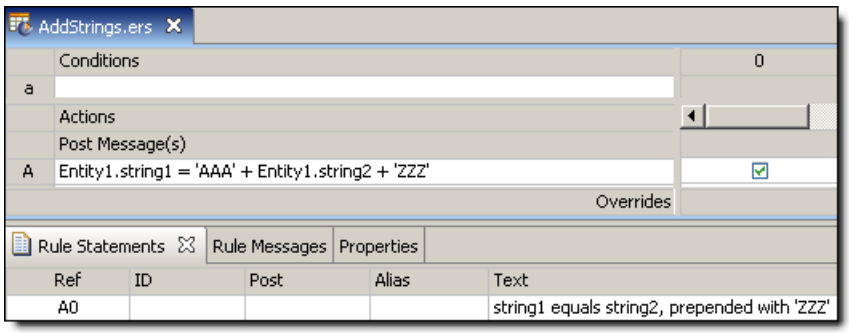
Adds `<String1>` to `<String2>`. This has the same effect as using the .concat operator. However, the “+” syntax permits concatenation of more than two String values without nesting, as shown in the example below.

USAGE RESTRICTIONS

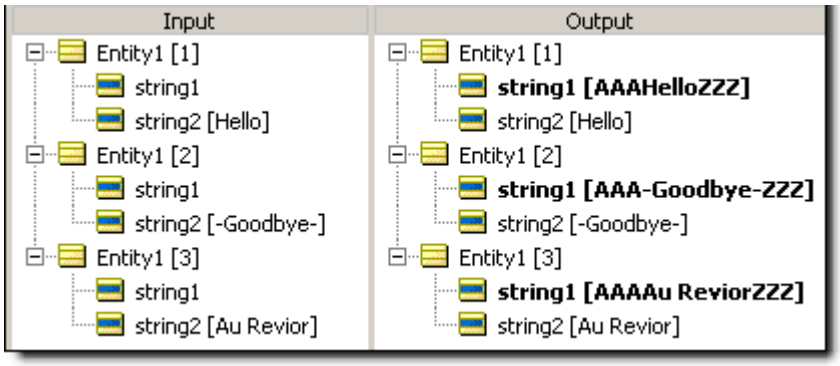
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

This sample Rulesheet uses **add strings** operation to add the String `AAA` to `string2` to `ZZZ` and assign the result to `string1`



SAMPLE RULETEST



Add days

SYNTAX

`<DateTime>`.addDays(`<Integer>`)

`<Date>`.addDays(`<Integer>`)

DESCRIPTION

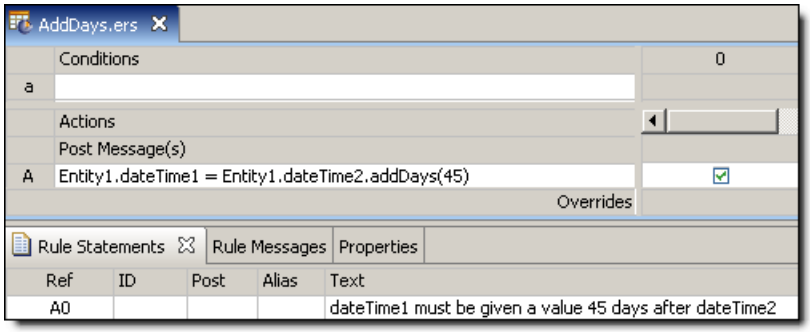
Adds the number of days in `<Integer>` to the number of days in `<DateTime>` or `<Date>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

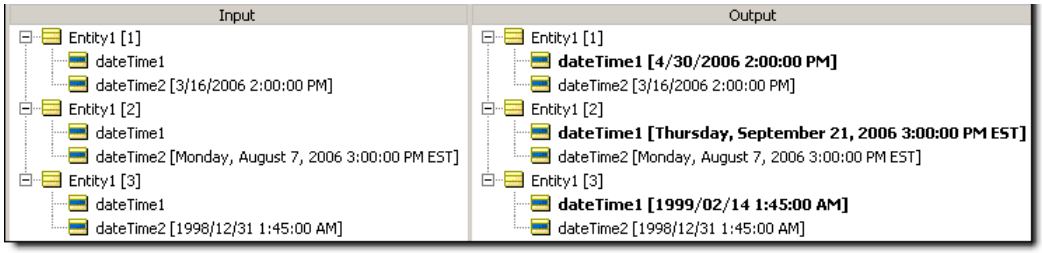
RULESHEET EXAMPLE

This sample Rulesheet uses **.addDays** to add `45` days to the value of `dateTime2` and assign the result to `dateTime1`.



SAMPLE RULETEST

A sample Ruletest provides values of `dateTime2` for three instances of `Entity1`. Input and Output panels are shown below. Notice the month portion of `dateTime1` also changes accordingly.



Add hours

SYNTAX

`<DateTime>`.addHours(`<Integer>`)

`<Time>`.addHours(`<Integer>`)

DESCRIPTION

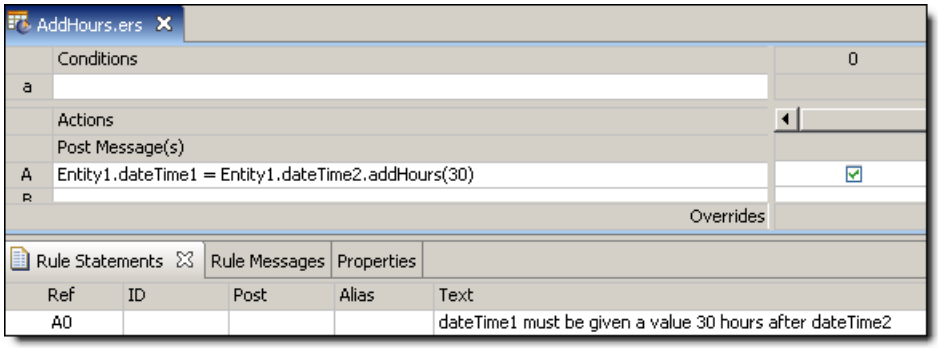
Adds the number of hours in `<Integer>` to the number of hours in the Time portion of `<DateTime>` or `<Time>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

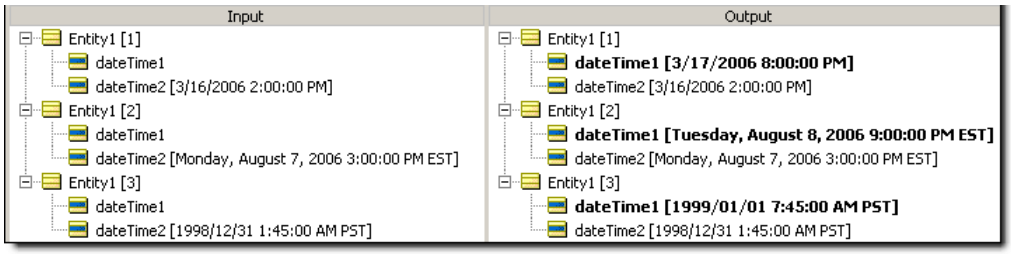
RULESHEET EXAMPLE

This sample Rulesheet uses the **. addHours** to add `30` hours to the value of `dateTime2` and assign the result to `dateTime1`.



SAMPLE RULETEST

A sample Ruletest provides values of `dateTime2` for three instances of `Entity1`. Input and Output panels are shown below.



Add minutes

SYNTAX

<DateTime>.addMinutes(<Integer>)

<Time>.addMinutes(<Integer>)

DESCRIPTION

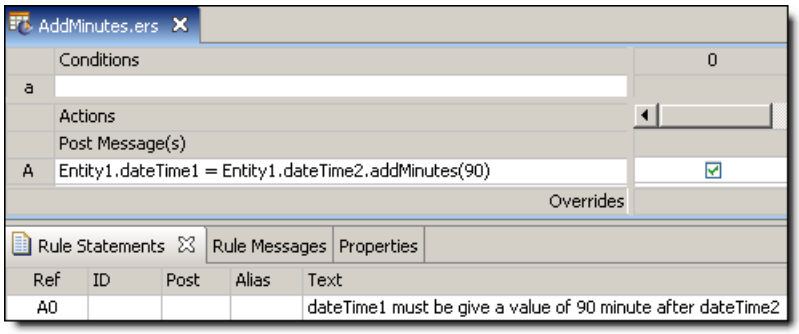
Adds the number of minutes in <Integer> to the number of minutes in the Time portion of <DateTime> or <Time>.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

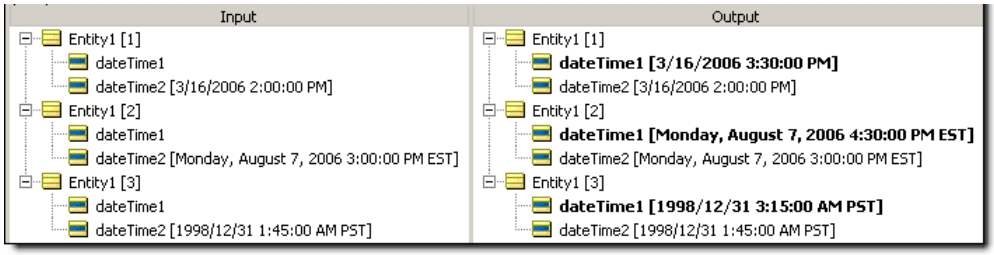
RULESHEET EXAMPLE

This sample Rulesheet uses the **. addMinutes** add 90 minutes to the value of dateTime2 and assign the result to dateTime1.



SAMPLE RULETEST

A sample Ruletest provides values of dateTime2 for three instances of Entity1. Input and Output panels are shown below.



Add months

SYNTAX

`<DateTime>`.addMonths(`<Integer>`)

`<Date>`.addMonths(`<Integer>`)

DESCRIPTION

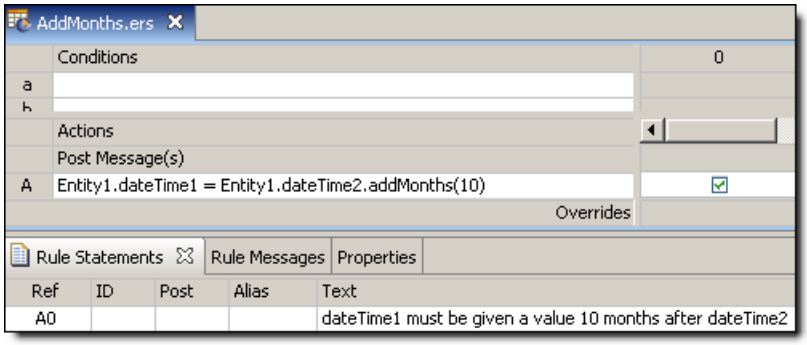
Adds the number of months in `<Integer>` to the number of months in `<DateTime>` or `<Date>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

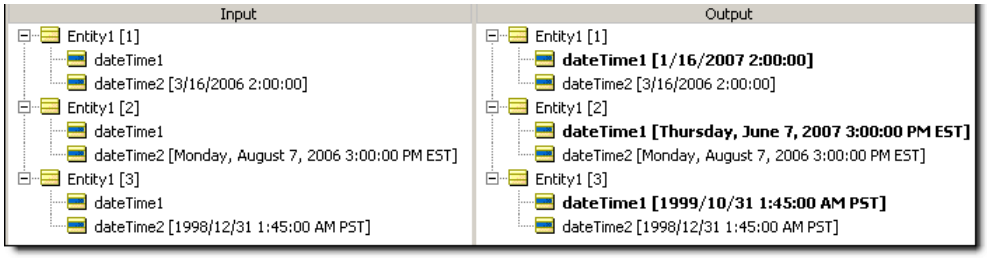
RULESHEET EXAMPLE

This sample Rulesheet uses **. addMonths** in a Nonconditional rule to add `10` months to the value of `dateTime2` and assign the result to `dateTime1`.



SAMPLE RULETEST

A sample Ruletest provides values of `dateTime2` for three instances of `Entity1`. Input and Output panels are shown below. Notice the year portion of `dateTime1` also changes accordingly.



Add seconds

SYNTAX

`<DateTime>`.addSeconds(`<Integer>`)

`<Time>`.addSeconds(`<Integer>`)

DESCRIPTION

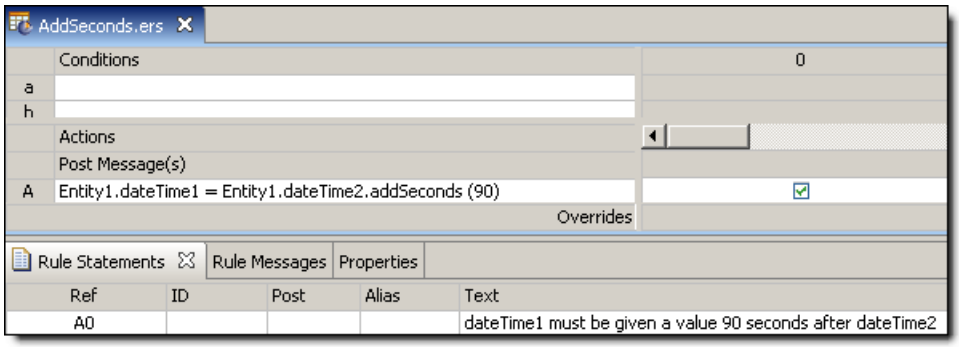
Adds the number of seconds in `<Integer>` to the number of seconds in the Time portion of `<DateTime>` or `<Time>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

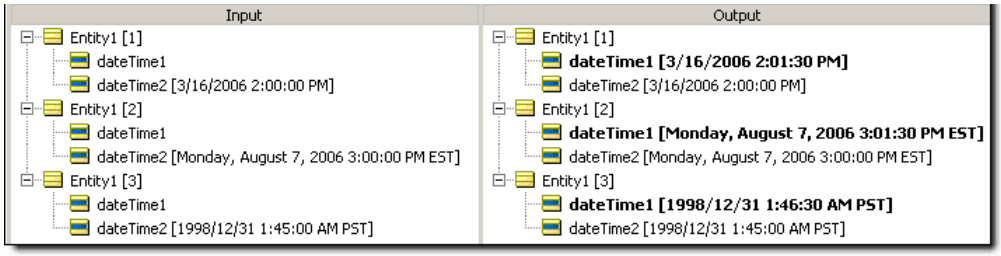
RULESHEET EXAMPLE

This sample Rulesheet uses **.addSeconds** in a Nonconditional rule to add `90` seconds to the value of `timeOnly2` and assign the result to `timeOnly1`.



SAMPLE RULETEST

A sample Ruletest provides values of `timeOnly2` for three instances of `Entity1`. Input and Output panels are shown below. Notice how the time “wraps” around to the beginning of the day, even though Time data type does not include date information.



Add years

SYNTAX

`<DateTime>`.addYears(`<Integer>`)

`<Date>`.addYears(`<Integer>`)

DESCRIPTION

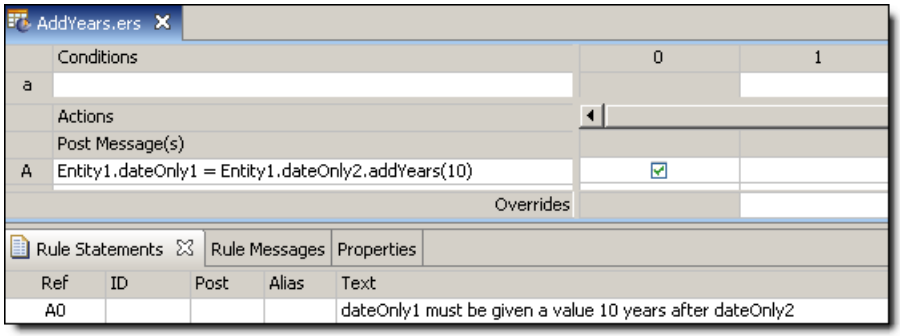
Adds the number of years in `<Integer>` to the number of years in the Date portion of `<DateTime>` or `<Date>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

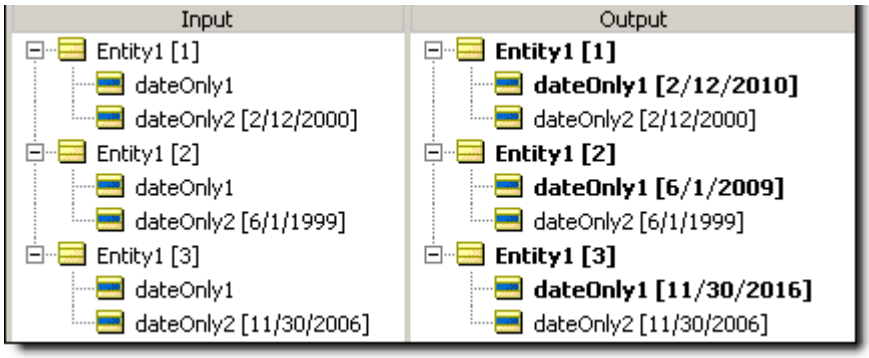
RULESHEET EXAMPLE

This sample Rulesheet uses **.addYears** in a Nonconditional rule to add `10` years to the value of `dateOnly2` and assign the result to `dateOnly1`.



SAMPLE RULETEST

A sample Ruletest provides values of `dateOnly2` for three instances of `Entity1`. Input and Output panels are shown below.



Associate element(s)

SYNTAX

`<Collection1>` **+=** `<Collection2>`

`<Collection1>` **+=** `<Entity>`

DESCRIPTION

Associates all elements of `<Collection2>` or a single element named `<Entity>` with `<Collection1>`, provided such an association is allowed by the Vocabulary. Every `<Collection>` must be expressed as a unique alias.

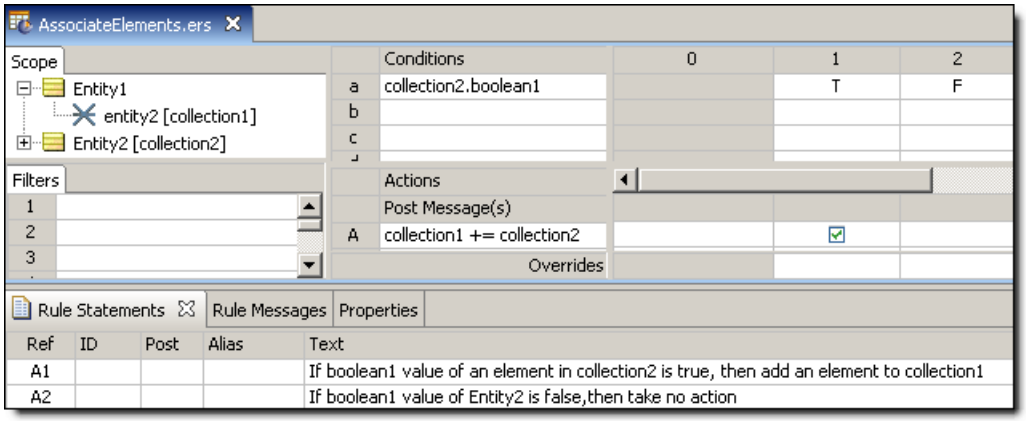
If the cardinality of the association between the parent entity of `<Collection>` and the `<Entity>` being added is “one-to-one” (a straight line icon beside the association in the Rule Vocabulary), then this **associate element** syntax is not used. Instead, replace element syntax is used, since the collection can contain only one element, and any element present will be replaced by the new element.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **associate element** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

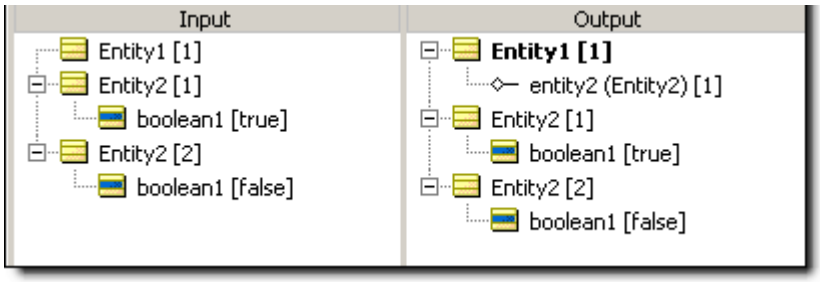
RULESHEET EXAMPLE

The following Rulesheet uses **associate element** to associate an element of `collection2` to `collection1` when `boolean1` value of any element in `collection2` is `true`. Note that the Action is not associating *all* elements in `collection2` with `collection1`, *only* those elements within `collection2` that satisfy the condition.



SAMPLE RULETEST

A sample Ruletest provides two examples of `Entity2` with `boolean1` values, and a single `Entity1`. Input and Output panels are described below:



At

SYNTAX

`<Sequence>` ->at(`<Integer>`).`<Attribute1>`

DESCRIPTION

Returns the value of `<Attribute1>` for the element at position `<Integer>` in `<Sequence>`. Another operator, such as ->sortedBy, must be used to transform a `<Collection>` into a `<Sequence>` before **->at** may be used. `<Sequence>` must be expressed as a unique alias. See *"Advanced collection sorting syntax" in the Rule Modeling Guide* for more examples of usage.

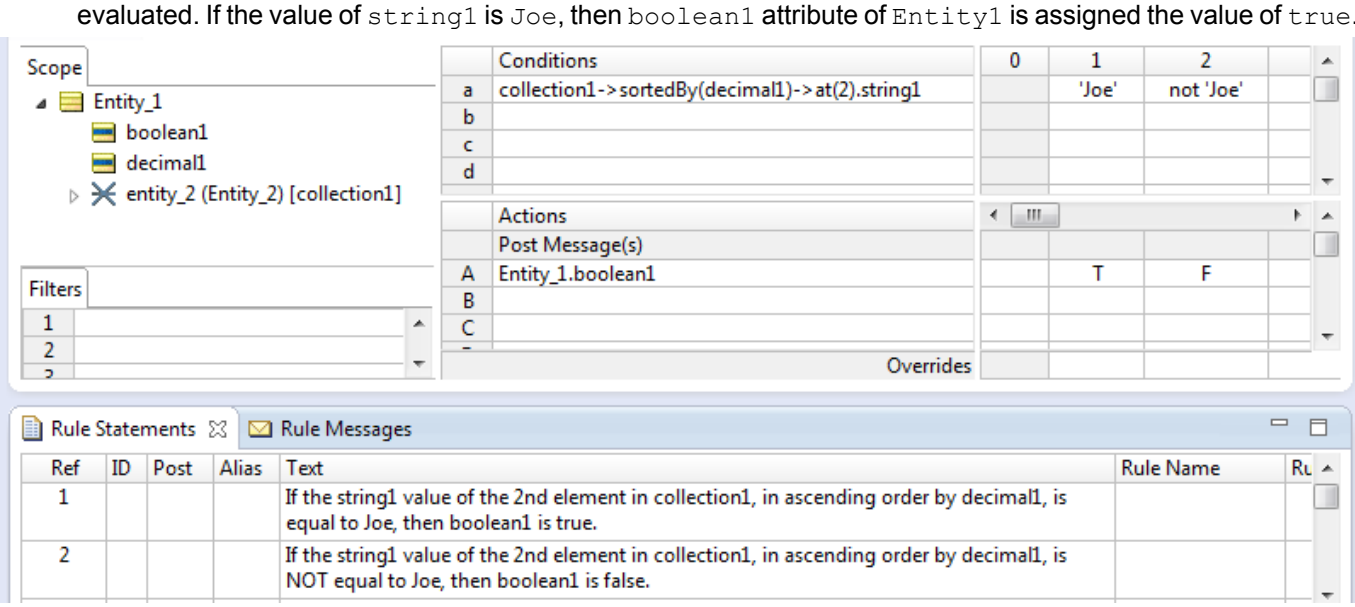
`<Attribute1>` may be of any data type.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

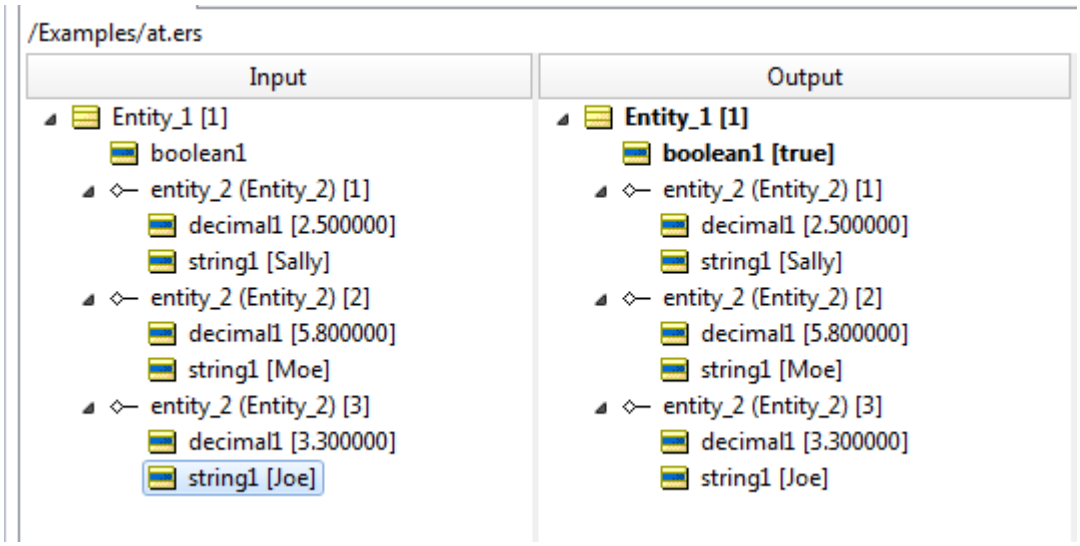
RULESHEET EXAMPLE

This sample Rulesheet uses **->at(2)** to identify the second element of the sequence created by applying sortedBy to `collection1`. Once identified, the value of the `string1` attribute belonging to this second element is evaluated. If the value of `string1` is `Joe`, then `boolean1` attribute of `Entity1` is assigned the value of `true`.



SAMPLE RULETEST

A sample Ruletest provides a collection of three elements, each with a `decimal1` value. Input and Output panels are shown below.



Average

SYNTAX

`<Collection.attribute>` ->avg

DESCRIPTION

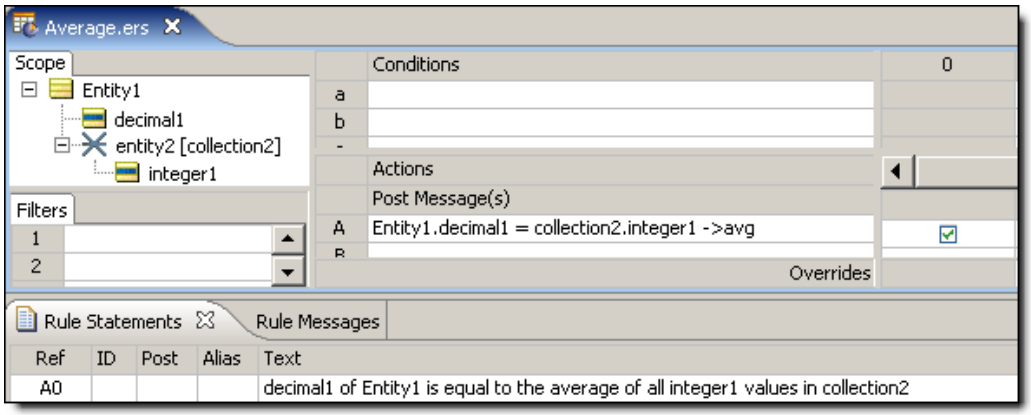
Averages the values of all of the specified attributes in <`Collection`>. <`Collection`> must be expressed as a unique alias. <`attribute`> must be a numeric data type.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

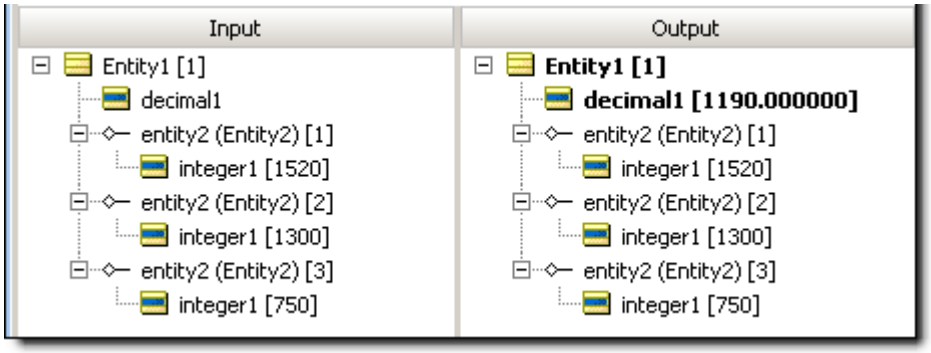
RULESHEET EXAMPLE

This sample Rulesheet uses **->avg** to average the `integer1` values of all elements in `collection2`, then assigns the resulting value to `decimal1` in `Entity1`. Note the use of the alias `collection2` to represent the collection of `Entity2` elements associated with `Entity1`.



SAMPLE RULETEST

A sample Ruletest provides `integer1` values for three elements in `collection2`. The following illustration shows Input and Output panels:



CellValue

SYNTAX

Various, see Examples below

DESCRIPTION

When used in an expression, **cellValue** is essentially a variable whose value is determined by the rule Column that executes. Using **cellValue** in a Condition or Action expression eliminates the need for multiple, separate Rows to express the same logic.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **cellValue** may only be used in Condition and Action Rows (sections 3 and 5 in Sections of Rulesheet that correlate with usage restrictions).

RULESHEET EXAMPLE 1

This sample Rulesheet uses **cellValue** to increment `integer1` by the amount in the Action Cell of the rule Column that fires. An equivalent Rulesheet which does not use cellValue is also shown for comparison purposes.

CellValue1.ers

	Conditions	0	1	2
a	Entity1.boolean1		T	F
b				
	Actions			
	Post Message(s)			
A	Entity1.integer1 += cellValue		3	6
B				
	Overrides			

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If boolean1 is true, increment integer1 by 3
2				If boolean1 is false, increment integer1 by 6

Equivalent Rulesheet without using **cellValue**:

CellValue2.ers

	Conditions	0	1	2
a	Entity1.boolean1		T	F
b				
	Actions			
	Post Message(s)			
A	Entity1.integer1 +=3		☑	
B	Entity1.integer1 +=6			☑
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If boolean1 is true, increment integer1 by 3
2				If boolean1 is false, increment integer1 by 6

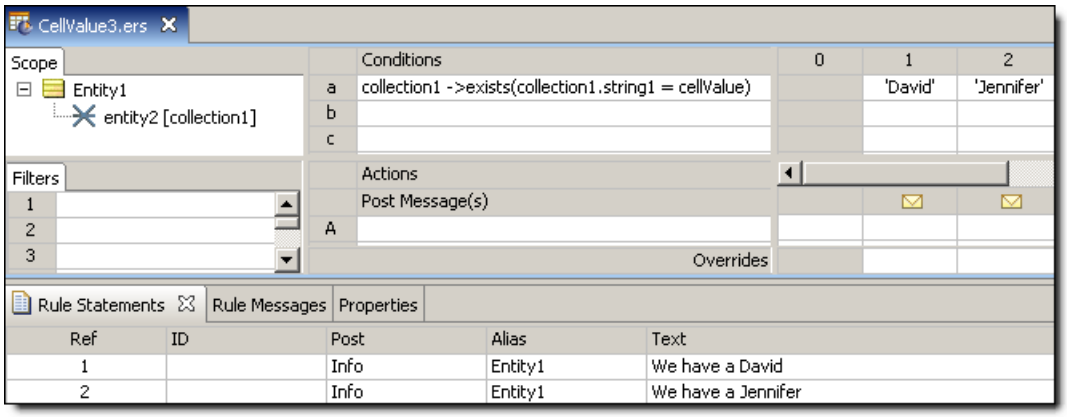
SAMPLE RULETEST 1

A sample Ruletest provides two examples of `boolean1`. The following table shows Input and Output panels.

Input	Output
Entity1 [1]	**Entity1 [1]**
boolean1 [true]	boolean1 [true]
integer1 [2]	**integer1 [5]**
Entity1 [2]	**Entity1 [2]**
boolean1 [false]	boolean1 [false]
integer1 [4]	**integer1 [10]**

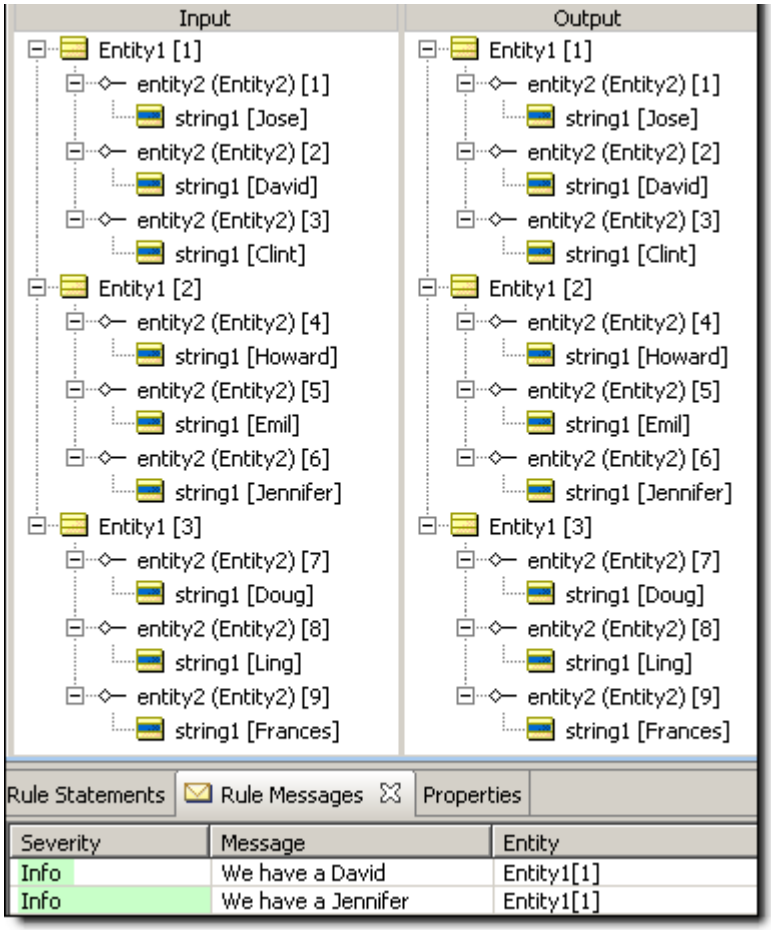
RULESHEET EXAMPLE 2

The following Rulesheet uses **cellValue** to evaluate whether `collection1` includes at least one member with a `string1` value of the entry in the Conditions Cell of the rule Column.



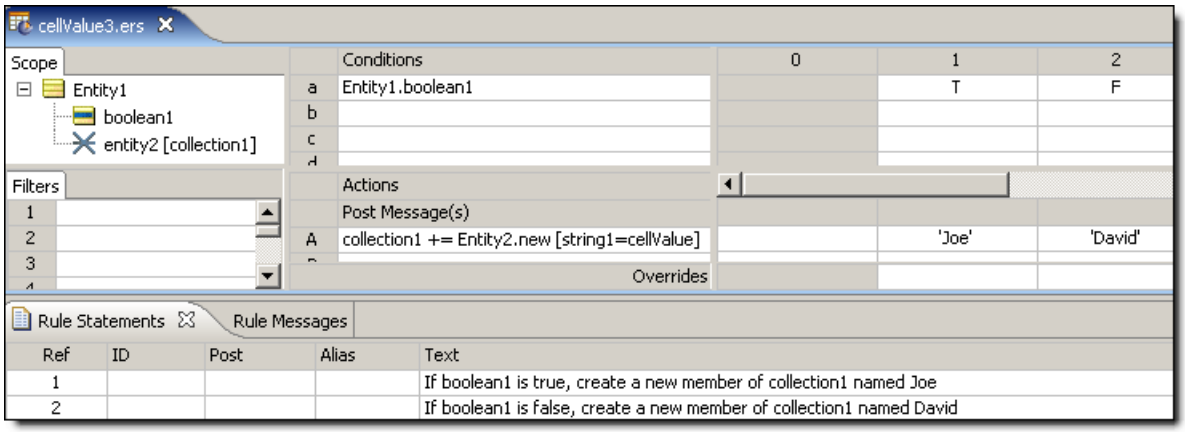
SAMPLE RULETEST 2

A sample Ruletest provides three examples of `collection1` – each member has a `string1` value. Input and Output panels are shown below.



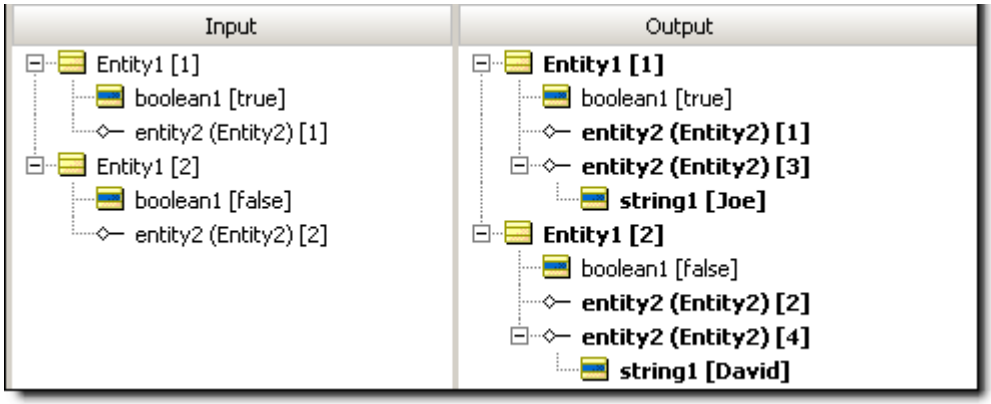
RULESHEET EXAMPLE 3

The following Rulesheet uses **cellValue** to create a new member of `collection1` with `string1` value equal to the Action Cell in the rule Column that fires.



SAMPLE RULETEST 3

A sample Ruletest provides `string1` values for three examples. The following illustration shows Ruletest Input and Output panels. Notice that each `collection1` already has one element prior to executing the test. This simply ensures the results will be displayed in hierarchical style.



Clone

SYNTAX

<`Entity`>.clone[<`Expression1`>,<`Expression2`>...]

DESCRIPTION

Copies the specified `Entity` and its attribute values to a new `Entity` where `Expressions` (in the form *`attribute=value`*) override the corresponding cloned attribute values. The new `Entity` has no associations. Where an Entity specifies an Entity Identity, that identity is not copied to its clone entity. For each `Entity` in `Collection`, the operator creates a duplicate of `Entity`. The implementation is a *shallow clone* -- associations are not duplicated.

Note: If the cloned entity is database-enabled and contains primary keys, the primary key values must be specified in the qualifier clause or an exception will occur. If an Entity uses a Datastore Identity as its Identity Strategy, a new identifier is created by the database for each clone.

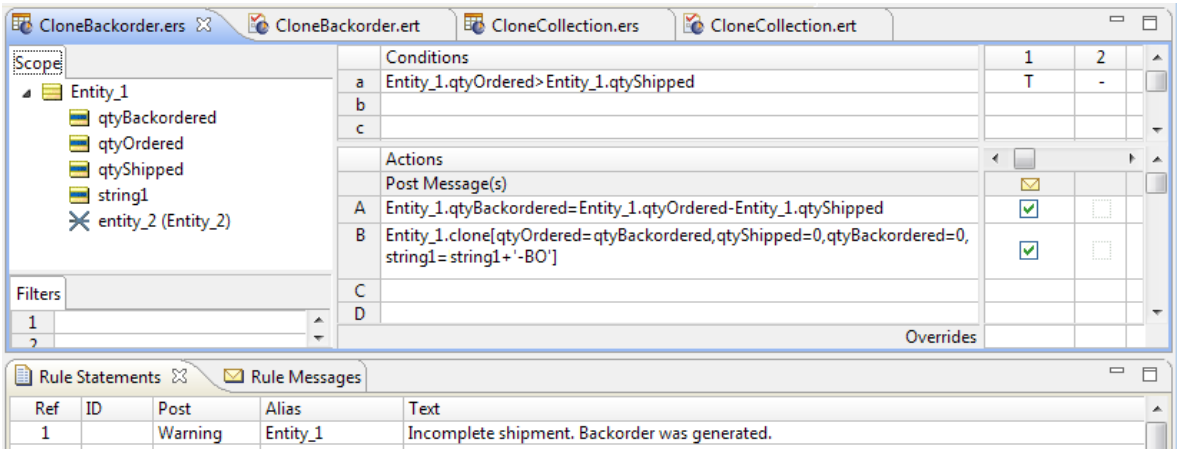
USAGE RESTRICTIONS

The Operators row in the table of Summary Table of Vocabulary Usage Restriction does not apply. Special exceptions: **clone** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

Nested clone calls are not supported, such as `E1.clone[assoc1 += E1.assoc1.clone[…]]`.

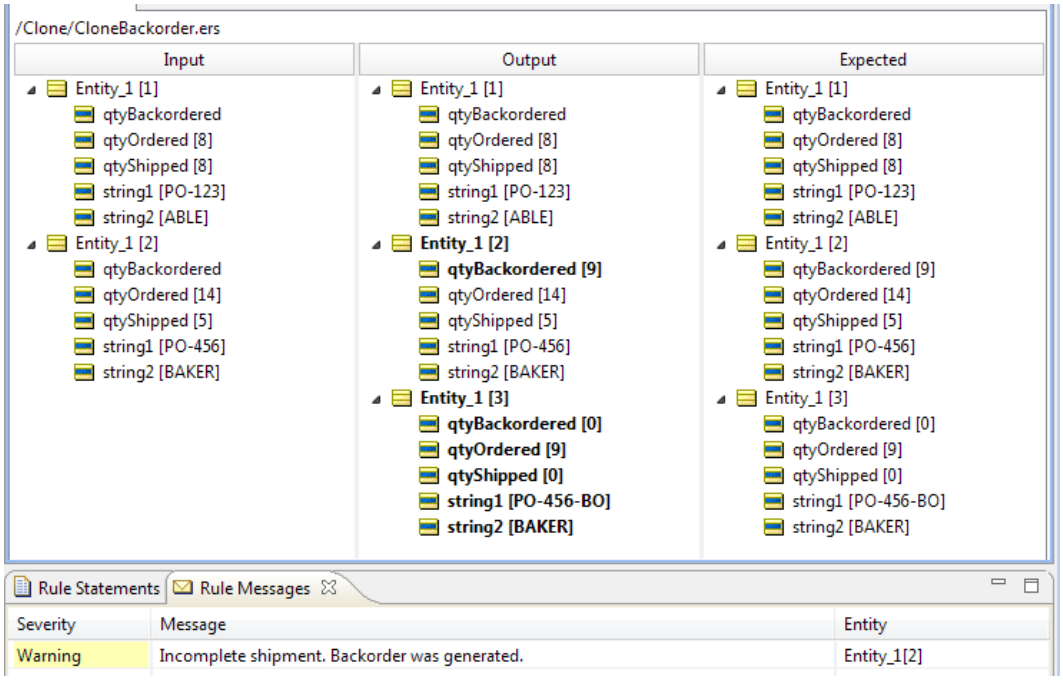
RULESHEET EXAMPLE

The following Rulesheet uses **.clone** to create a new `Entity2` element when the value of `qtyOrdered` in `Entity1` is greater than the `qtyShipped` value. An alias is not required by the **.clone** operator, because it is possible to create a new entity at the root level, without inserting it into a collection.



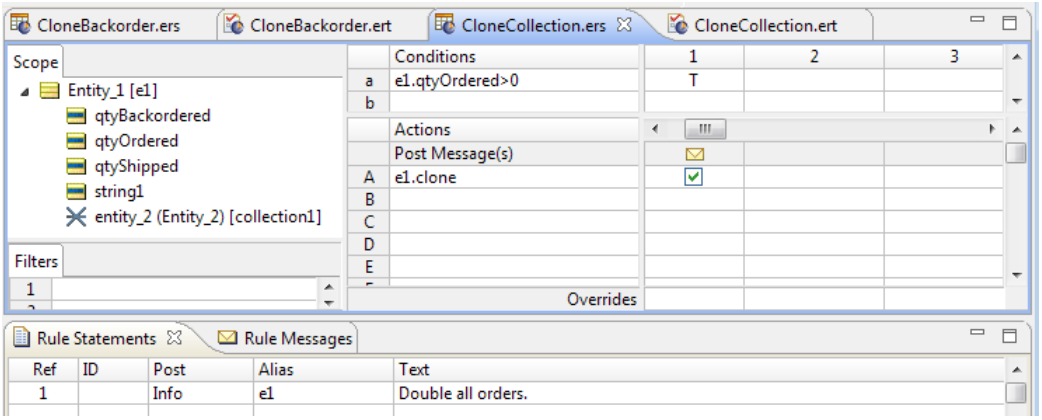
SAMPLE RULETEST

A sample Ruletest provides two collections of `Entity1`. Input, Output, and Expected panels are as follows:



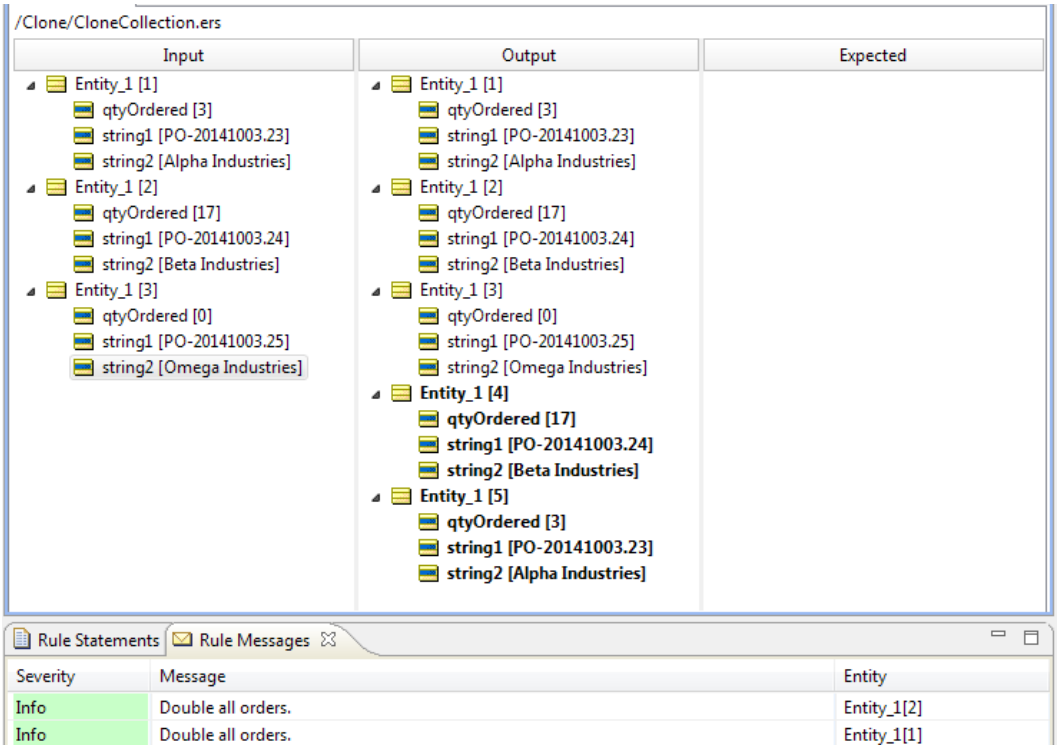
RULESHEET EXAMPLE: COLLECTION

The following Rulesheet uses **.clone** to create a new `Entity2` element in `collection1` when `Entity1` has a non-zero `qtyOrdered` value.



SAMPLE RULETEST: COLLECTION

A sample Ruletest provides three collections of `Entity1`. Input and Output panels are illustrated below:



Concatenate

SYNTAX

`<String1>`.concat(`<String2>`)

DESCRIPTION

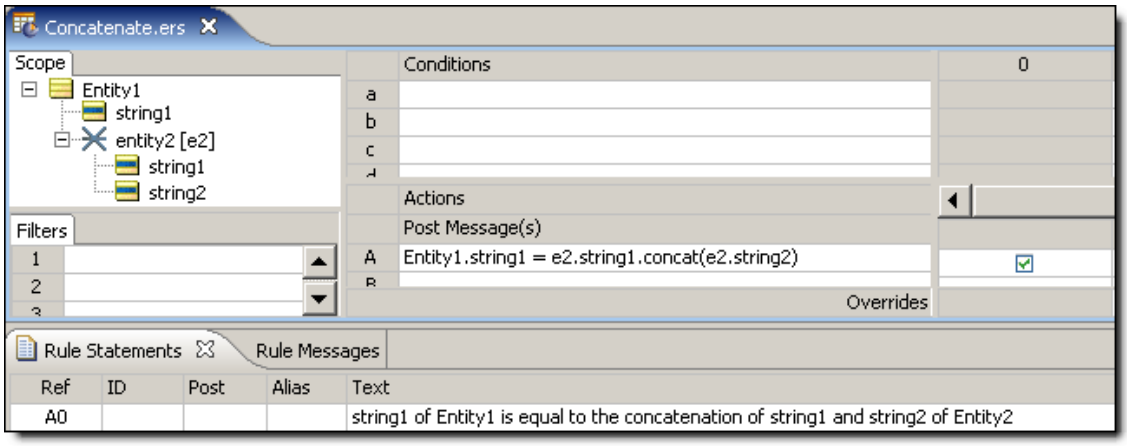
Concatenates `<String1>` to `<String2>`, placing `<String2>` at the end of `<String1>`

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions

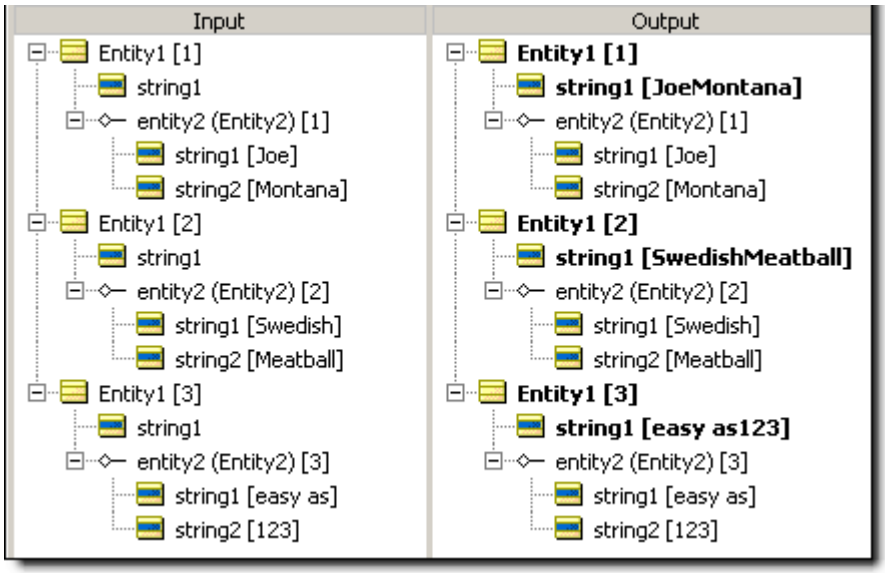
RULESHEET EXAMPLE

This sample Rulesheet uses **.concat** to create `string1` by combining `string1` and `string2` from `Entity1.entity2`.



SAMPLE RULETEST

A sample Ruletest provides three examples of `string1` and `string2`. Input and Output panels are shown below.



Contains

SYNTAX

`<String1>`.contains(`<String2>`)

DESCRIPTION

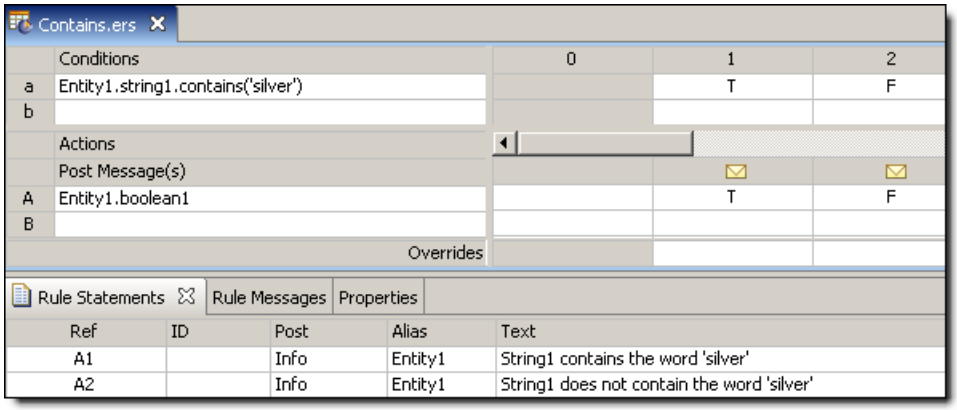
Evaluates `<String1>` and returns a value of true if it contains or includes the exact (case-sensitive) characters specified in `<String2>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions

RULESHEET EXAMPLE 1

The following uses **.contains** to evaluate whether `string1` includes the characters `silver` and assigns a value to `boolean1` for each outcome.



Contains.ers

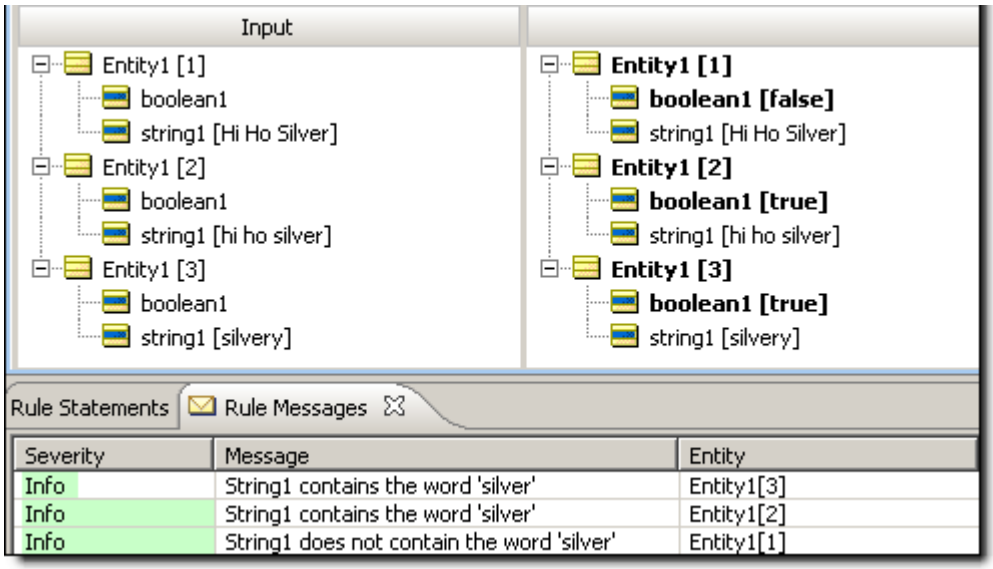
	Conditions	0	1	2
a	Entity1.string1.contains('silver')		T	F
b				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
B				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
A1		Info	Entity1	String1 contains the word 'silver'
A2		Info	Entity1	String1 does not contain the word 'silver'

SAMPLE RULETEST 1

A sample Ruletest provides `string1` values for three examples. Input and Output panels are shown below. Note case sensitivity in these examples. Posted messages are not shown.



Day

SYNTAX

`<DateTime>`.day

`<Date>`.day

`

DESCRIPTION

Returns the day portion of `<DateTime>` or `<Date>` as an Integer between 1 and 31.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.day** to assign a value to `string1` and post a message.

Day.ers

	Conditions	0	1	2
a	Entity1.dateTime1.day		<15	>=15
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.string1		'Hold'	'Ship'
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
A1		Warning	Entity1	If the day of dateTime1 is earlier than the 15th, then assign string1 a value of 'Hold' and issue a Warning Message
A2		Info	Entity1	If the day of dateTime1 is on or after the 15th, then assign string1 a value of 'Ship' and issue an Info Message

SAMPLE RULETEST

A sample Ruletest provides `dateTime1` values for three examples. Input and Output panels are shown below. Posted messages are not shown.

Input

- Entity1 [1]
  - dateTime1 [1/12/2006 9:30:00 AM]
- Entity1 [2]
  - dateTime1 [May 19, 2003 3:00:00 PM]
- Entity1 [3]
  - dateTime1 [March 9, 2010 10:45:00 AM]

Output

- **Entity1 [1]**
  - dateTime1 [1/12/2006 9:30:00 AM]
  - **string1 [Hold]**
- **Entity1 [2]**
  - dateTime1 [May 19, 2003 3:00:00 PM]
  - **string1 [Ship]**
- **Entity1 [3]**
  - dateTime1 [March 9, 2010 10:45:00 AM]
  - **string1 [Hold]**

Rule Statements | Rule Messages | Properties

Severity	Message	Entity
Warning	If the day of dateTime1 is earlier than the 15th, then assign string1 a value of 'Hold' and issue a Warning Message	Entity1[1]
Warning	If the day of dateTime1 is earlier than the 15th, then assign string1 a value of 'Hold' and issue a Warning Message	Entity1[3]
Info	If the day of dateTime1 is on or after the 15th, then assign string1 a value of 'Ship' and issue an Info Message	Entity1[2]

Days between

SYNTAX

`<DateTime1>`.daysBetween(`<DateTime2>`)

`<Date1>`.daysBetween(`<Date2>`)

DESCRIPTION

Returns the Integer number of days between DateTimes or Dates. This function calculates the number of milliseconds between the date values and divides that number by 86,400,000 (the number of milliseconds in a day). Any fraction is truncated, leaving an Integer result. If the two dates differ by less than a full 24-hour period, the value returned is zero. A positive Integer value is returned when `<DateTime2>` occurs after `<DateTime1>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions

RULESHEET EXAMPLE

The following Rulesheet uses **.daysBetween** to determine the number of days that have elapsed between `dateTime1` and `dateTime2`, compare it to the values in the Condition cells, and assign a value to `string1`.

DaysBetween.ers

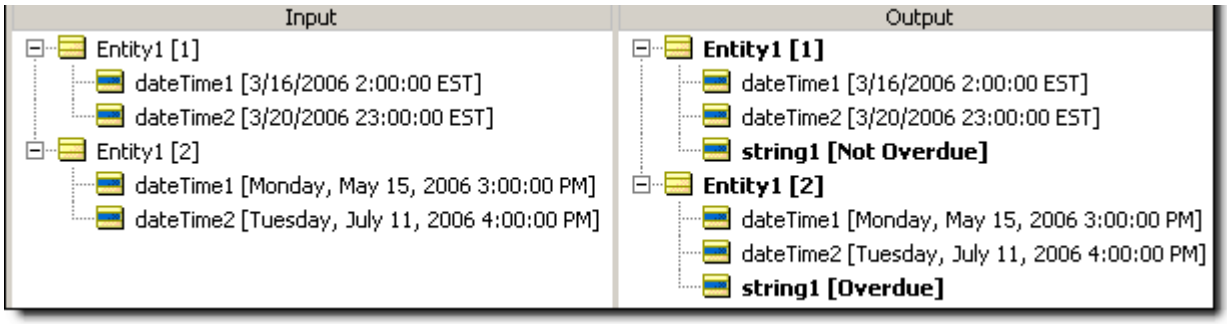
	Conditions	0	1	2
a	Entity1.dateTime1.daysBetween(Entity1.dateTime2)		<=30	>30
b				
	Actions			
	Post Message(s)			
A	Entity1.string1		'Not Overdue'	'Overdue'
-				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
A1				If 30 days or fewer have elapsed between dateTime1 and dateTime2, then Entity1 is not overdue
A2				If more than 30 days have elapsed between dateTime1 and dateTime2, then Entity 1 is overdue

SAMPLE RULETEST

A sample Ruletest provides `dateTime1` and `dateTime2` for two examples. Input and Output panels are shown below.



Day of week

SYNTAX

`<DateTime>`.dayOfWeek

`<Date>`.dayOfWeek

DESCRIPTION

Returns an Integer between 1 and 7, corresponding to the table below:

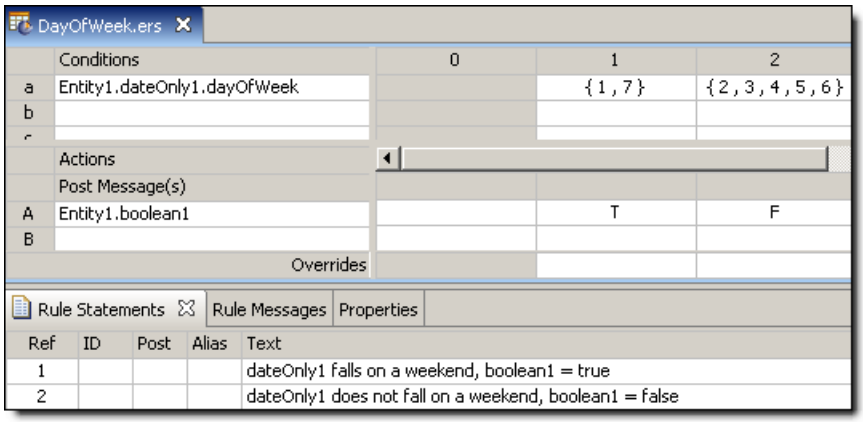
returned Integer	day of the week
1	Sunday
2	Monday
3	Tuesday
4	Wednesday
5	Thursday
6	Friday
7	Saturday

USAGE RESTRICTIONS

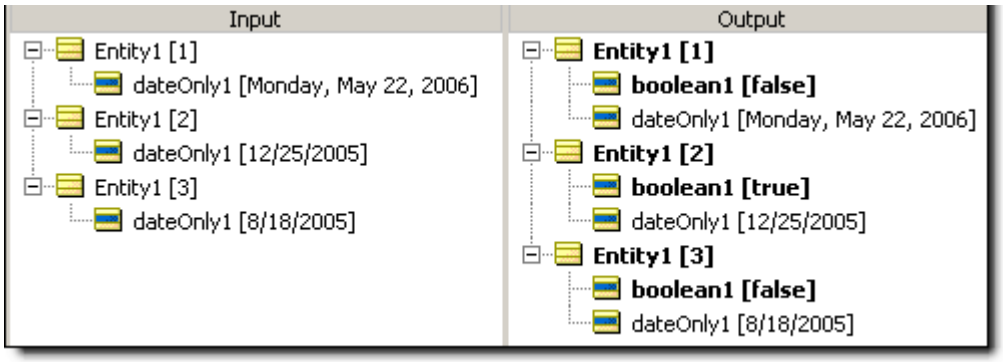
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions

RULESHEET EXAMPLE

The following Rulesheet uses **.dayOfWeek** to assign a value to `boolean1`.



SAMPLE RULETEST



Day of year

SYNTAX

`<DateTime>`.dayOfYear

`<Date>`.dayOfYear

DESCRIPTION

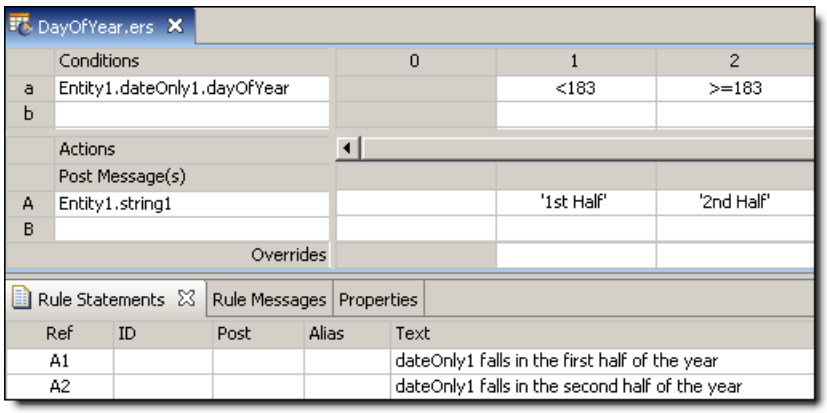
Returns an Integer from 1 to 366, equal to the day number within the year.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions

RULESHEET EXAMPLE

The following Rulesheet uses **.dayOfYear** to assign a value to `string1`.



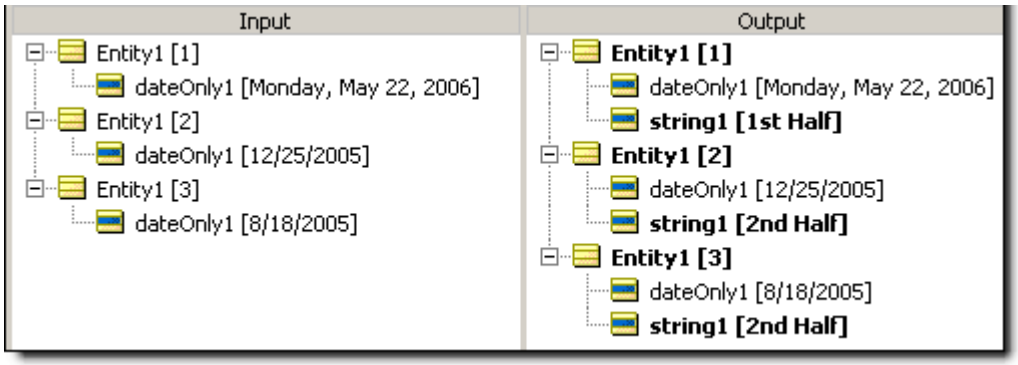
DayOfYear.ers

	Conditions	0	1	2
a	Entity1.dateOnly1.dayOfYear		<183	>=183
b				
	Actions			
	Post Message(s)			
A	Entity1.string1		'1st Half'	'2nd Half'
B				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
A1				dateOnly1 falls in the first half of the year
A2				dateOnly1 falls in the second half of the year

SAMPLE RULETEST



Input	Output
Entity1 [1]	**Entity1 [1]**
dateOnly1 [Monday, May 22, 2006]	dateOnly1 [Monday, May 22, 2006]
Entity1 [2]	**string1 [1st Half]**
dateOnly1 [12/25/2005]	**Entity1 [2]**
Entity1 [3]	dateOnly1 [12/25/2005]
dateOnly1 [8/18/2005]	**string1 [2nd Half]**
	Entity1 [3]
	dateOnly1 [8/18/2005]
	string1 [2nd Half]

Decrement

SYNTAX

`<Number1> -= <Number2>`

DESCRIPTION

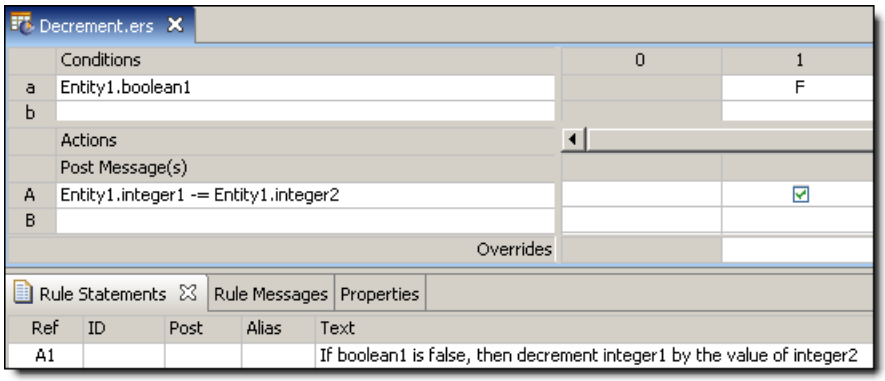
Decrements `<Number1>` by the value of `<Number2>`. The data type of `<Number1>` must accommodate the subtraction of `<Number2>`. In other words, an Integer may not be decremented by a Decimal without using another operator (such as .toInteger or Floor on page 94) to first convert the Decimal to an Integer.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **decrement** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

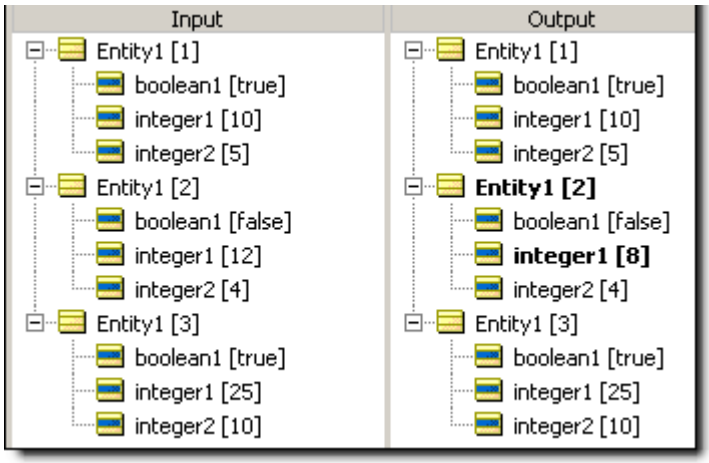
RULESHEET EXAMPLE

This sample Rulesheet uses **decrement** to reduce `integer1` by the value of `integer2` when `boolean1` is `false`.



SAMPLE RULETEST

A sample Ruletest provides three examples of `integer1`, `integer2`, and `boolean1`. Input and Output panels are shown below.



Disassociate element(s)

SYNTAX

`<Collection1> -= <Collection2>`

DESCRIPTION

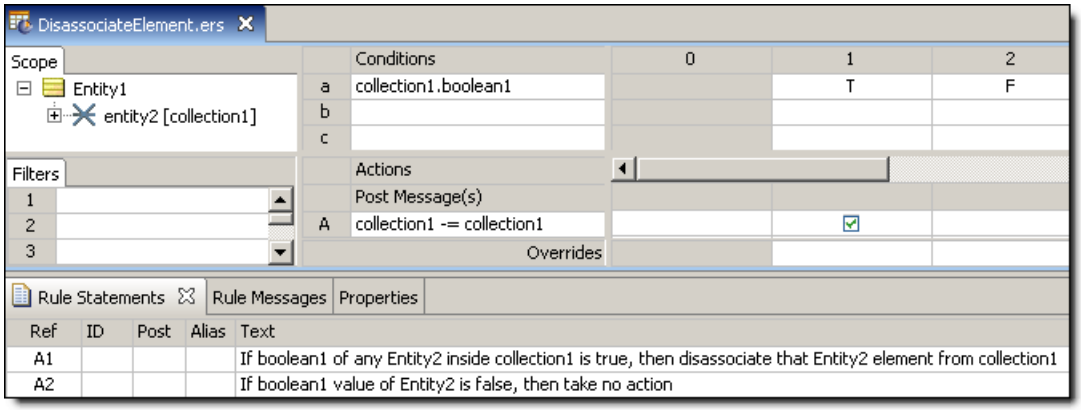
Disassociates all elements of `<Collection2>` from `<Collection1>`. Elements are not deleted, but once disassociated from `<Collection1>`, they are moved to the root level of the data. `<Collection1>` must be expressed as a unique alias. Contrast this behavior with remove, which deletes elements entirely.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **disassociate element** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

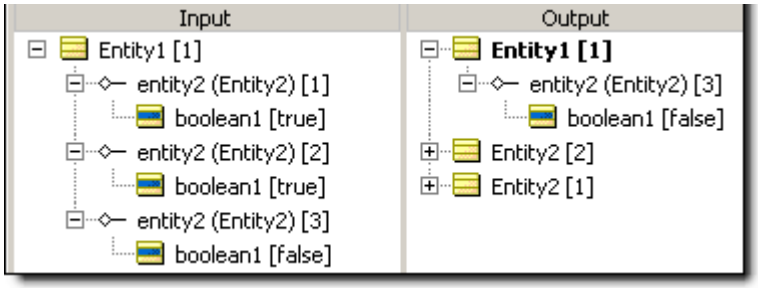
RULESHEET EXAMPLE

This sample Rulesheet removes those elements from `collection1` whose `boolean1` value is true.



SAMPLE RULETEST

A sample Ruletest provides a collection with three elements. The illustration shows Input and Output panels:



Divide

SYNTAX

<Number1>/<Number2>

DESCRIPTION

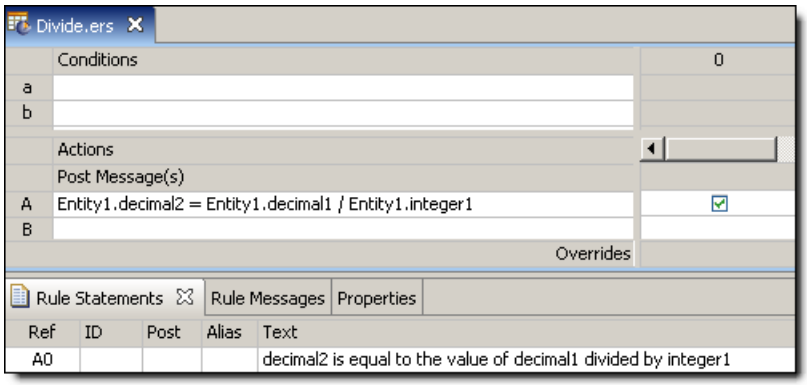
Divides <Number1> by <Number2>. The resulting data type is the more expansive of those of <Number1> and <Number2>.

USAGE RESTRICTIONS

The Operators row in the table of Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

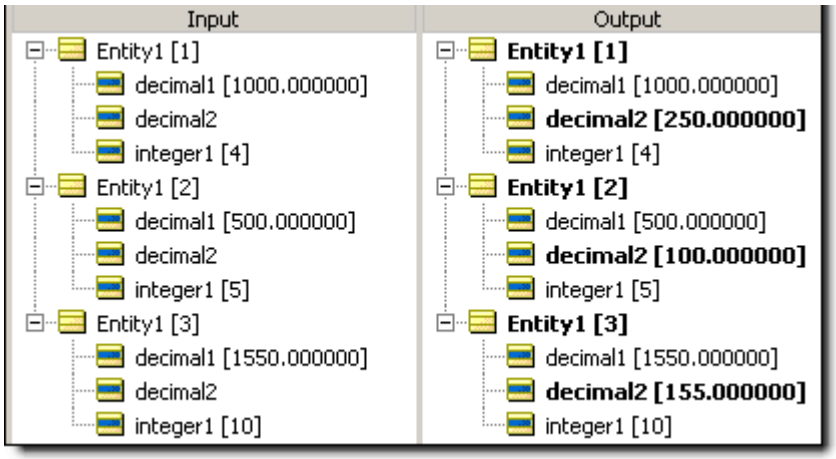
RULESHEET EXAMPLE

This sample Rulesheet uses **divide** to divide decimal1 by integer1 and assign the resulting value to decimal2



SAMPLE RULETEST

A sample Ruletest provides decimal1 and integer1 values for three examples. Input and Output panels are shown below.



Div

SYNTAX

`<Integer1>`.div(`<Integer2>`)

DESCRIPTION

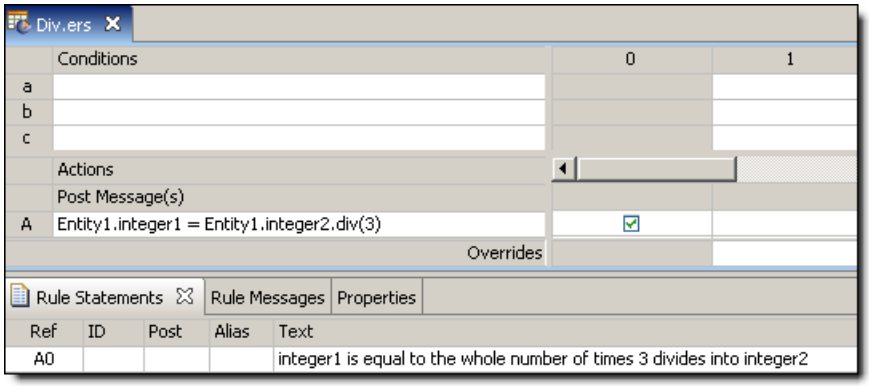
Returns an Integer equal to the whole number of times that `<Integer2>` divides into `<Integer1>`. Any remainder is discarded.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

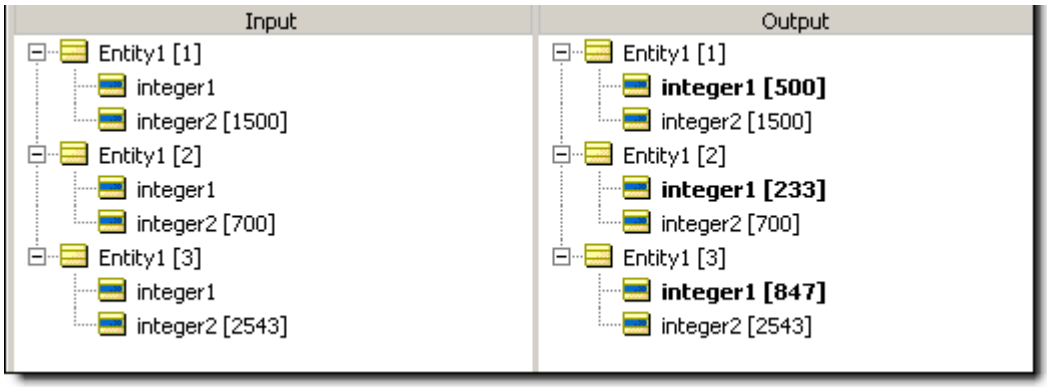
RULESHEET EXAMPLE

This sample Rulesheet uses **.div** to calculate the whole number of times `3` divides into `integer2`, and assigns the resulting value to `integer1` .



SAMPLE RULETEST

A sample Ruletest provides `integer2` values for three examples. Input and Output panels are shown below.



Ends with

SYNTAX

`<String1>`.endsWith(`<String2>`)

DESCRIPTION

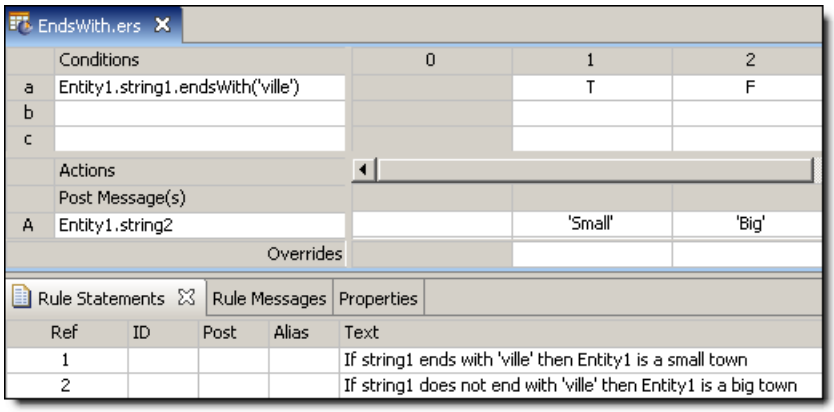
Evaluates `<String1>` and returns a value of true if it ends with the characters specified in `<String2>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.endsWith** to evaluate whether `string1` ends with the characters `ville` and assigns a different value to `string2` for each outcome.



EndsWith.ers

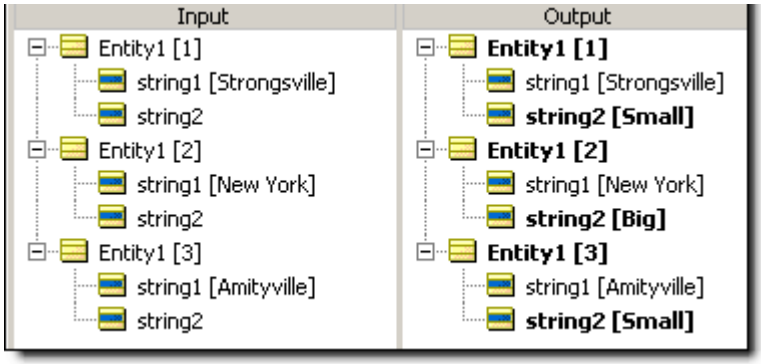
	Conditions	0	1	2
a	Entity1.string1.endsWith('ville')		T	F
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.string2		'Small'	'Big'
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If string1 ends with 'ville' then Entity1 is a small town
2				If string1 does not end with 'ville' then Entity1 is a big town

SAMPLE RULETEST

A sample Ruletest provides `string1` values for three examples. Input and Output panels are shown below.



Input	Output
Entity1 [1]	**Entity1 [1]**
string1 [Strongsville]	string1 [Strongsville]
string2	**string2 [Small]**
Entity1 [2]	**Entity1 [2]**
string1 [New York]	string1 [New York]
string2	**string2 [Big]**
Entity1 [3]	**Entity1 [3]**
string1 [Amityville]	string1 [Amityville]
string2	**string2 [Small]**

Equals when used as an assignment

SYNTAX

Boolean	`<Boolean1>` = `<Expression1>`
DateTime*	`<DateTime1>` = `<DateTime2>`
Number	`<Number1>` = `<Number2>`
String	`<String1>` = `<String2>`

DESCRIPTION

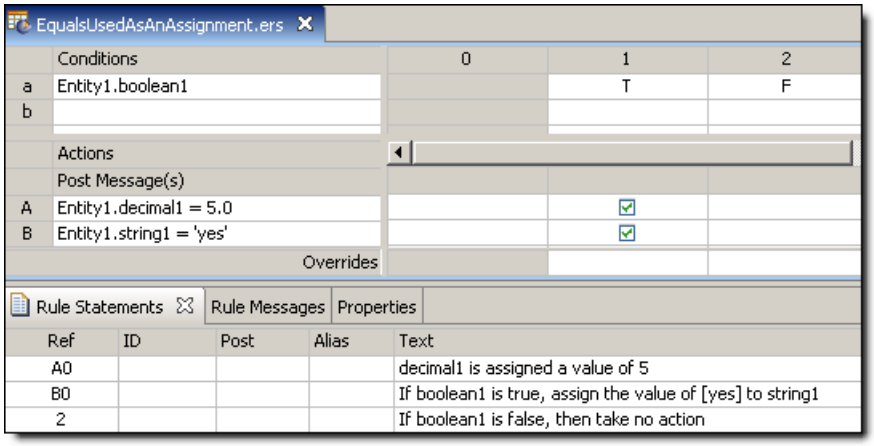
Boolean	Assigns the truth value of `<Expression1>` to `<Boolean1>`.
DateTime*	Assigns the value of `<DateTime2>` to `<DateTime1>`.
Number	Assigns the value of `<Number2>` to `<Number1>`. Automatic *casting* (the process of changing a value's data type) -- which includes DateTime, Date, or Time data types -- will occur when assigning an Integer data type to a Decimal data type. To assign a Decimal value to an Integer value, use the .toInteger operator.
String	Assigns the value of `<String2>` to `<String1>`.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **equals** used as an assignment may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

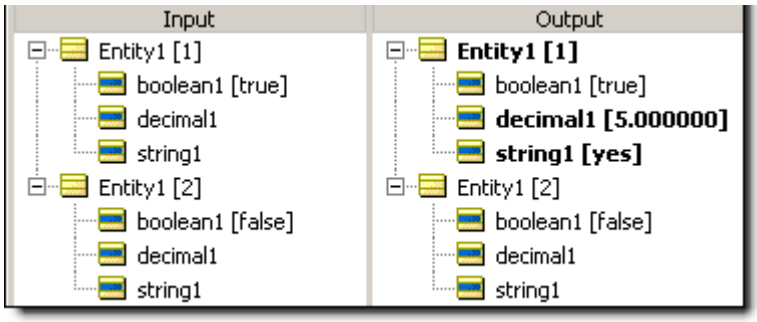
RULESHEET EXAMPLE

The following Rulesheet uses **equals** twice: in an Action row to assign a value to `decimal1`, and in an Action row to assign a value to `string1` based on the value of `boolean1`.



SAMPLE RULETEST

A sample Ruletest provides two examples of `boolean1`. Input and Output panels are shown below:



Equals when used as a comparison

SYNTAX

Boolean	`<Expression1> = <Expression2>`
DateTime*	`<DateTime1> = <DateTime2>`
Number	`<Number1> = <Number2>`
String	`<String1> = <String2>`

DESCRIPTION

Boolean	Returns a value of true if `<Expression1>` is the same as `<Expression2>`.
DateTime*	Returns a value of true if `<DateTime1>` is the same as `<DateTime2>`, including both the Date and the Time portions
Number	Returns a value of true if `<Number1>` is the same as `<Number2>`. Different numeric data types may be compared in the same expression.
String	Returns a value of true if `<String1>` is the same as `<String2>`. Both case and length are examined to determine equality. Corticon Studio uses the ISO character precedence in comparing String values. See Character precedence: Unicode and Java Collator on page 189.

*includes DateTime, Date, and Time data types

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **equals** to Ruletest whether `decimal1` equals `decimal2`, and assign a value to `string1` based on the result of the comparison.

EqualsUsedAsAComparison.ers

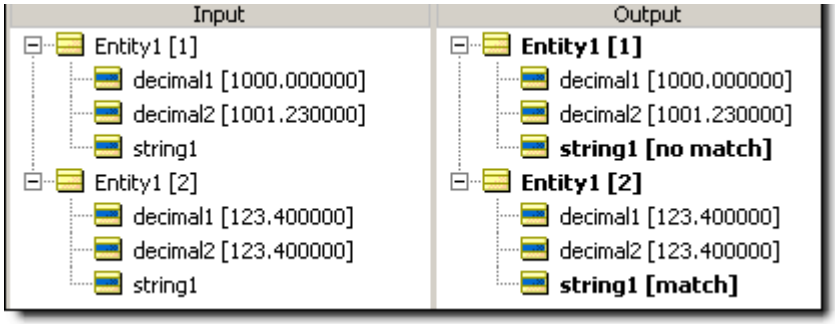
	Conditions	0	1	2
a	Entity1.decimal1 = Entity1.decimal2		T	F
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.string1		'match'	'no match'
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If decimal1 equals decimal2, then assign a value of [match] to string1
2				If decimal1 does not equal decimal2, then assign a value of [no match] to string1

SAMPLE RULETEST

A sample Ruletest provides two examples. Input and Output panels are shown below:



Equals ignoring case

SYNTAX

`<String1>`.equalsIgnoreCase(`<String2>`)

DESCRIPTION

Returns a value of true if `<String1>` is the same as `<String2>`, irrespective of case.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

This sample Rulesheet uses **.equalsIgnoreCase** to compare the values of `string1` and `string2`, and assign a value to `boolean1` based on the results of the comparison.

EqualsIgnoringCase.ers

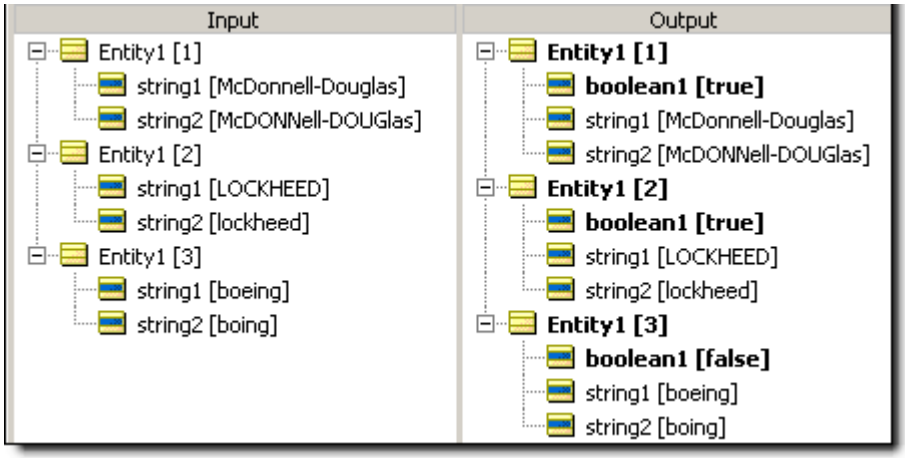
	Conditions	0	1	2
a	Entity1.string1.equalsIgnoreCase(Entity1.string2)		T	F
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				boolean1 must be true if string1 and string2 are the same (ignoring case)
2				boolean1 must be true if string1 and string2 are not the same (ignoring case)

SAMPLE RULETEST

A sample Ruletest provides the plane type for three sets of `string1` and `string2`. Input and Output panels are shown below. Notice how these results differ from those shown in the equals example.



Equals when using Strings

SYNTAX

`<String1>`.equals(`<String2>`)

DESCRIPTION

Returns a value of true if `<String1>` is exactly the same as `<String2>`, including character case. This is alternative syntax to equals (used as a comparison).

USAGE RESTRICTIONS

The Operators row in the table Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

This sample Rulesheet uses **.equals** to compare the contents of `string1` and `string2`, and assign a value to `boolean1` as a result.

EqualsStringsOnly.ers

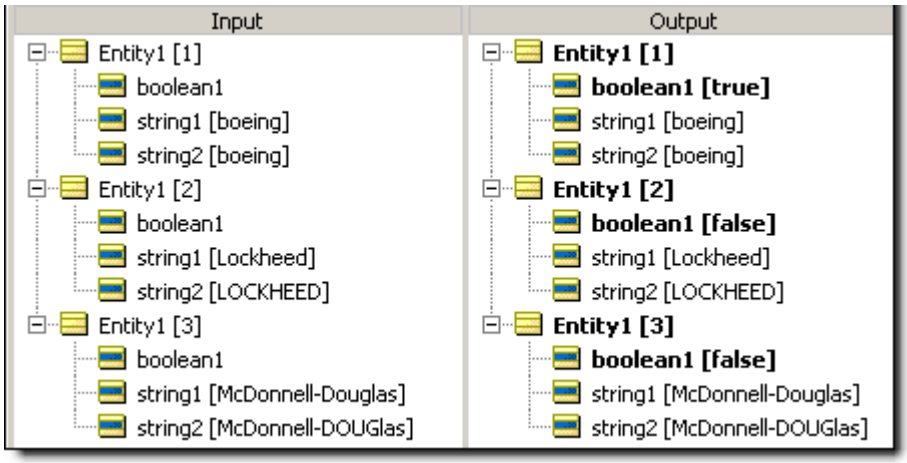
	Conditions	0	1	2
a	Entity1.string1.equals(Entity1.string2)		T	F
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				boolean1 must be true if string1 and string2 are the same
2				boolean1 must be false if string1 and string2 are not the same

SAMPLE RULETEST

A sample Ruletest provides three sets of `string1` and `string2`. Input and Output panels are shown below. Notice how these results differ from those shown in the .equalsIgnoreCase example.



Exists

SYNTAX

`<Collection>` ->exists(`<Expression1>`,`<Expression2>`,...)

`<Collection>` ->exists(`<Expression1>` or `<Expression2>` or ...)

DESCRIPTION

Returns a value of true if `<Expression>` holds true for *at least one* element of `<Collection>`. `<Collection>` must be expressed as a unique alias. Multiple `<Expressions>` are optional, but at least one is required.

Both **AND** (indicated by commas between `<Expressions>`) and **OR** syntax (indicated by `or` between `<Expressions>`) are supported within the parentheses `(..)`. However, take care to ensure invariant expressions are not inadvertently created. For example:

```
<Collection> -> exists(integer1=5, integer1=8)
```

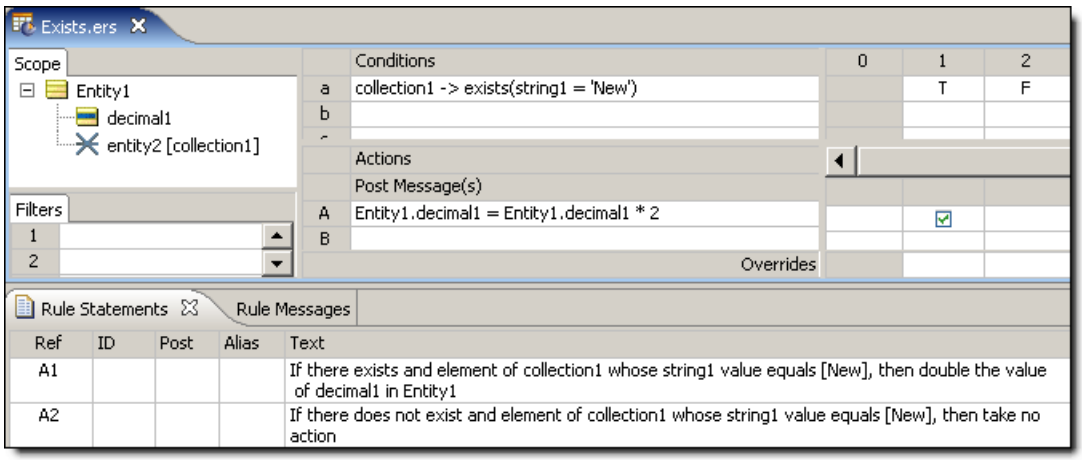
will always evaluate to `false` because no `integer1` value can be both `5` **AND** `8` simultaneously.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

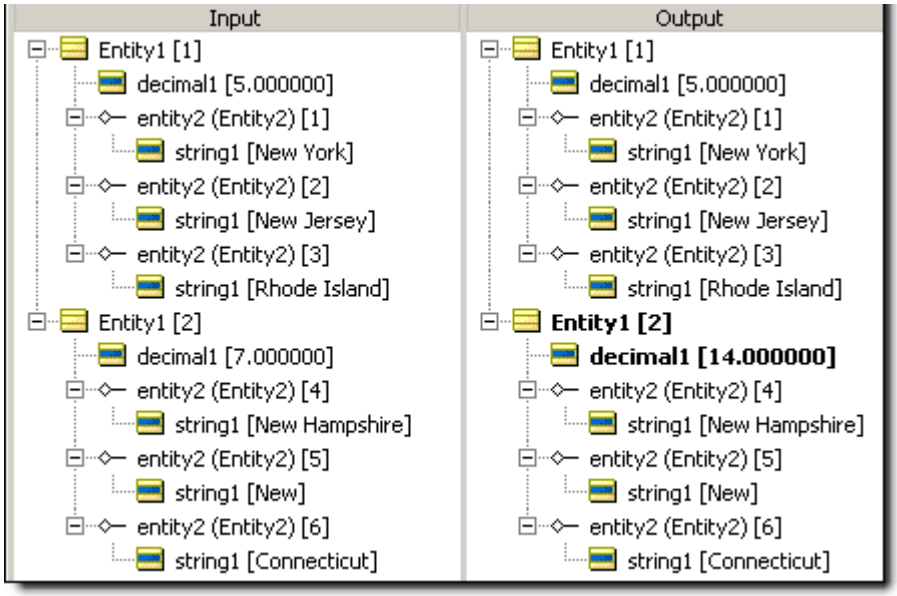
RULESHEET EXAMPLE

This sample Rulesheet uses **->exists** to check for the existence of an element in `collection1` whose `string1` value equals `New`, and assigns a value to `decimal1` based on the results of the test. Note the use of unique alias `collection1` to represent the collection of `Entity2` associated with `Entity1`.



SAMPLE RULETEST

A sample Ruletest provides 2 separate collections of `Entity2` elements and `Entity1.decimal1` values. Input and Output panels are shown below.



Exponent

SYNTAX

`<Number1>` ** `<Number2>`

DESCRIPTION

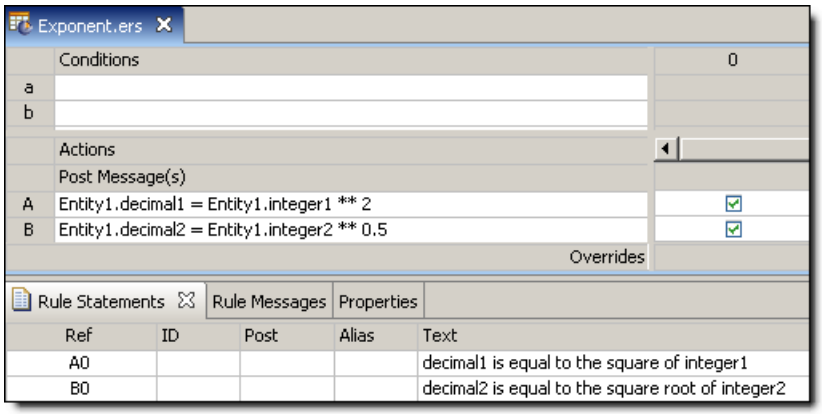
Raises `<Number1>` by the power of `<Number2>`. The resulting data type is the more expansive of those of `<Number1>` and `<Number2>`. To find a root, `<Number2>` can be expressed as a decimal value, such as 0.5 for a square root, or -- for greater accuracy in larger roots -- in decimal format within parentheses, such as `**(1.0/3.0)` for a cube root.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

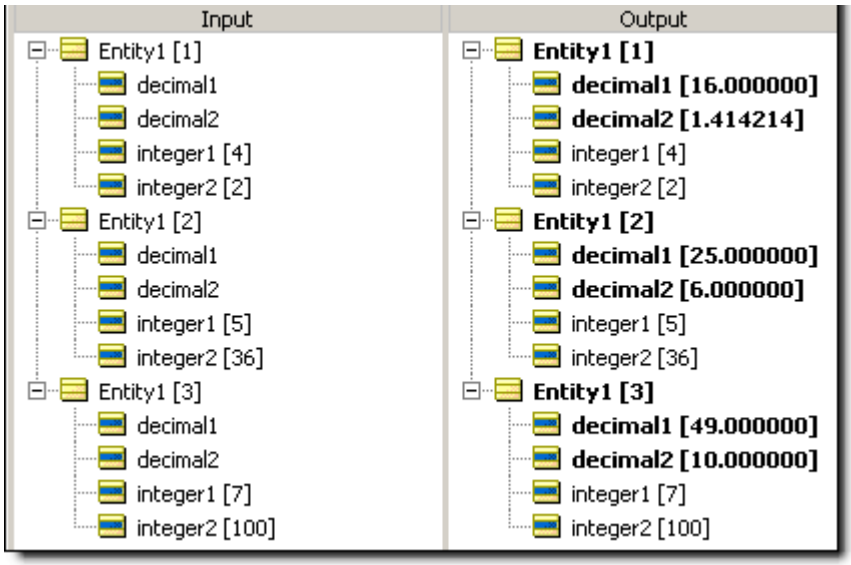
RULESHEET EXAMPLE

This sample Rulesheet uses **exponent** to raise `integer1` and `integer2` by the power of `2` and `0.5`, respectively, and assign the resulting value to `decimal1` and `decimal2`, respectively.



SAMPLE RULETEST

A sample Ruletest provides `decimal1` and `integer1` values for three examples.



False

SYNTAX

false or F

DESCRIPTION

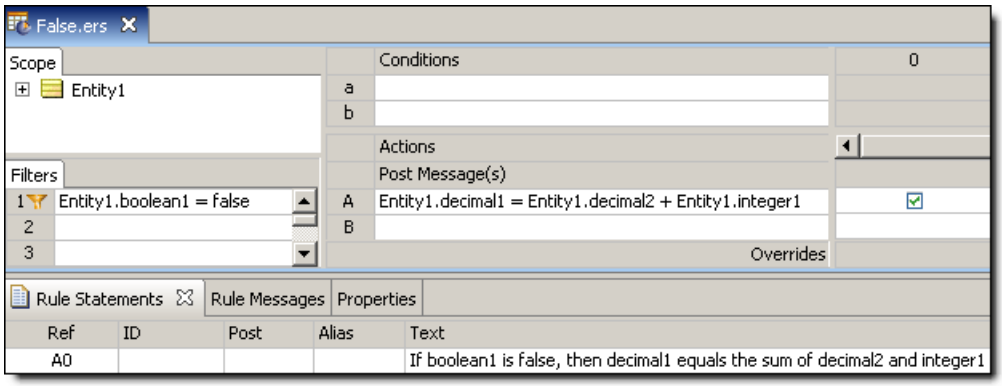
Represents the Boolean value false. Recall from discussion of truth values that an `<expression>` is evaluated for its truth value, so the expression `Entity1.boolean1=false` evaluates to `true` only when `boolean1=false`. But since `boolean1` is Boolean and has a truth value all by itself without any additional syntax, we could simply state `not Entity1.boolean1`, with the same effect. Many examples in the documentation use explicit syntax like `boolean1=true` or `boolean2=false` for clarity and consistency, even though `boolean1` or `not boolean2` are equivalent, respectively, to the explicit syntax.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions applies. No special exceptions.

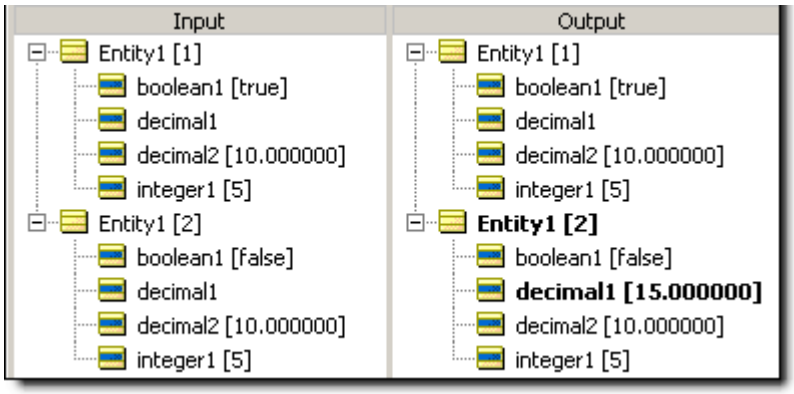
RULESHEET EXAMPLE

The following Rulesheet uses **false** in a Filter row to test whether `boolean1` is false, and perform the Nonconditional computation if it is. As discussed above, the alternative expression `not Entity1.boolean1` is logically equivalent.



SAMPLE RULETEST

A sample Ruletest provides three examples. Assume `decimal2=10.0` and `integer1=5` for all examples. Input and Output panels are shown below:



First

SYNTAX

`<Sequence>` ->first.`<attribute1>`

DESCRIPTION

Returns the value of `<attribute1>` of the first element in `<Sequence>`. Another operator, such as ->sortedBy, must be used to transform a `<Collection>` into a `<Sequence>` before **->first** may be used. `<Sequence>` must be expressed as a unique alias. See *"Advanced collection sorting syntax" in the Rule Modeling Guide* for more examples of usage.

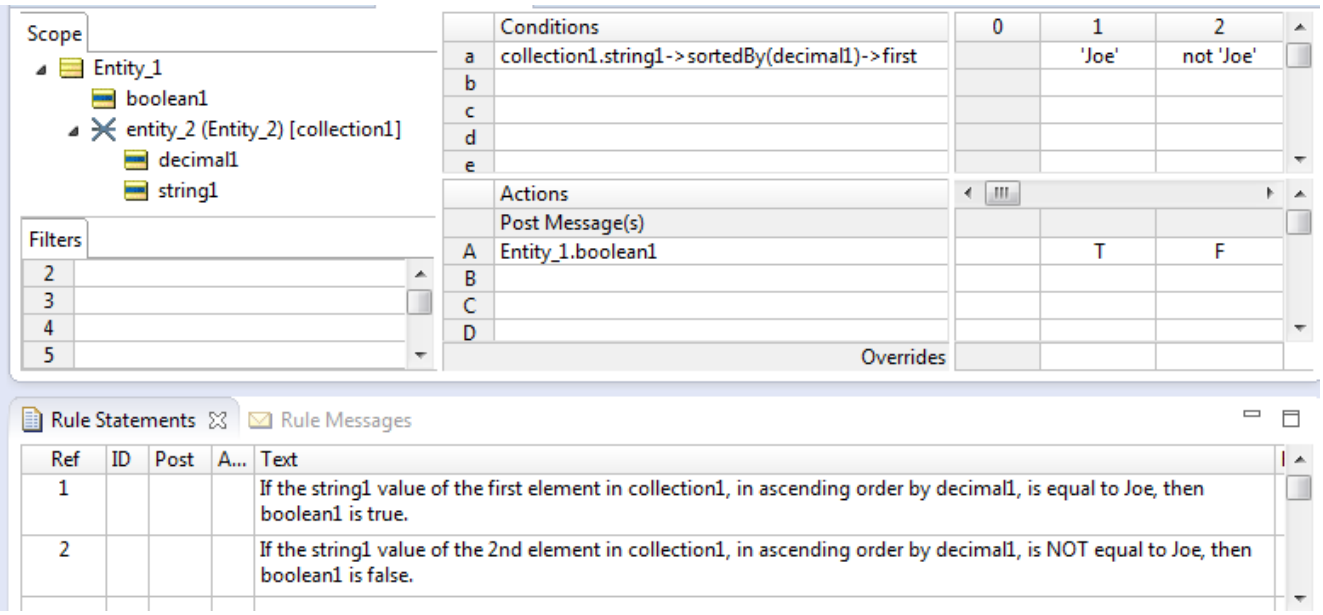
`<attribute1>` may be of any data type.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

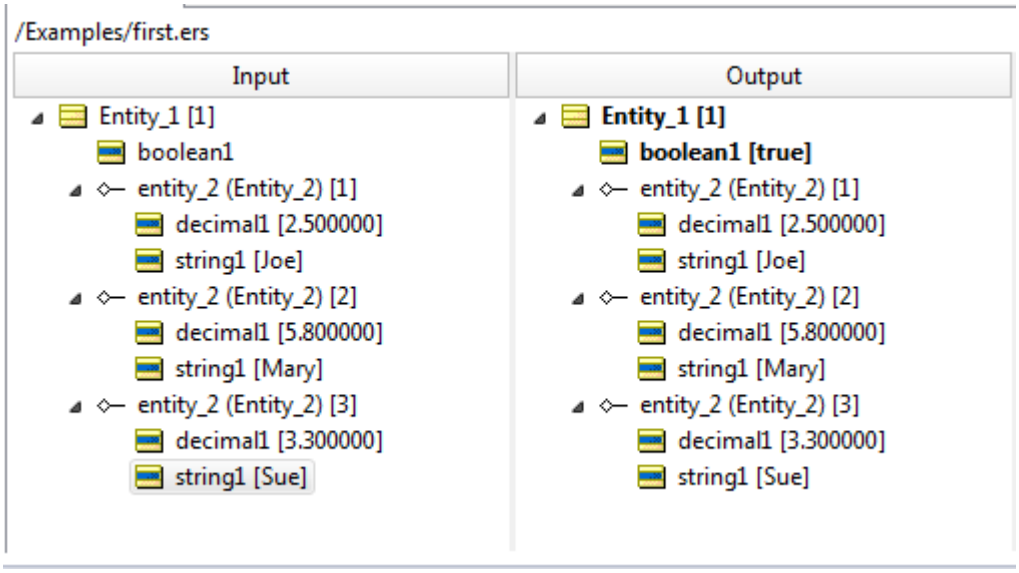
RULESHEET EXAMPLE

This sample Rulesheet uses **->first** to identify the first element of the sequence created by applying ->sortedBy to `collection1`. Once identified, the value of the `string1` attribute belonging to this first element is evaluated. If the value of `string1` is `Joe`, then `boolean1` attribute of `Entity1` is assigned the value of `true`.



SAMPLE RULETEST

A sample Ruletest provides a collection of three elements, each with a `decimal1` value. Input and Output panels are shown below.



First (number)

SYNTAX

```
<Sequence> ->first(integer)
```

DESCRIPTION

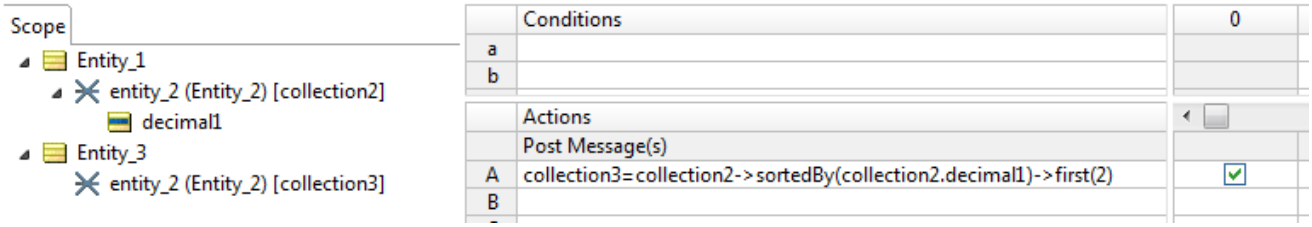
Returns a ->subSequence of the first *integer* entities in the collection `<Sequence>`. Another operator, such as ->sortedBy or ->sortedByDesc, must be used to transform a `<Collection>` into a `<Sequence>` before **->first** can be used. `<Sequence>` must be expressed as a unique alias. If *integer* is larger than the number of entities in the collection, all the entities in the collection are returned. See *"Advanced collection sorting syntax" in the Rule Modeling Guide* for more examples of usage.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **last(x)** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

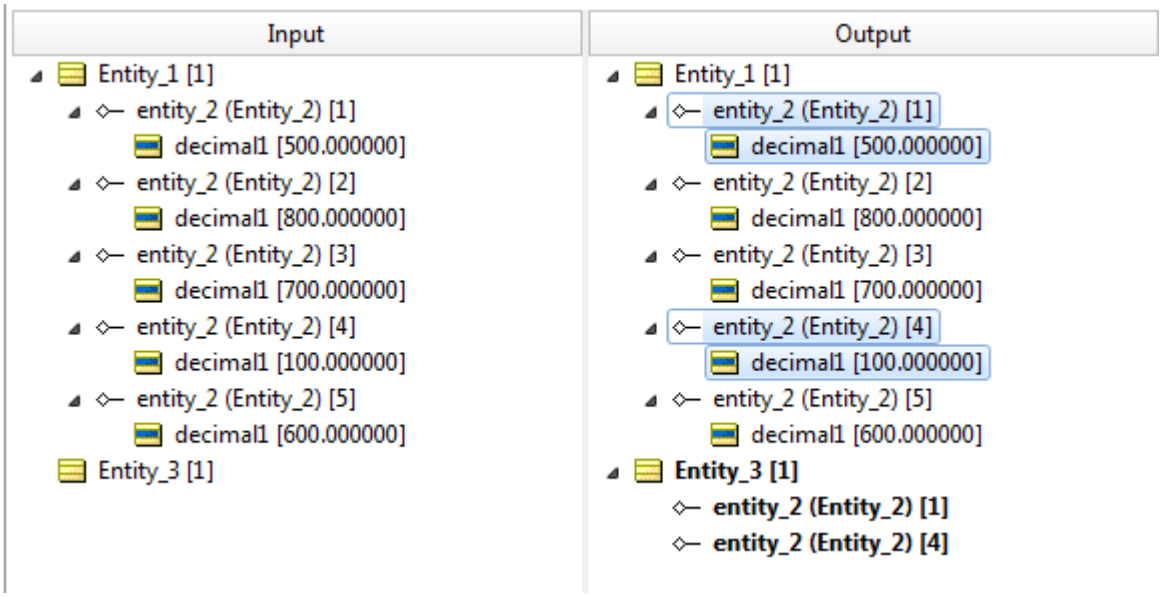
RULESHEET EXAMPLE

This sample Rulesheet uses **->first(2)** to select the first two elements of the sequence created by applying ->sortedBy to `collection2`. Once identified, the first 2 entities will be returned as the sequence `collection3`.



SAMPLE RULETEST

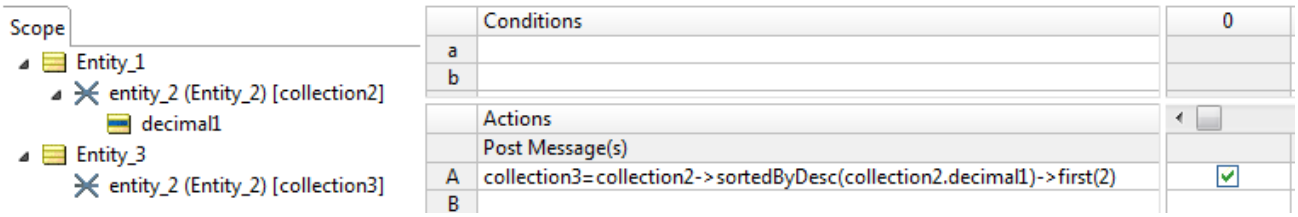
A sample Ruletest provides a collection of five elements, each with a `decimal1` value. Input and Output panels are shown below.



Note: The selected entities and their values are highlighted to improve readability.

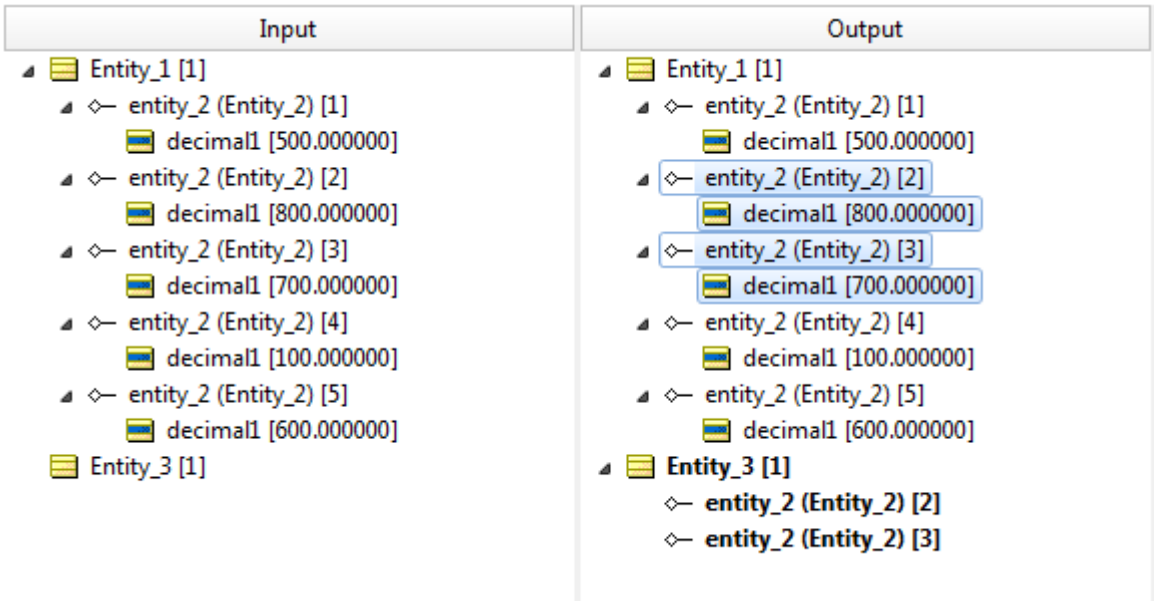
RULESHEET EXAMPLE: USING DESCENDING SORT

Sometimes it is easier to understand this type of action when you sort the data in descending order; when thinking of the "the top three sales figures", the first three largest values are what is intended. In this example, the action uses `->sortByDesc` to order the collection largest-to-smallest and then moves the top 2 entities to the result sequence:



SAMPLE RULETEST: USING DESCENDING SORT

The sample Ruletest shows the two entities with the highest values are copied to the results sequence:



Note: The selected entities and their values are highlighted to improve readability.

Floor

SYNTAX

`<Decimal>`.floor

DESCRIPTION

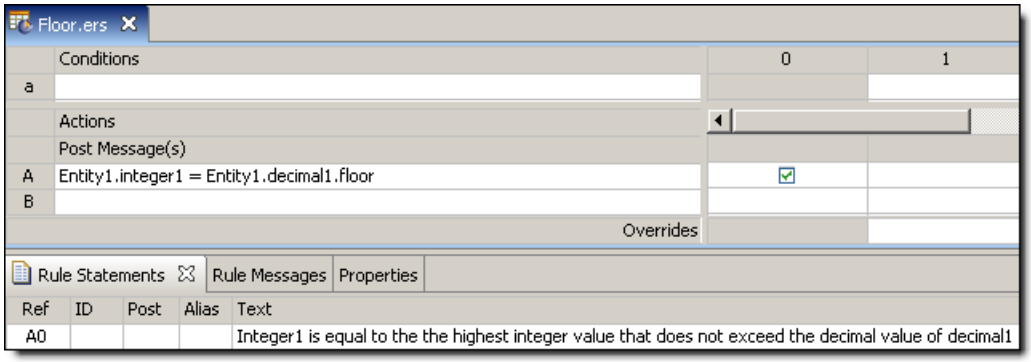
Returns the Integer closest to zero from `<Decimal>`. **.floor** may also be thought of as a truncation of `<Decimal>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

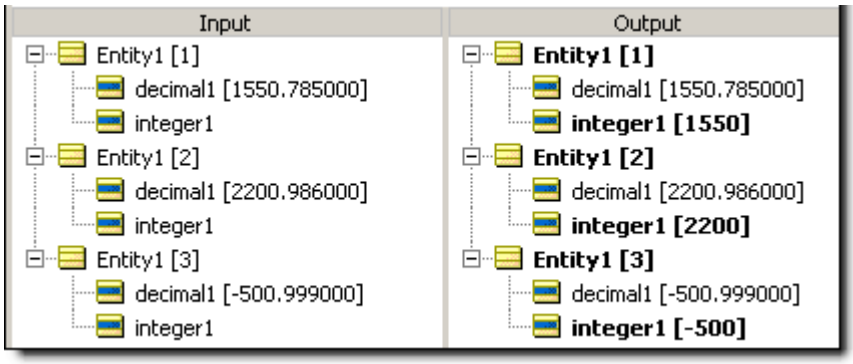
The Rulesheet uses **.floor** to assign Integer values to `integer1` that are closer to zero than the input `decimal1` values.



SAMPLE RULETEST

A sample Ruletest provides three `decimal1` values. Input and Output panels are shown below:

Note: Notice how these results differ from those shown in the Round example.



For all

SYNTAX

`<Collection>` ->forAll(`<Expression1>`, `<Expression2>`,...)

`<Collection>` ->forAll(`<Expression1>` or `<Expression2>` or ...)

DESCRIPTION

Returns a value of true if *every* `<Expression>` holds true for *every* element of `<Collection>`. `<Collection>` must be expressed as a unique alias. Multiple `<Expressions>` are optional, but at least one is required.

Both **AND** (indicated by commas between `<Expressions>`) and **OR** syntax (indicated by `or` between `<Expressions>`) is supported within the parentheses `(..)`. However, take care to ensure invariant expressions are not inadvertently created. For example:

```
<Collection> -> forAll(integer1=5, integer1=8)
```

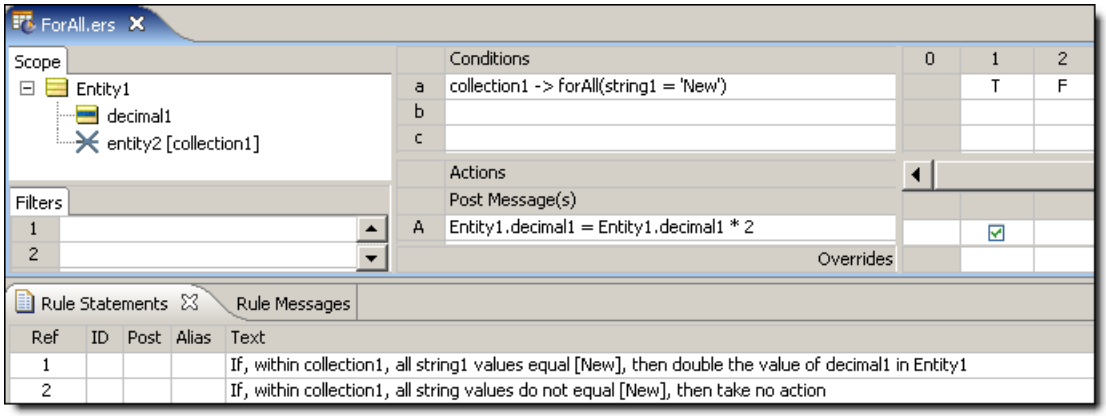
will always evaluate to `false` because no single `integer1` value can be both `5` **AND** `8` simultaneously, let alone all of them.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

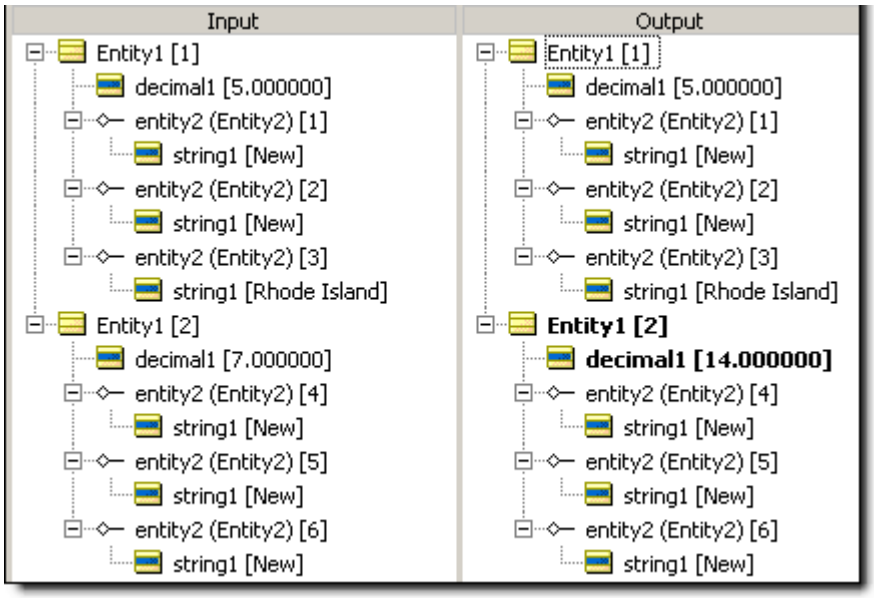
RULESHEET EXAMPLE

This sample Rulesheet uses **->forAll** to check for the existence of an element in `collection1` whose `string1` value equals `New`, and assigns a value to `decimal1` based on the results of the test. Note the use of unique alias `collection1` to represent the collection of `Entity2` associated with `Entity1`.



SAMPLE RULETEST

A sample Ruletest provides 2 separate collections of `Entity2` elements and `Entity1.decimal1 values`. The following illustration shows Input and Output panel



Greater than

SYNTAX

DateTime*	`<DateTime1>` > `<DateTime2>`
Number	`<Number1>` > `<Number2>`
String	`<String1>` > `<String2>`

DESCRIPTION

DateTime*	Returns a value of true if `<DateTime1>` is greater than or equal to `<DateTime2>`. This is equivalent to `<DateTime1>` occurring “after” `<DateTime2>`
Number	Returns a value of true if `<Number1>` is greater than `<Number2>`. Different numeric data types may be compared in the same expression.
String	Returns a value of true if `<String1>` is greater than `<String2>`. Studio uses Character precedence: Unicode and Java Collator on page 189 to determine character precedence.

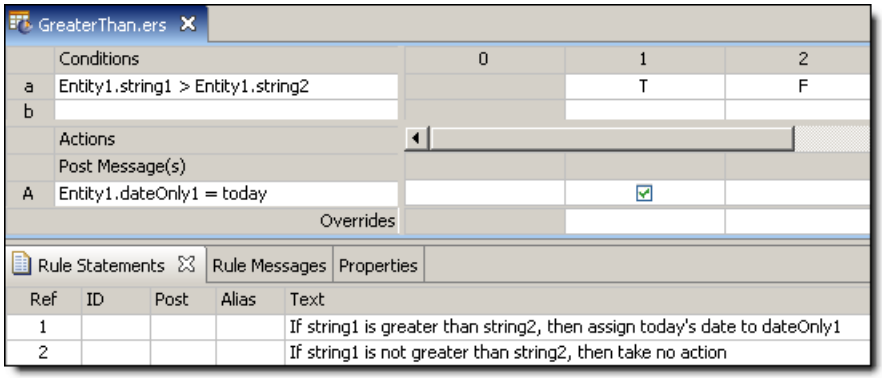
*includes DateTime, Date, and Time data types

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions applies, with the following exception: **greater than** may also be used in Conditional Value Sets & Cells (section 5 in Sections of Rulesheet that correlate with usage restrictions).

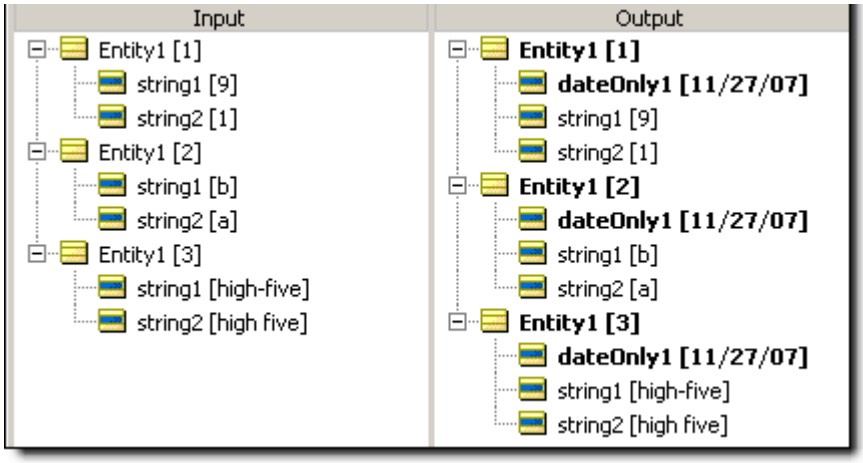
RULESHEET EXAMPLE

The following Rulesheet uses **greater than** to test whether `string1` is greater than `string2`, and assign today's date to `dateTime1` if it is. See today for an explanation of this literal term.



SAMPLE RULETEST

A sample Ruletest provides three examples. Input and Output panels are shown below:



Greater than or equal to

SYNTAX

DateTime*	`<DateTime1>` **>=** `<DateTime2>`
Number	`<Number1>` **>=** `<Number2>`
String	`<String1>` **>=** `<String2>`

DESCRIPTION

DateTime*	Returns a value of true if `<DateTime1>` is greater than or equal to `<DateTime2>`. This is equivalent to `<DateTime1>` occurring on or after `<DateTime2>`
Number	Returns a value of true if `<Number1>` is greater than or equal to `<Number2>`. Different numeric data types may be compared in the same expression.
String	Returns a value of true if `<String1>` is greater than or equal to `<String2>`. Corticon Studio uses Character precedence: Unicode and Java Collator on page 189 to determine character precedence.

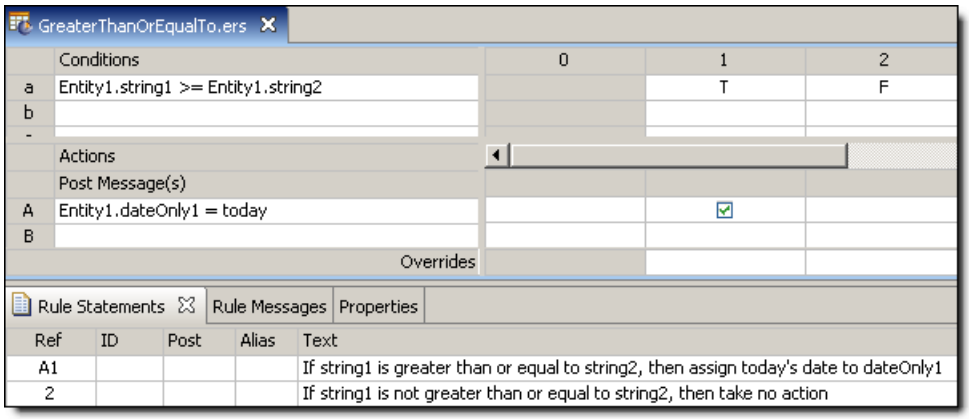
*includes DateTime, Date, and Time data types

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions applies, with the following exception: **greater than or equal to** may also be used in Conditional Value Sets & Cells (section 5 in Sections of Rulesheet that correlate with usage restrictions).

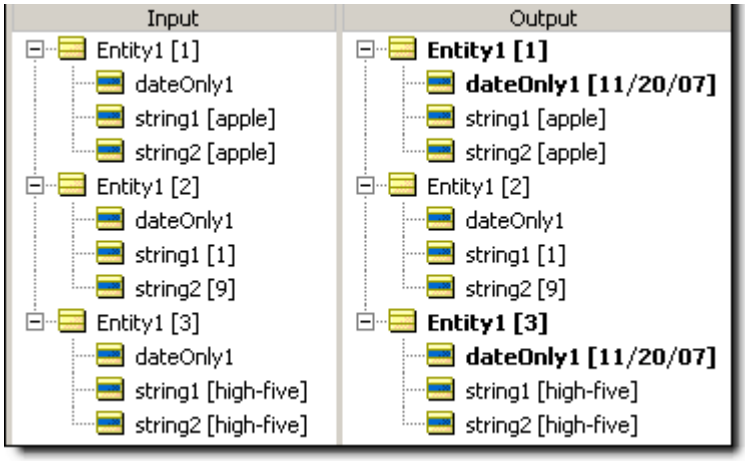
RULESHEET EXAMPLE

The following Rulesheet uses **greater than or equal to** to test whether `string1` is greater than or equal to `string2`, and assign today's date to `dateTime1` if it is. See today for an explanation of this literal term.



SAMPLE RULETEST

A sample Ruletest provides two examples. Input and Output panels are shown below:



Hour

SYNTAX

`<DateTime>`.hour

`<Time>`.hour

DESCRIPTION

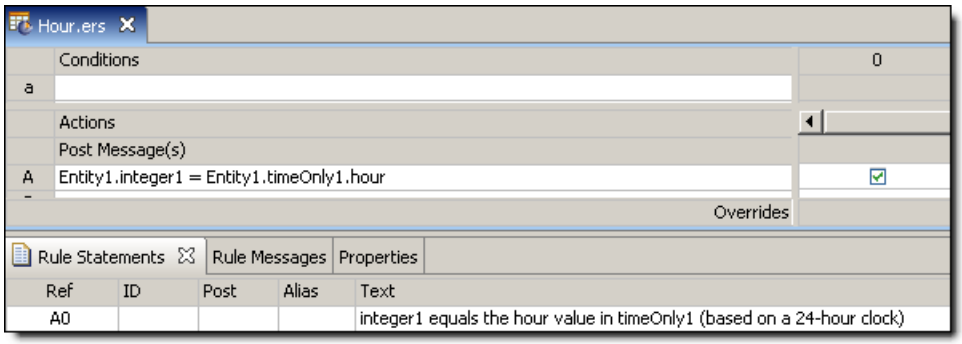
Returns the hour portion of `<DateTime>` or `<Time>`. The returned value is based on a 24-hour clock. For example, 10:00 PM (22:00 hours) is returned as 22.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

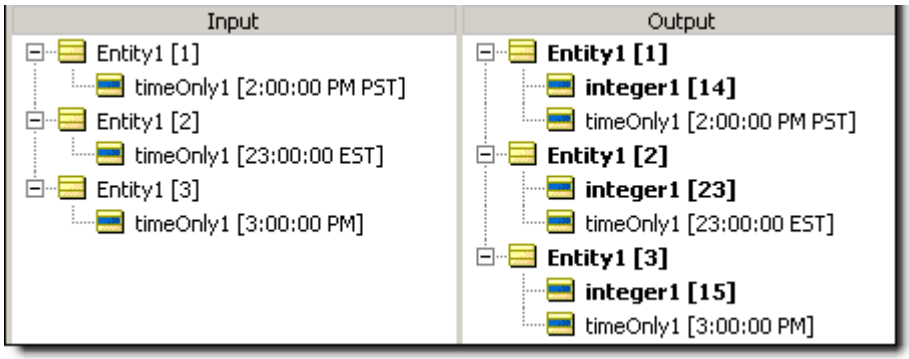
RULESHEET EXAMPLE

The following Rulesheet uses **.hour** to evaluate `dateTime1` and assign the hour value to `integer1`.



SAMPLE RULETEST

A sample Ruletest provides three examples of `dateTime1`. Input and Output panels are shown below. Notice that the hour returned is dependent upon the timezone of the machine executing the rule. The hour returned is independent of the machine running the Ruletest and only depends on the locale/timezone of the data itself.



Hour between

SYNTAX

`<DateTime1>`.hoursBetween(`<DateTime2>`)

DESCRIPTION

Returns the Integer number of hours between any two DateTimes or Times. The function calculates the number of milliseconds between the two values and divides that number by 3,600,000 (the number of milliseconds in an hour). The decimal portion is then truncated. If the two dates differ by less than a full hour, the value is zero. This function returns a positive number if `<DateTime2>` is later than `<DateTime1>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.hoursBetween** to determine the number of hours that have elapsed between `dateTime1` and `dateTime2`, compare it to the Values set, and assign a value to `string1`.

HoursBetween.ers

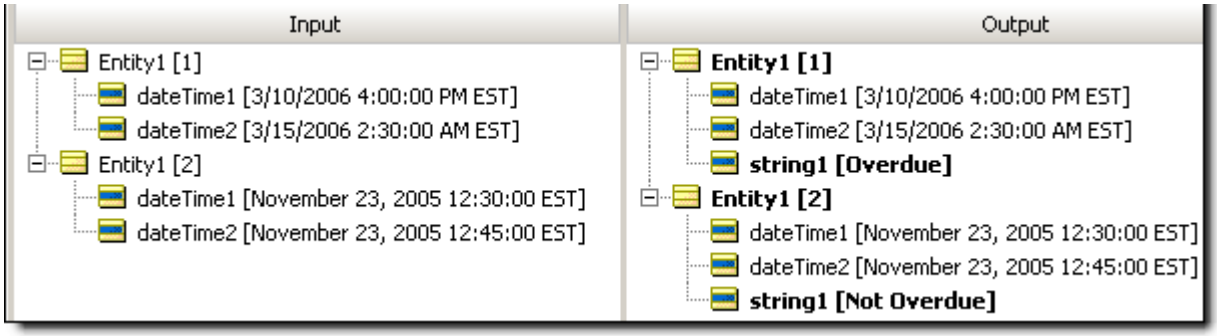
	Conditions	0	1	2
a	Entity1.dateTime1.hoursBetween(Entity1.dateTime2)		<=24	>24
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.string1		'Not Overdue'	'Overdue'
	Overrides			

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If 24 or fewer hours have elapsed between dateTime1 and dateTime2, then Entity1 is not overdue
2				If more than 24 hours have elapsed between dateTime1 and dateTime2, then Entity1 is not overdue

SAMPLE RULETEST

A sample Ruletest provides `dateTime1` and `dateTime2` for two examples. Input and Output panels are shown below.



In {List}

SYNTAX

Date	`<Date1>` in {`<Date2>`,`<Date3>`,...}
DateTime	`<DateTime1>` in {`<DateTime2>`,`<DateTime3>`,...}
Decimal	`<Decimal1>` in {`<Decimal2>`,`<Decimal3>`,...}
Integer	`<Integer1>` in {`<Integer2>`,`<Integer3>`,...}
String	`<String1>` in {`<String2>`,`<String3>`,...}
Time	`<Time1>` in {`<Time2>`,`<Time3>`,...}

DESCRIPTION

Returns the value `true` if the attribute type is contained in the set of valid values for the attribute.

USAGE RESTRICTIONS

- The set of values is always enclosed in braces: { }
- For integer and decimal data types, a list of literals or enumerated values without labels requires that the values are not in single quotes, such as `{3,1,2}`.
- For date and String data types, a list of literals or enumerated values without labels requires that the values are in single quotes, such as `{'B','A','C'}`.
- The list can be in any order.
- Duplicate values or labels in a list are tolerated.

When enumerated datatypes with labels are used:

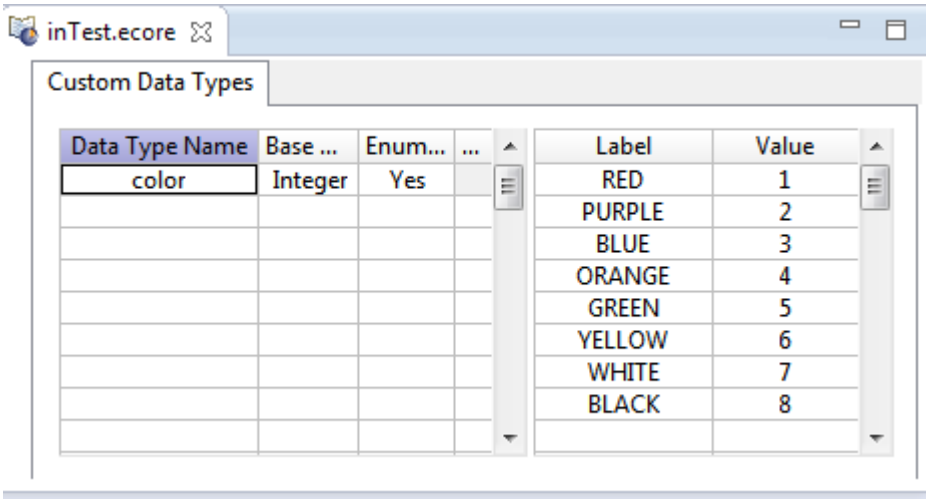
- The labels are listed without delimiters, such as `{B,A,C}`
- Values and labels can be mixed, such as `{A,B,'C_value'}`.

Note: While literal values in the enumeration table are accepted in a list, only existing label values will be exposed and accepted as valid.

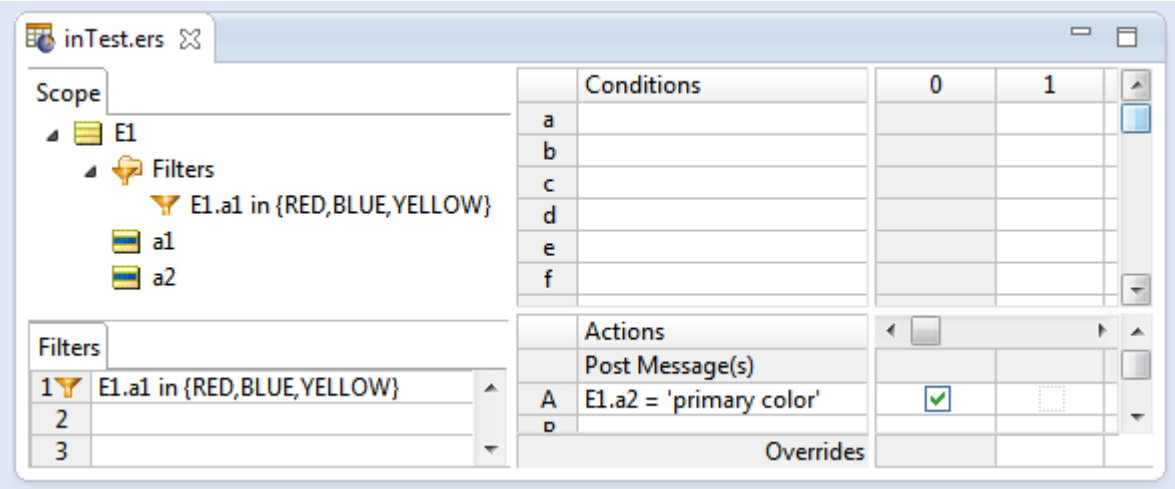
The Operators row of the table in Vocabulary Usage Restriction does not apply. The `in` operator can be used in Conditions and Filters, but not in Actions.

RULESHEET EXAMPLE

The example's Vocabulary defined an enumerated list:

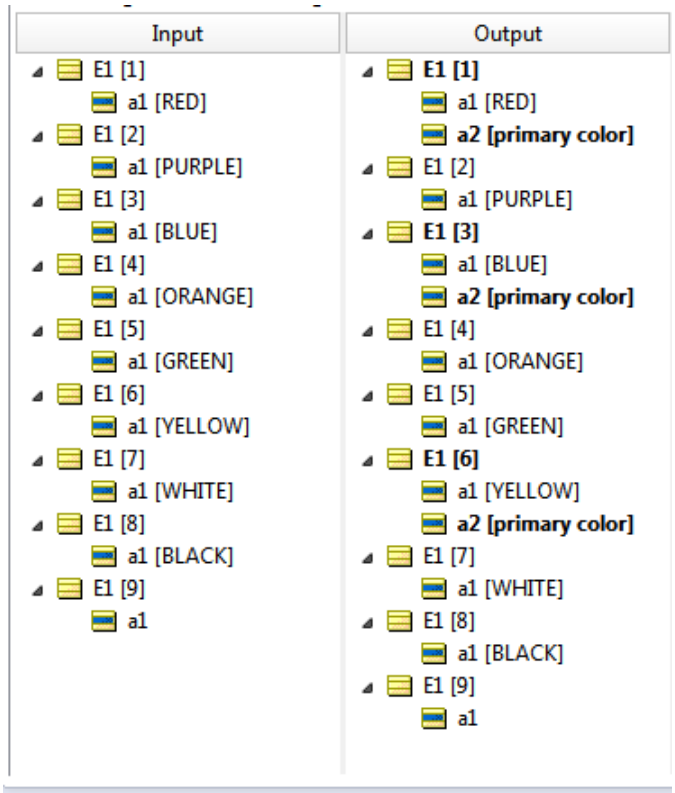


The following Rulesheet uses **in** to filter certain labels to be tested against request data:



SAMPLE TEST

A sample Ruletest provides examples. Input and Output panels are shown below.



In (Range)

SYNTAX

Date	`<Date1>` in `(<earlierDate2>..<laterDate3>)`
DateTime	`<DateTime1>` in `(<earlierDateTime2>..<laterDateTime3>)`
Decimal	`<Decimal1>` in `(<smallerDecimal2>..<largerDecimal3>)`
Integer	`<Integer1>` in `(<smallerInteger2>..<largerInteger3>)`
String	`<String1>` in `(<startString2>..<endString3>)`
Time	`<Time1>` in `(<earlierTime2>..<laterTime3>)`

A square bracket on either end of the expression indicates that the start or end value is to be included in the range.

DESCRIPTION

Returns the value `true` if the attribute type is contained in the range of valid values for the attribute.

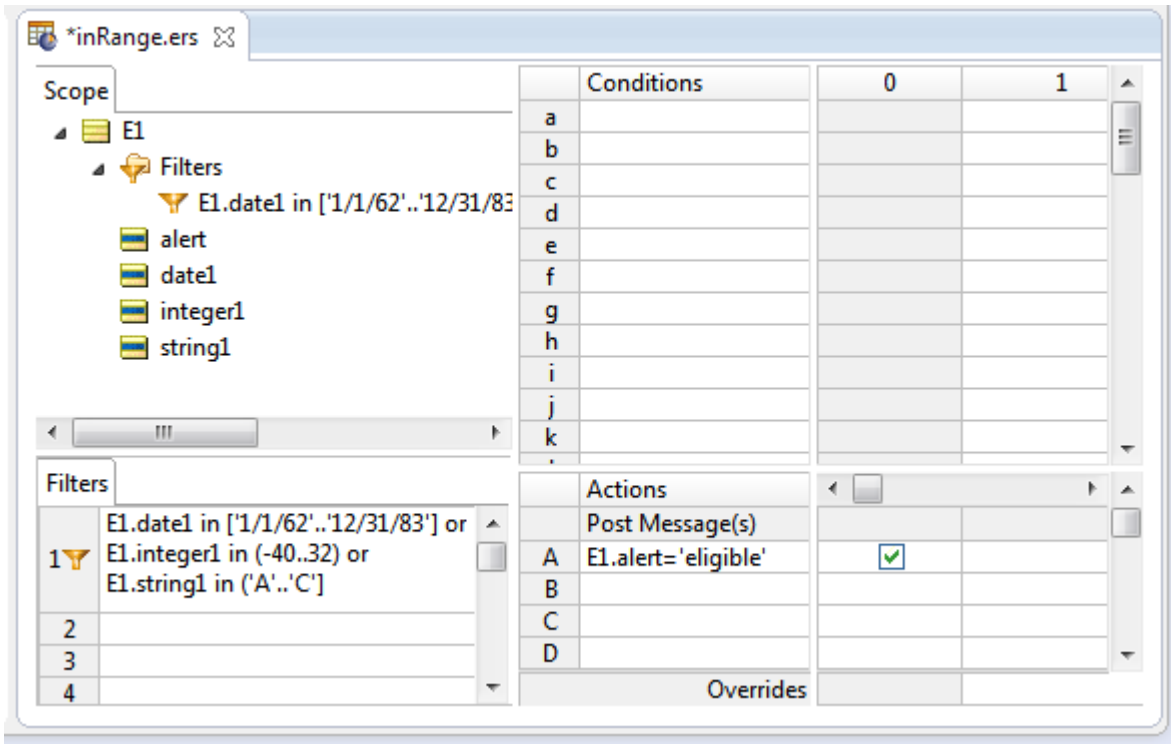
USAGE RESTRICTIONS

- For integer and decimal data types, the range of values are not in single quotes. For example, `(1..3)`).
- For date and String data types, the range of values are in single quotes. For example, `('A'..'C')`).

The Operators row of the table in Vocabulary Usage Restriction does not apply. The `in` operator can be used in Conditions and Filters, but not in Actions.

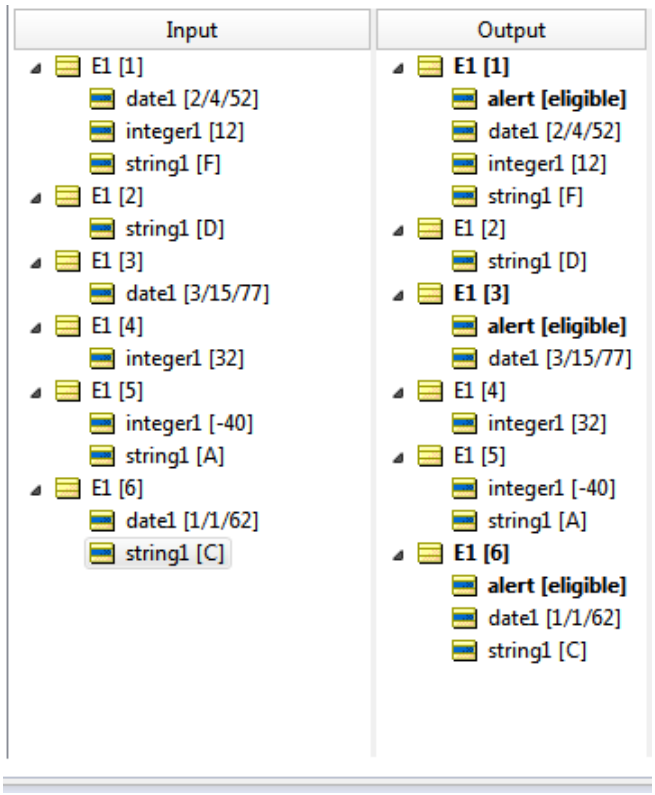
RULESHEET EXAMPLE

The following Rulesheet uses **in** ranges for three data types OR'ed together in a filter to be tested against request data:



SAMPLE TEST

A sample Ruletest provides examples. Input and Output panels are shown below.



Increment

SYNTAX

`<Number1>` **+=** `<Number2>`

DESCRIPTION

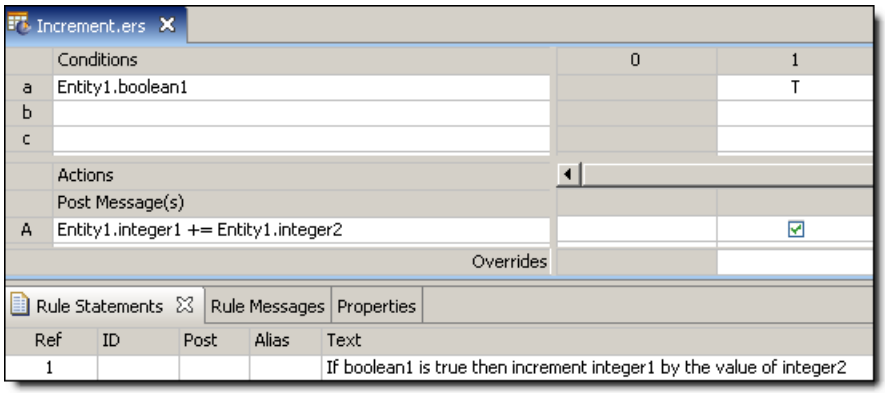
Increments `<Number1>` by the value of `<Number2>`. The data type of `<Number1>` must accommodate the addition of `<Number2>`. In other words, an Integer may not be incremented by a Decimal without using another operator (such as .toInteger or Floor on page 94.floor) to first convert the Decimal to an Integer.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **increment** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

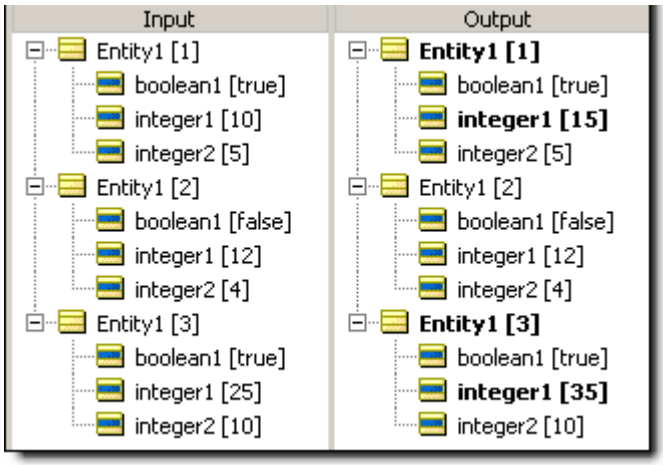
RULESHEET EXAMPLE

This sample Rulesheet uses **increment** to increment `integer1` by the value of `integer2` when `boolean1` is `true`.



SAMPLE RULETEST

A sample Ruletest provides three examples of `integer1`, `integer2`, and `boolean1`. Input and Output panels are shown below.



Index of

SYNTAX

`<String1>`.indexOf(`<String2>`)

DESCRIPTION

Determines if `<String2>` is contained within `<String1>` and returns an Integer value equal to the beginning character position of the first occurrence of `<String2>` within `<String1>`. If `<String1>` does not contain `<String2>`, then a value of `0` (zero) is returned. This operator is similar to .contains but returns different results. A `0` result from **.indexOf** is equivalent to a `false` value returned by the .contains operator.

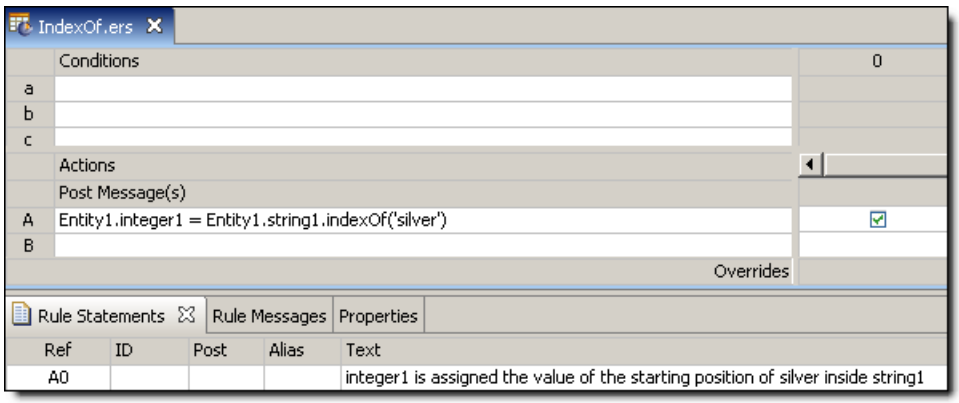
If `<String1>` contains more than one occurrence of `<String2>`, **.indexOf** returns the first character position of the first occurrence. For example: If `<String1>` holds the String value `'Mississippi'` and `<String2>` holds the String value `'ss'`, then the **.indexOf** operator returns `3`. The second occurrence of `'ss'` beginning at position 6 is not identified.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

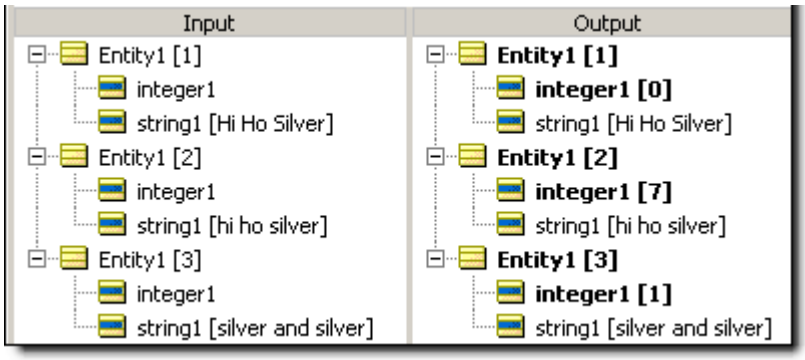
RULESHEET EXAMPLE

The following Rulesheet uses **.indexOf** to evaluate whether `string1` includes the characters `silver` and assigns a value to `integer1` corresponding to the beginning character position of the first occurrence.



SAMPLE RULETEST

A sample Ruletest provides `string1` values for three examples. Input and Output panels are shown below. Notice sensitivity to case in example 1.



Is empty

SYNTAX

`<Collection>` ->isEmpty

DESCRIPTION

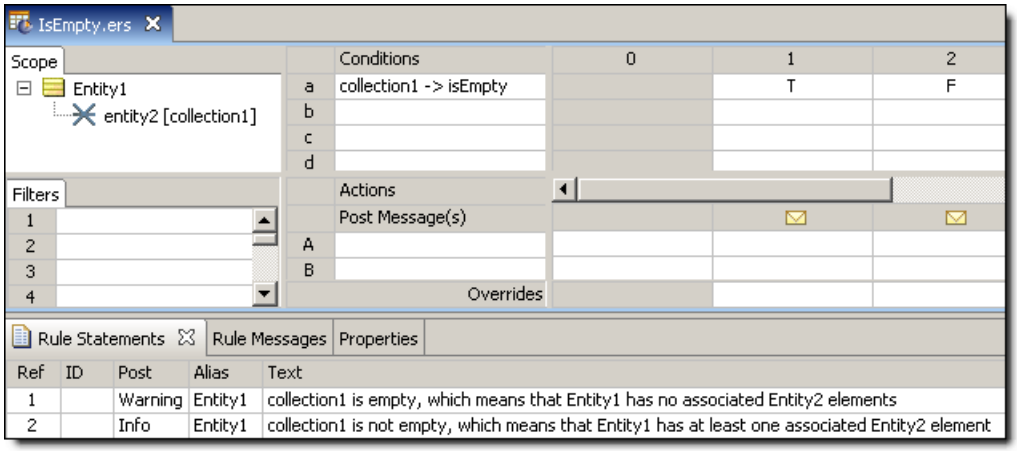
Returns a value of true if `<Collection>` contains *no* elements (that is, has no children). **->isEmpty** does not check for an empty or null value of an attribute, but instead checks for *existence* of elements within the collection. As such, a unique alias must be used to represent the `<Collection>` being tested.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

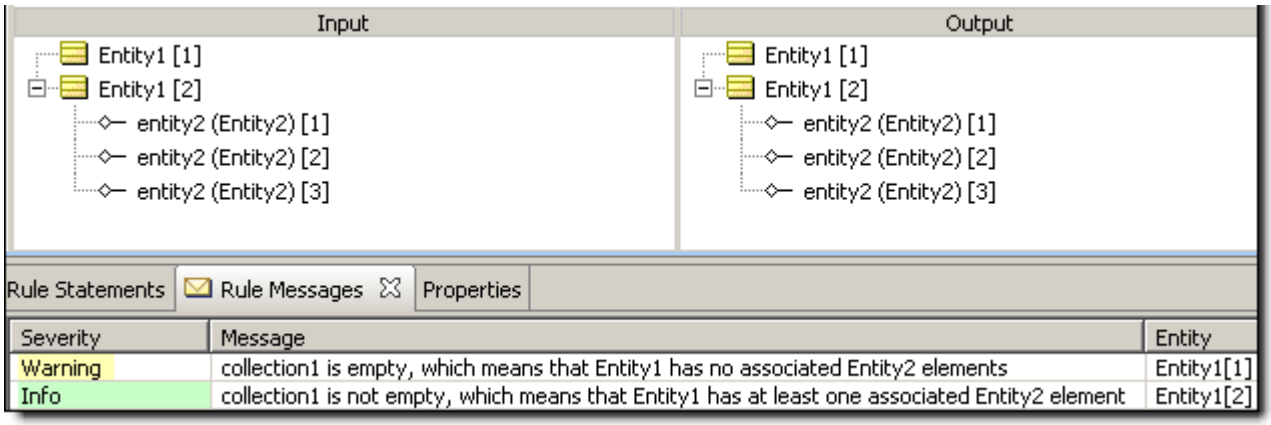
RULESHEET EXAMPLE

This sample Rulesheet uses **->isEmpty** to determine if `collection1` has any elements. Note the use of unique alias `collection1` to represent the collection of `Entity2` associated with `Entity1`.



SAMPLE RULETEST

A sample Ruletest provides two example `collection1`. The following illustration shows Input and Output panels



Iterate

SYNTAX

`<Collection>` ->iterate(`<Expression>`)

DESCRIPTION

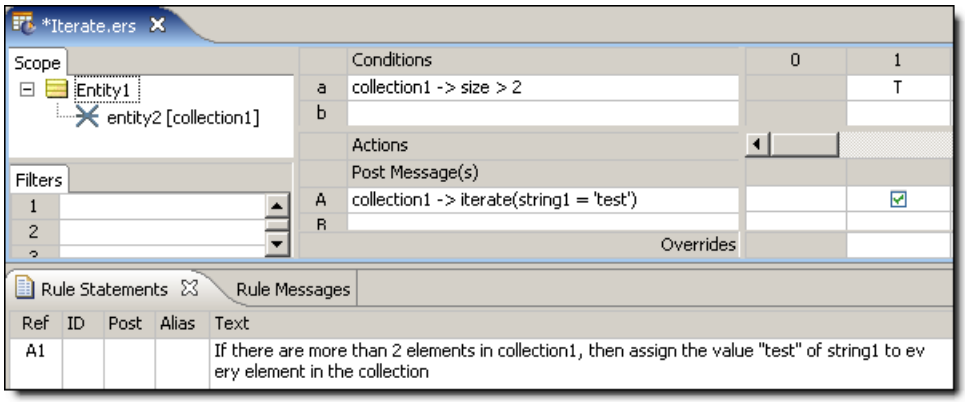
Executes `<Expression>` for every element in `<Collection>`. `<Collection>` must be expressed as a unique alias.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction does not apply. Special exceptions: **->iterate** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

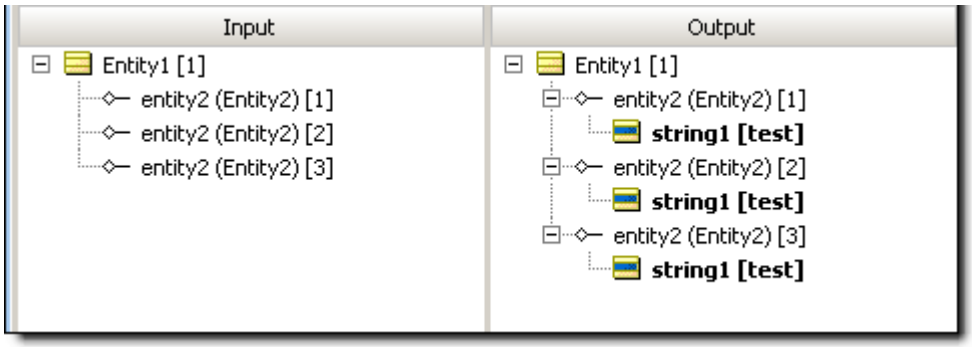
RULESHEET EXAMPLE

This sample Rulesheet uses **->iterate** to assign the value of `test` to `string1` in every element in `collection1` . See ->exists for more information on this operator.



SAMPLE RULETEST

A sample Ruletest provides three elements in `collection1`. Input and Output panels are shown below.



Last

SYNTAX

`<Sequence>` ->last.`<Attribute1>`

DESCRIPTION

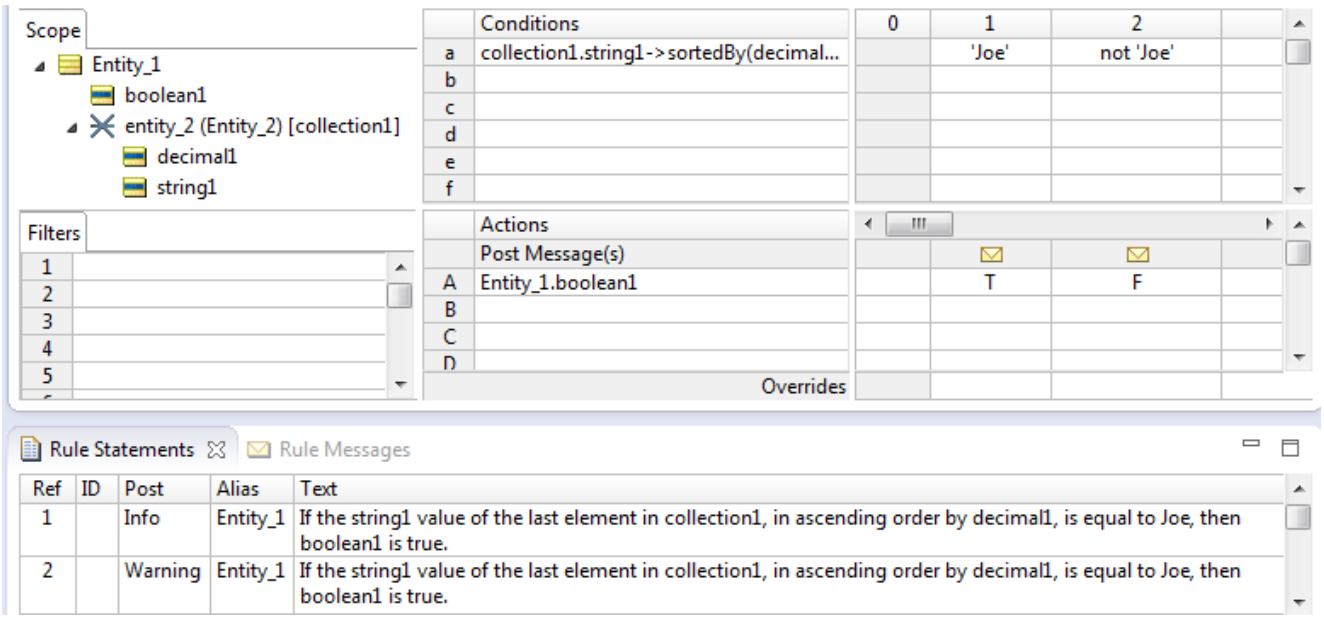
Returns the value of `<Attribute1>` of the last element in `<Sequence>`. Another operator, such as ->sortedBy, must be used to transform a `<Collection>` into a `<Sequence>` before **->last** may be used. `<Sequence>` must be expressed as a unique alias. `<Attribute1>` may be of any data type. See *"Advanced collection sorting syntax" in the Rule Modeling Guide* for more examples of usage.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

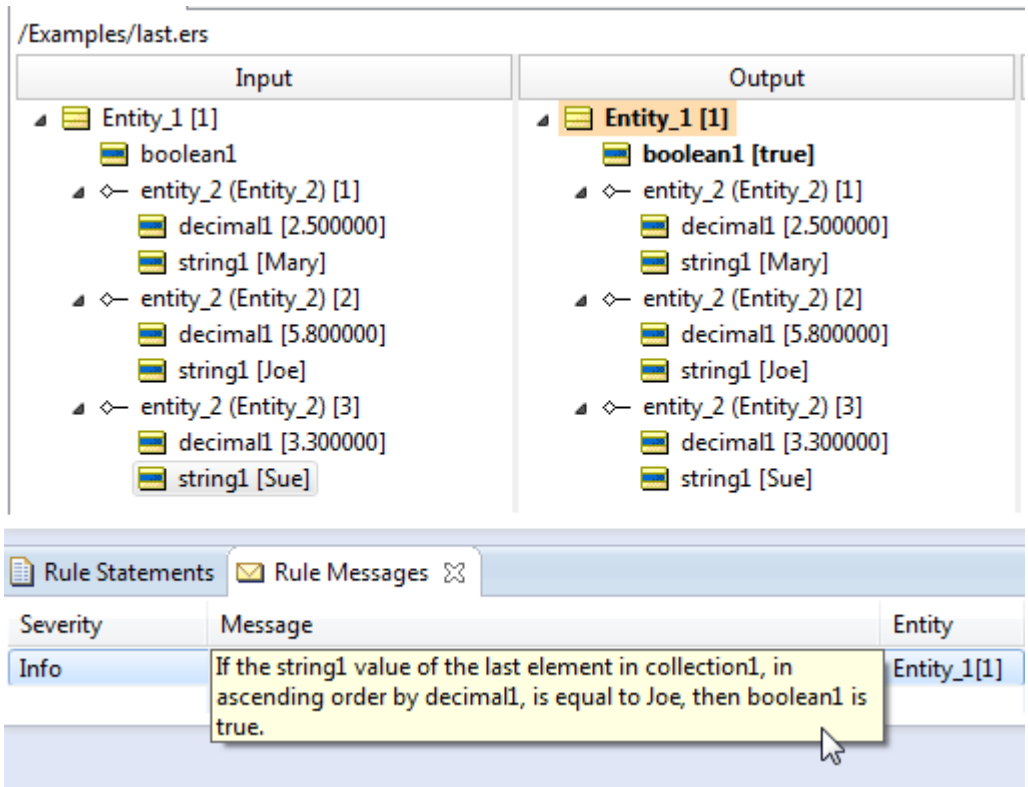
RULESHEET EXAMPLE

This sample Rulesheet uses **->last** to identify the last element of the sequence created by applying ->sortedBy to `collection1`. Once identified, the value of the `string1` attribute belonging to this last element is evaluated. If the value of `string1` is `Joe`, then `boolean1` attribute of `Entity1` is assigned the value of `true`.



SAMPLE RULETEST

A sample Ruletest provides a collection of three elements, each with a `decimal1` value. Input and Output panels are shown below.



Last (number)

SYNTAX

`<Sequence> ->last(integer)`

DESCRIPTION

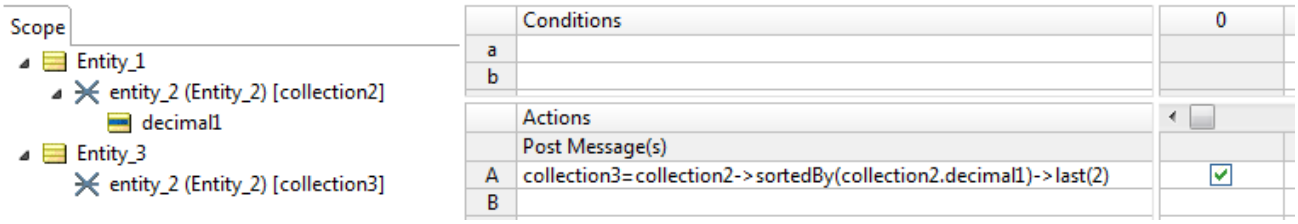
Returns a ->subSequence of the last *integer* entities in the collection `<Sequence>`. Another operator, such as ->sortedBy or ->sortedByDesc, must be used to transform a `<Collection>` into a `<Sequence>` before **->last** can be used. `<Sequence>` must be expressed as a unique alias. If integer is larger than the number of entities in the collection, all the entities in the collection are returned. See *"Advanced collection sorting syntax" in the Rule Modeling Guide* for more examples of usage.

USAGE RESTRICTIONS

The Operators row of the table in Vocabulary usage restrictions does not apply. Special exceptions: **last(x)** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

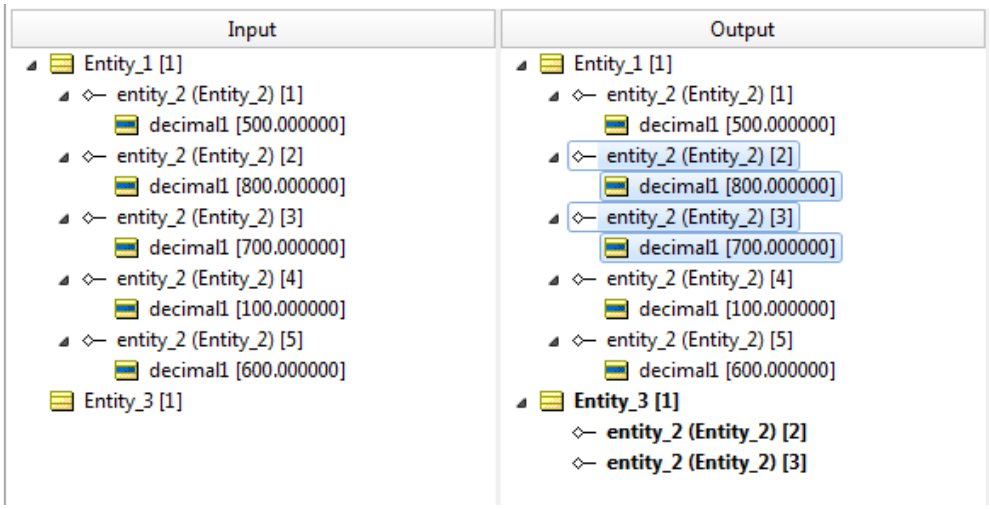
RULESHEET EXAMPLE

This sample Rulesheet uses **->last(2)** to select the last two elements of the sequence created by applying ->sortedBy to `collection2`. Once identified, the last 2 entities will be returned as the sequence `collection3`.



SAMPLE RULETEST

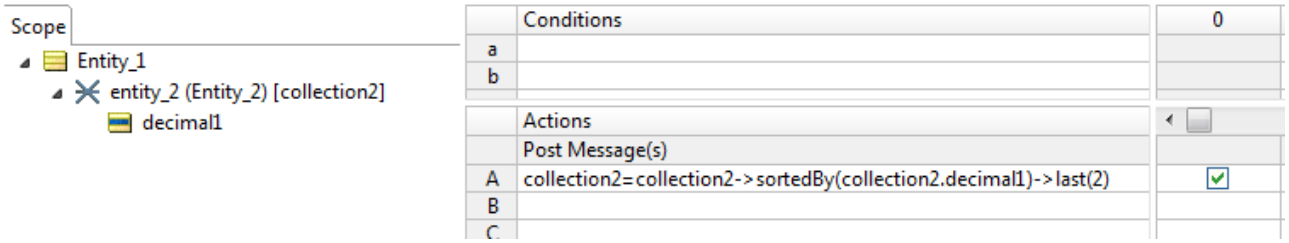
A sample Ruletest provides a collection of five elements, each with a `decimal1` value. Input and Output panels are shown below.



Note: The selected entities and their values are highlighted to improve readability.

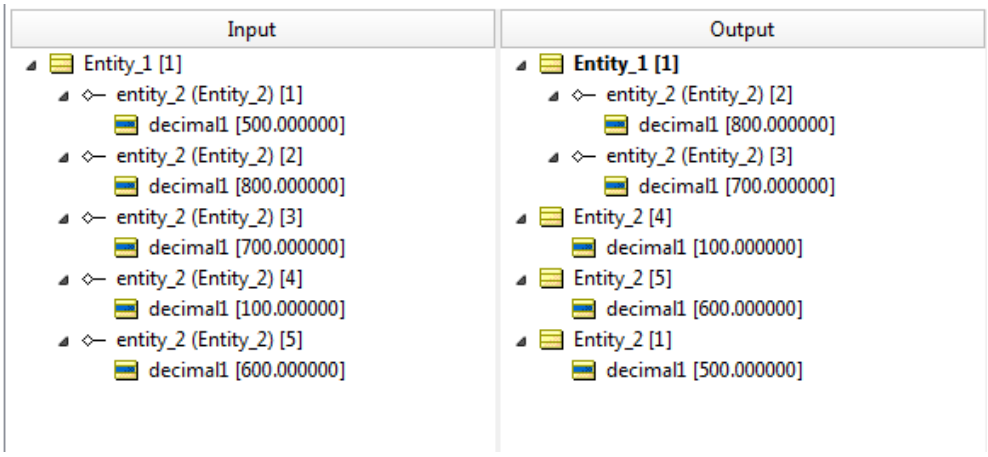
RULESHEET EXAMPLE: SAME COLLECTION

In this example, the action uses the same collection for the source and the target:



SAMPLE RULETEST: SAME COLLECTION

The sample Ruletest shows the last 2 entities are retained in the collection, and the extraneous entities are moved out of the collection to root level:



Note: Using the same collection as the source and the target is an important consideration because the original collection cannot be accessed again, and another iteration using this operator would likely produce a different result.

Less than

SYNTAX

DateTime*	`<DateTime1>` **<** `<DateTime2>`
Number*	`<Number1>` **<** `<Number2>`
String	`<String1>` **<** `<String2>`

DESCRIPTION

DateTime*	Returns a value of true if `<DateTime1>` is less than `<DateTime2>`. This is equivalent to `<DateTime1>` occurring “before” `<DateTime2>`
Number	Returns a value of true if `<Number1>` is less than `<Number2>`. Different numeric data types may be compared in the same expression.
String	Returns a value of true if `<String1>` is less than `<String2>`. Corticon Studio uses Character precedence: Unicode and Java Collator on page 189.

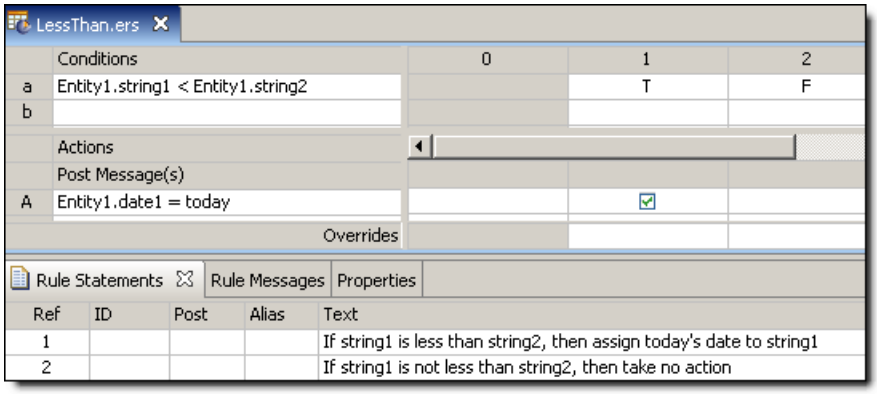
*includes DateTime, Date, or Time data types

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies, with the following exception: **less than** may also be used in Conditional Value Sets & Cells (section 5 in Sections of Rulesheet: Numbers Correlate with Table Above).

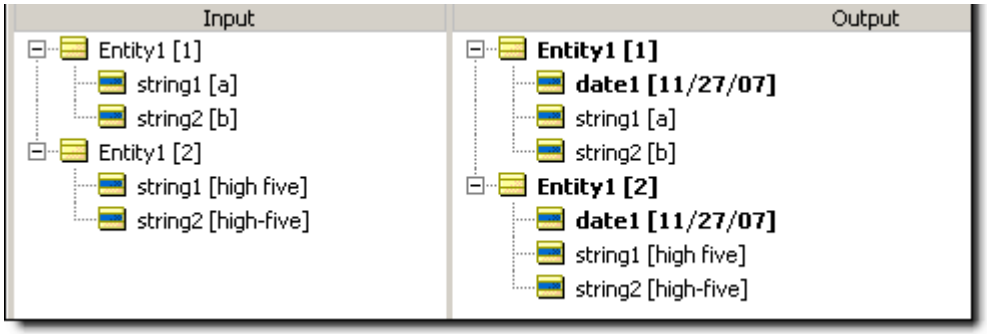
RULESHEET EXAMPLE

The following Rulesheet uses **less than** to test whether `string1` is less than `string2`, and assign today's date to `dateTime1` if it is. See today for an explanation of this literal term.



SAMPLE RULETEST

A sample Ruletest provides two examples. Input and Output panels are shown below:



Less than or equal to

SYNTAX

DateTime*	`<DateTime1>` **<=** `<DateTime2>`
Number*	`<Number1>` **<=** `<Number2>`
String	`<String1>` **<=** `<String2>`

DESCRIPTION

DateTime*	Returns a value of true if `<DateTime1>` is less than or equal to `<DateTime2>`. This is equivalent to `<DateTime1>` occurring “on or before” `<DateTime2>`
Number	Returns a value of true if `<Number1>` is less than or equal to `<Number2>`. Different numeric data types may be compared in the same expression.
String	Returns a value of true if `<String1>` is less than or equal to `<String2>`. Corticon Studio uses Character precedence: Unicode and Java Collator on page 189.

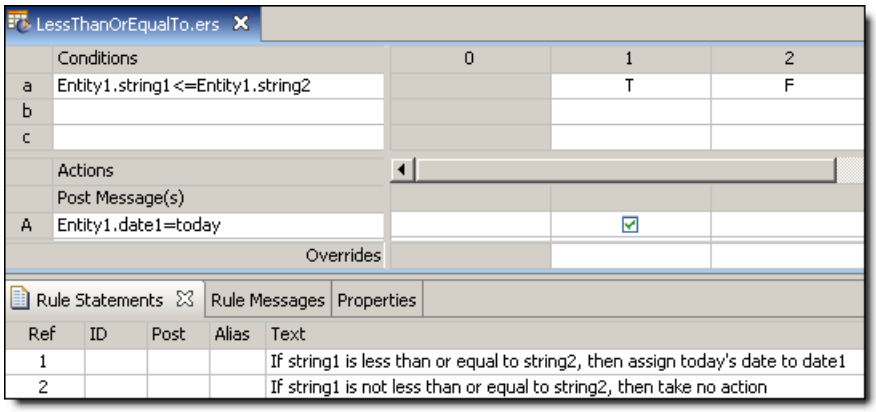
*includes DateTime, Date, or Time data types

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies, with the following exception: **less than or equal to** may also be used in Conditional Value Sets & Cells (section 5 of Sections of Rulesheet that correlate with usage restrictions).

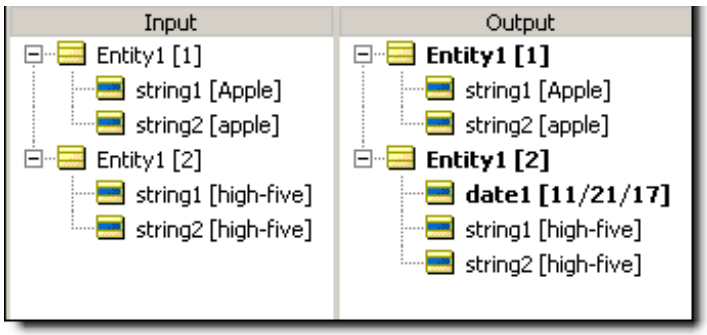
RULESHEET EXAMPLE

The following Rulesheet uses **less than or equal to** to test whether `string1` is less than or equal to `string2`, and assign today's date to `dateTime1` if it is. See today for an explanation of this literal term.



SAMPLE RULETEST

A sample Ruletest provides two examples. Input and Output panels are shown below:



Logarithm (Base 10)

SYNTAX

`<Number>`.log

DESCRIPTION

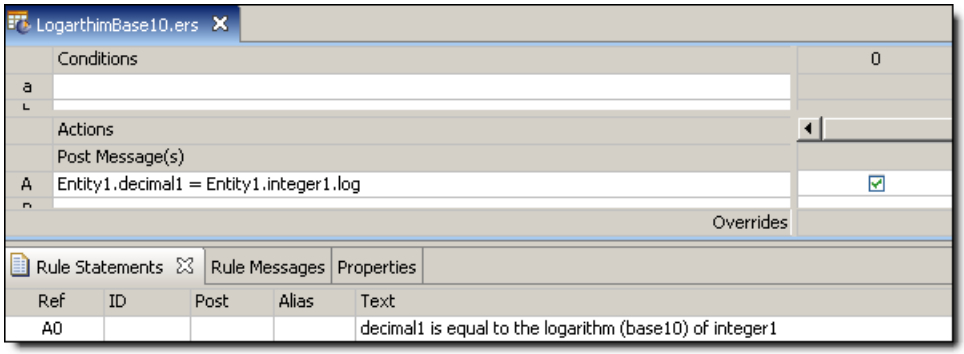
Returns a Decimal value equal to the logarithm (base 10) of `<Number>`. If `<Number>` is equal to `0` (zero) an error is returned when the rule is executed.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

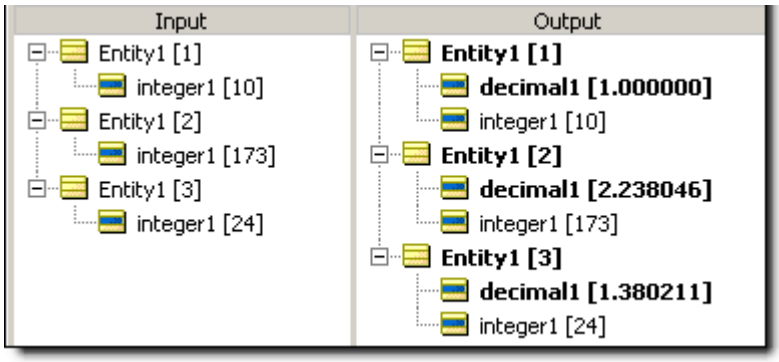
RULESHEET EXAMPLE

The following Rulesheet uses **.log** to calculate the logarithm (base 10) of `integer1` and assign it to `decimal1`.



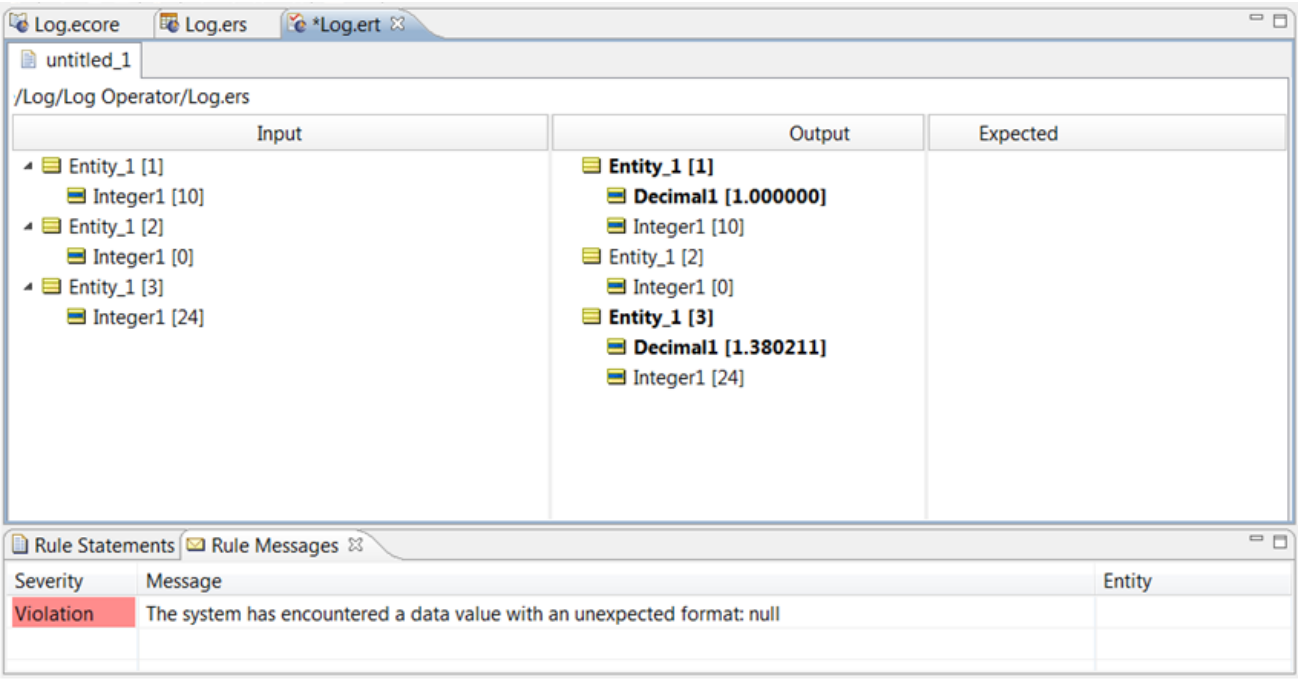
SAMPLE RULETEST 1

A sample Ruletest provides results for three examples of `integer1`. Input and Output panels are shown below:



SAMPLE RULETEST 2

Another sample Ruletest for three examples of `integer1` where one example is equal to zero (0). The resulting error is illustrated below. Notice that the error encountered in the second example causes all Rulesheet execution to halt, leaving the third example unprocessed.



Logarithm (Base x)

SYNTAX

`<Number>`.log(`<Decimal>`)

DESCRIPTION

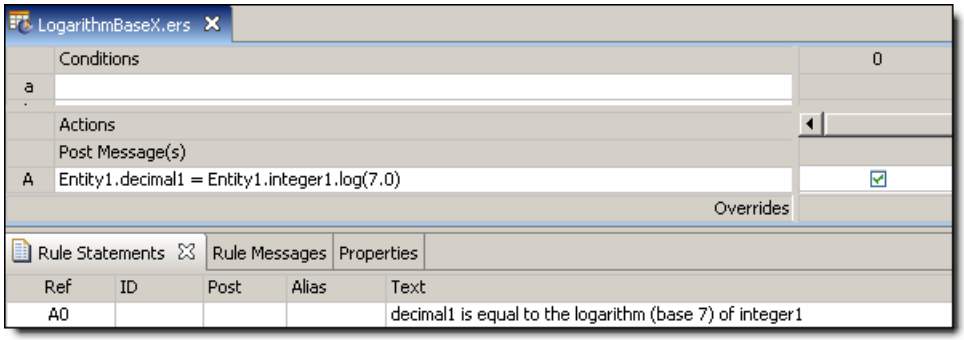
Returns a Decimal value equal to the logarithm (base `<Decimal>`) of `<Number>`. If `<Number>` is equal to `0` (zero) an error is returned when the rule is executed.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

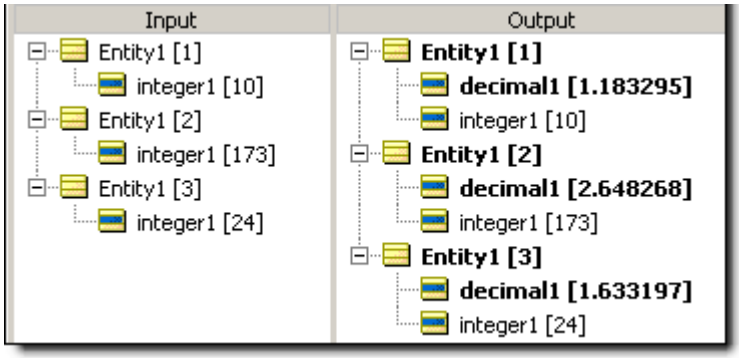
RULESHEET EXAMPLE

The following Rulesheet uses **.log** to calculate the logarithm (base 7.0) of `integer1` and assign it to `decimal1`.



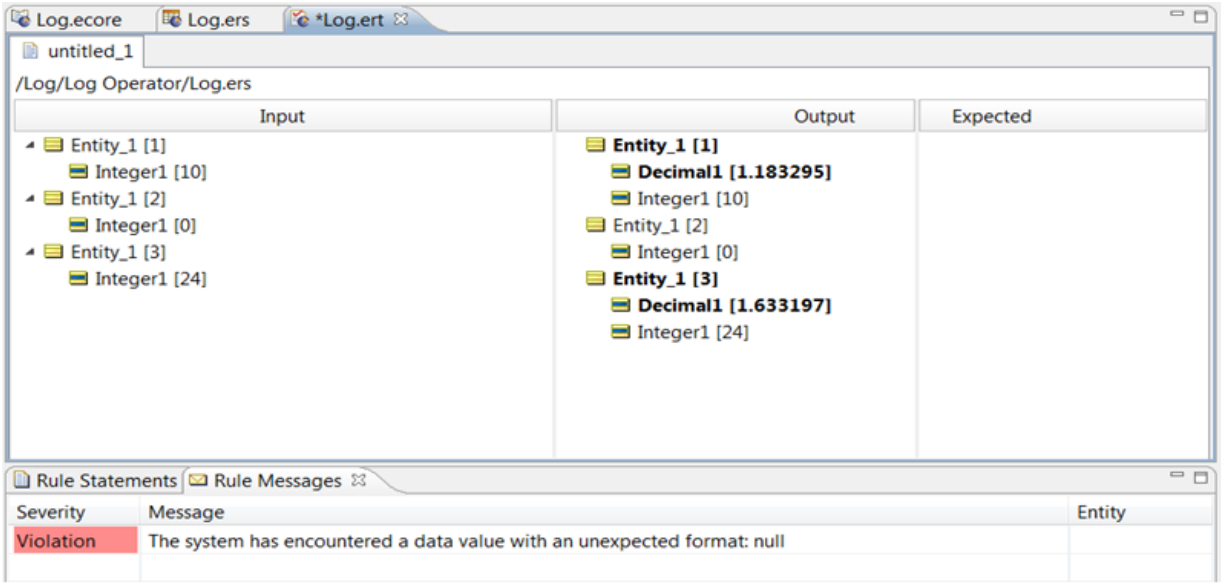
SAMPLE RULETEST 1

A sample Ruletest provides results for three examples of `integer1`. Input and Output panels are shown below:



SAMPLE RULETEST 2

Another sample Ruletest for three examples of `integer1` where one example is equal to zero (0). The resulting error is illustrated below.



Lowercase

SYNTAX

`<String>`.toLower

DESCRIPTION

Converts all characters in `<String>` to lowercase characters.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toLower** to convert `string1` to lowercase, compare its value with `string2`, and assign a value to `boolean1` based on the results of the comparison.

Lowercase.ers

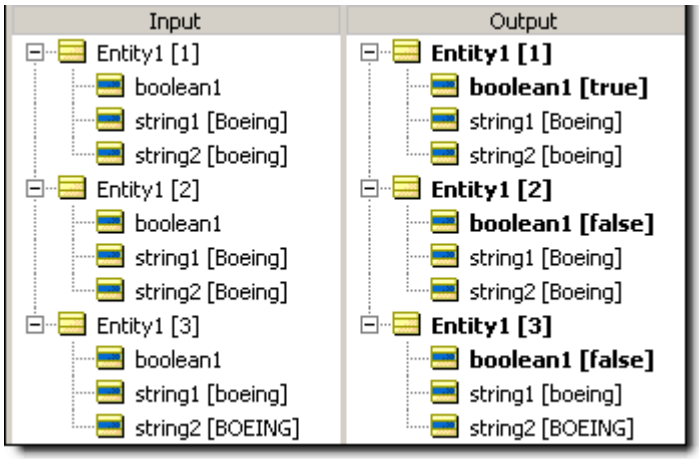
	Conditions	0	1	2
a	Entity1.string1.toLower=Entity1.string2		T	F
b				
c				
d				
e				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
B				
C				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If string1 converted to lowercase is equal to string2, then assign boolean1 a value of true
2				If string1 converted to lowercase is not equal to string2, then assign boolean1 a value of false

SAMPLE RULETEST

A sample Ruletest provides three examples of `string1` and `string2`. Input and Output panels are shown below:



Maximum value

SYNTAX

`<Number1>`.max(`<Number2>`)

DESCRIPTION

Returns either `<Number1>` or `<Number2>`, whichever is greater.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.max** to compare the values of `decimal1` and `decimal2`, and `integer1` and `integer2`, and posts a message based on their size relative to `5.0` and `8`, respectively.

MaximumValue.ers

	Conditions	0	1	2
a	Entity1.decimal1.max(Entity1.decimal2) > 5.0		T	-
b	Entity1.integer1.max(Entity1.integer1) > 8		-	T
c				
	Actions			
	Post Message(s)			
A				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1		Info	Entity1	The larger of decimal1 and decimal2 is greater than 5
2		Info	Entity1	The larger of integer1 and integer2 is greater than 8

SAMPLE RULETEST

A sample Ruletest provides four examples, two using `decimal1` and `decimal2`, and two using `integer1` and `integer2` as input data.

Input	Output
Entity1 [1]	Entity1 [1]
decimal1 [4.900000]	decimal1 [4.900000]
decimal2 [5.100000]	decimal2 [5.100000]
Entity1 [2]	Entity1 [2]
decimal1 [5.000000]	decimal1 [5.000000]
decimal2 [4.300000]	decimal2 [4.300000]
Entity1 [3]	Entity1 [3]
integer1 [5]	integer1 [5]
integer2 [14]	integer2 [14]
Entity1 [4]	Entity1 [4]
integer1 [7]	integer1 [7]
integer2 [1]	integer2 [1]

Rule Statements | Rule Messages | Properties

Severity	Message	Entity
Info	The larger of decimal1 and decimal2 is greater than 5	Entity1[1]
Info	The larger of integer1 and integer2 is greater than 8	Entity1[3]

Maximum value (Collection)

SYNTAX

`<Collection.attribute>` -> max

DESCRIPTION

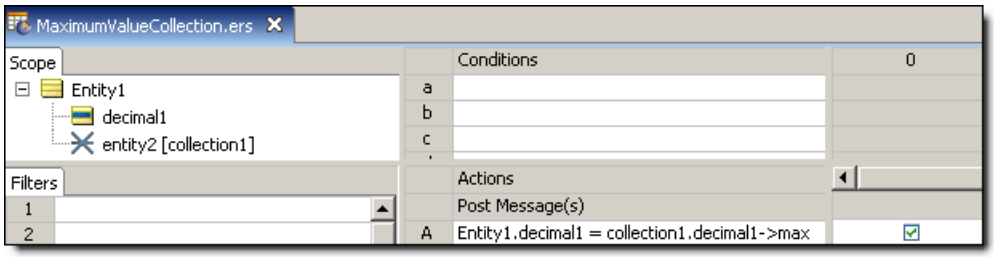
Returns the highest value of `<attribute>` for all elements in `<Collection>`. `<attribute>` must be a numeric data type. `<Collection>` must be expressed as a unique alias.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

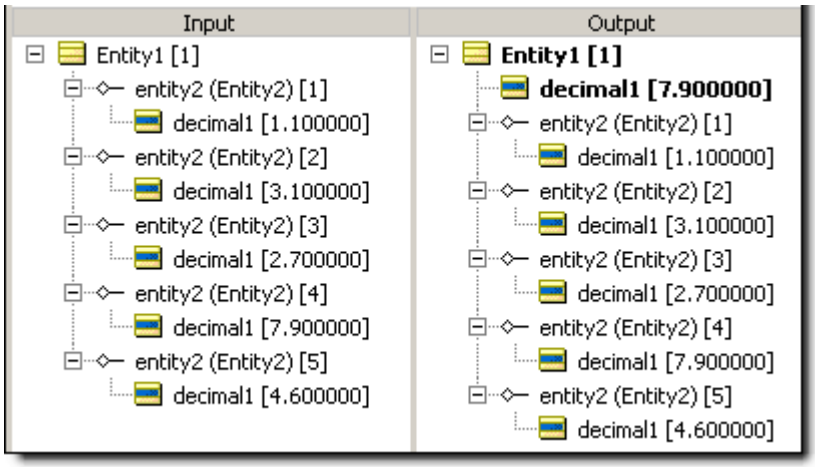
RULESHEET EXAMPLE

The following Rulesheet uses **->max** to identify the highest value of `decimal1` in all elements of `collection1`, then assign it to `Entity1.decimal1`.



SAMPLE RULETEST

A sample collection contains five elements, each with a value of `decimal1`.



Minimum value

SYNTAX

`<Number1>`.min(`<Number2>`)

DESCRIPTION

Returns either `<Number1>` or `<Number2>`, whichever is smaller.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.min** to compare the values of `decimal1` and `decimal2`, and `integer1` and `integer2`, and posts a message based on their size relative to `5.0` and `8`, respectively.

MinimumValue.ers

	Conditions	0	1	2
a	Entity1.decimal1.min(Entity1.decimal2) > 5.0	-	T	-
b	Entity1.integer1.min (Entity1.integer2) > 8	-	-	T
c				
	Actions			
	Post Message(s)			
A				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1		Info	Entity1	The smaller of decimal1 and decimal2 is greater than 5
2		Info	Entity1	The smaller of integer1 and integer2 is greater than 8

SAMPLE RULETEST

A sample Ruletest provides four examples, two using decimal inputs, and two using integers.

Input	Output
Entity1 [1]	Entity1 [1]
decimal1 [4.900000]	decimal1 [4.900000]
decimal2 [5.100000]	decimal2 [5.100000]
Entity1 [2]	Entity1 [2]
decimal1 [5.100000]	decimal1 [5.100000]
decimal2 [594.300000]	decimal2 [594.300000]
Entity1 [3]	Entity1 [3]
integer1 [1500]	integer1 [1500]
integer2 [245]	integer2 [245]
Entity1 [4]	Entity1 [4]
integer1 [350]	integer1 [350]
integer2 [1]	integer2 [1]

Rule Statements | Rule Messages | Properties

Severity	Message	Entity
Info	The smaller of decimal1 and decimal2 is greater than 5	Entity1[2]
Info	The smaller of integer1 and integer2 is greater than 8	Entity1[3]

Minimum value (Collection)

SYNTAX

`<Collection.attribute>` -> min

DESCRIPTION

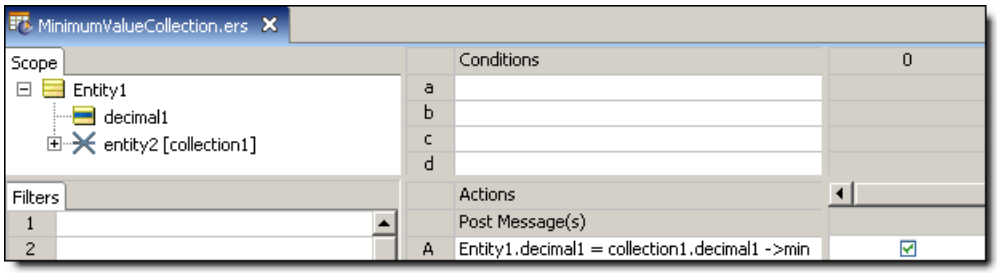
Returns the lowest value of `<attribute>` for all elements in `<Collection>`. `<attribute>` must be a numeric data type. `<Collection>` must be expressed as a unique alias.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

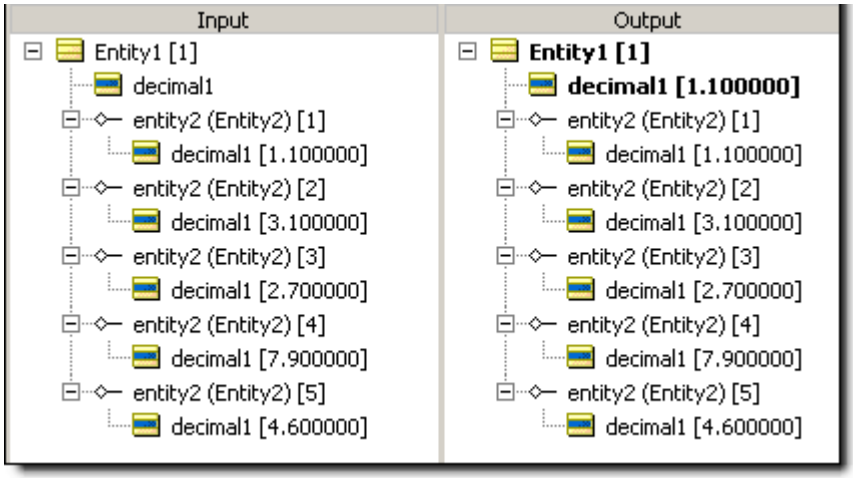
RULESHEET EXAMPLE

The following Rulesheet uses **->min** to identify the lowest value of `decimal1` in all elements of `collection1`, then assign it to `Entity1.decimal1`.



SAMPLE RULETEST

A sample collection contains five elements, each with a value of `decimal1`.



Minute

SYNTAX

`<DateTime>`.min

`<Time>`.min

DESCRIPTION

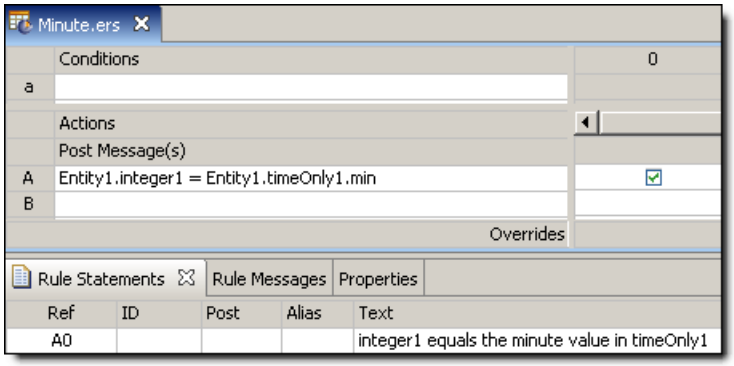
Returns the minute portion of `<DateTime>` or `<Time>` as an Integer between 0 and 59. This operator cannot be used with Date attributes because no time information is present.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

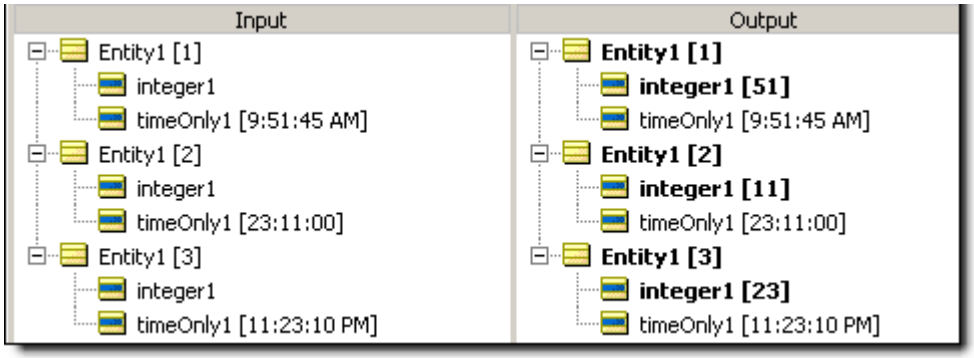
RULESHEET EXAMPLE

The following Rulesheet uses **.min** to evaluate `dateTime1` and assign the minute value to `integer1`.



SAMPLE RULETEST

A sample Ruletest provides three examples of `dateTime1`. Input and Output panels are shown below:



Minutes between

SYNTAX

`<DateTime1>`.minsBetween(`<DateTime2>`)

`<Time1>`.minsBetween(`<Time2>`)

DESCRIPTION

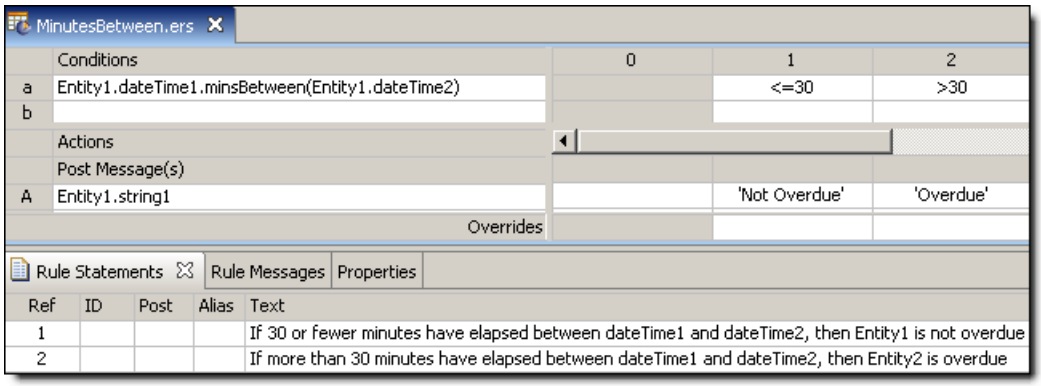
Returns the Integer number of minutes between DateTimes or between Times. The function calculates the number of milliseconds between the two dates and divides that number by 60,000 (the number of milliseconds in a minute). The decimal portion is then truncated. If the two dates differ by less than a full minute, the returned value is zero. This function returns a positive number if `<DateTime2>` is later than `<DateTime1>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

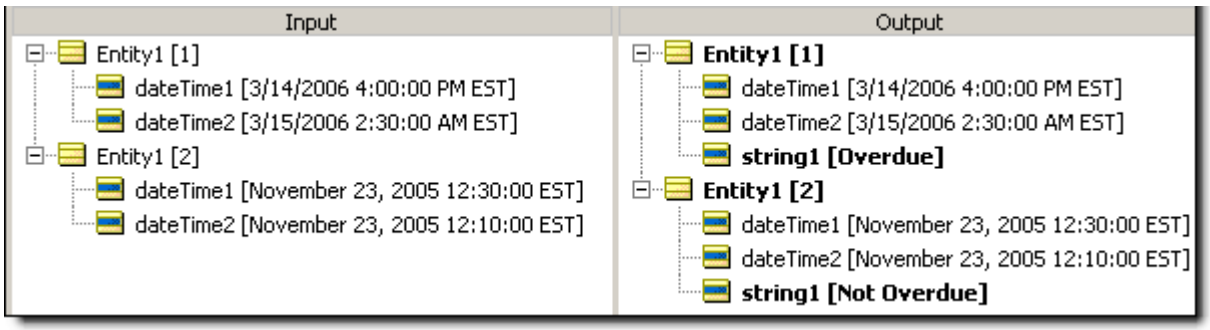
RULESHEET EXAMPLE

The following Rulesheet uses **.minsBetween** to determine the number of minutes that have elapsed between `dateTime1` and `dateTime2`, compare it to the Values set, and assign a value to `string1`.



SAMPLE RULETEST

A sample Ruletest provides `dateTime1` and `dateTime2` for two examples. Input and Output panels are shown below. Notice the different masks (formats) used for the DateTime data.



Mod

SYNTAX

<`Integer1`>.mod(<`Integer2`>)

DESCRIPTION

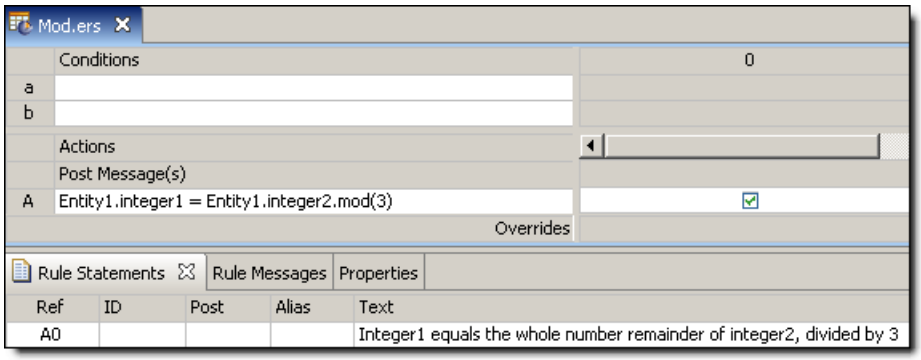
Returns the whole number remainder that results from dividing <`Integer1`> by <`Integer2`>. If the remainder is a fraction, then `0` (zero) is returned.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

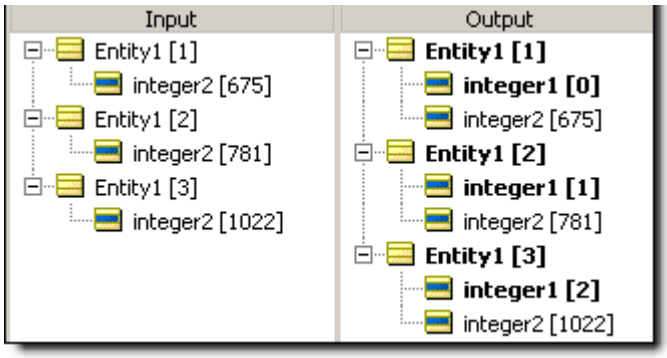
RULESHEET EXAMPLE

The following Rulesheet > uses **.mod** to calculate the whole number remainder resulting from the division of `integer2` by 3. The result is assigned to `integer1`.



SAMPLE RULETEST

A sample Ruletest provides three examples of `integer2`. Input and Output panels are shown below.



Month

SYNTAX

<`DateTime`>.month

<`Date`>.month

DESCRIPTION

Returns the month in <`DateTime`> or <`Date`> as an Integer between 1 and 12.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.month** to evaluate `dateTime1` and `dateOnly1` and assign the month value to `integer1` and `integer2`, respectively.

Month.ers

	Conditions	0
a		
b		
	Actions	
	Post Message(s)	
A	Entity1.integer1 = Entity1.dateTime1.month	☑
B	Entity1.integer2 = Entity1.dateOnly1.month	☑
	Overrides	

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
A0				integer1 equals the month value in dateTime1
B0				integer2 equals the month value in dateOnly1

SAMPLE RULETEST

A sample Ruletest provides three examples of `dateTime1` or `dateOnly1`. Input and Output panels are shown below. The month returned is independent of the machine running the Ruletest and only depends on the locale/timezone of the data itself.

Input	Output
Entity1 [1]	**Entity1 [1]**
dateTime1 [10/31/2000 10:00:00 PM EST]	dateTime1 [10/31/2000 10:00:00 PM EST]
integer1	**integer1 [10]**
Entity1 [2]	**Entity1 [2]**
dateTime1 [10/31/2000 10:00:00 PM PST]	dateTime1 [10/31/2000 10:00:00 PM PST]
integer1	**integer1 [10]**
Entity1 [3]	**Entity1 [3]**
dateOnly1 [10/31/2000]	dateOnly1 [10/31/2000]
integer2	**integer2 [10]**

Months between

SYNTAX

<`DateTime1`>.monthsBetween(<`DateTime2`>)

<`Date1`>.monthsBetween(<`Date2`>)

DESCRIPTION

Returns the Integer number of months between DateTimes or between Dates. The month and year portions of the date data are subtracted to calculate the number of elapsed months. The day portions are ignored. If the month and year portions are the same, the result is zero. This function returns a positive number if <`DateTime2`> is later than <`DateTime1`>.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.monthsBetween** to determine the number of months that have elapsed between `dateTime1` and `dateTime2`, compare it to the values in the Condition Cells, and assign a value to `string1`.

MonthsBetween.ers

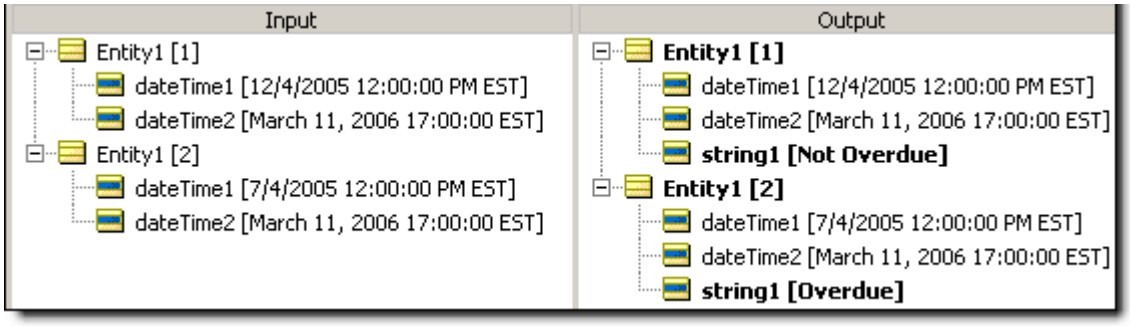
	Conditions	0	1	2
a	Entity1.dateTime1.monthsBetween(Entity1.dateTime2)	-	<=6	>6
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.string1		'Not Overdue'	'Overdue'
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If 6 or fewer months have elapsed between date1 and date2, then Entity1 is not overdue
2				If more than 6 months have elapsed between date1 and date2, then Entity1 is overdue

SAMPLE RULETEST

A sample Ruletest provides `dateTime1` and `dateTime2` for two examples. Input and Output panels are shown below. Notice the variations in date masks (formats).



Multiply

SYNTAX

`<Number1> * <Number2>`

DESCRIPTION

Multiplies `<Number1>` by `<Number2>`. The resulting data type is the more expansive of those of `<Number1>` and `<Number2>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

This sample Rulesheet uses **multiply** to multiply `integer1` and `integer2` and compare the result to `100`

Multiply.ers

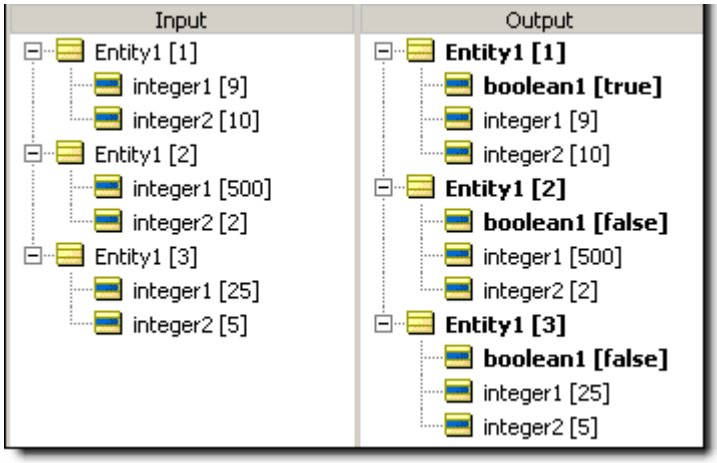
	Conditions	0	1	2
a	Entity1.integer1 * Entity1.integer2		<100	>=100
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If integer1 multiplied by integer2 is less than 100, then boolean1 is true
2				If integer1 multiplied by integer2 is greater than or equal to 100, then boolean1 is false

SAMPLE RULETEST

A sample Ruletest provides three examples of `integer1` and `integer2`. Input and Output panels are shown below.



Natural logarithm

SYNTAX

<`Number`>.ln

DESCRIPTION

Returns a Decimal value equal to the natural logarithm (base e) of <`Number`>. If <`Number`> is equal to `0` (zero), an error is returned when the rule is executed. This error will halt execution for all data present.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.ln** to calculate the natural logarithm of `decimal2` and assign it to `decimal1`.

Natural Logarithm.ers

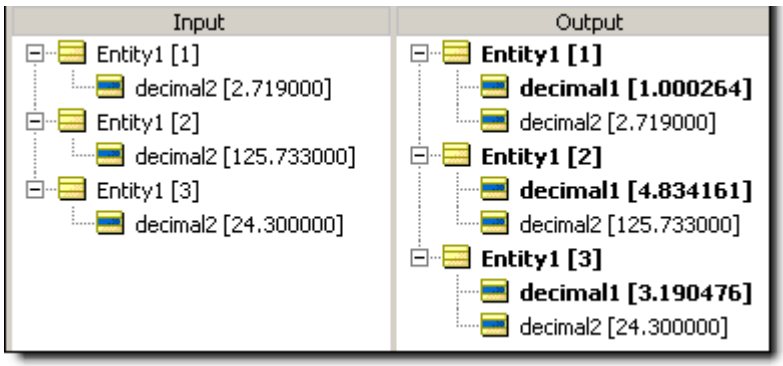
	Conditions	0	1
a			
b			
	Actions		
	Post Message(s)		
A	Entity1.decimal1 = Entity1.decimal2.ln	☑	
B			
	Overrides		

Rule Statements | Rule Messages | Problems

Ref	ID	Post	Alias	Text
A0				decimal1 is equal to the natural logarithm (base e) of decimal2

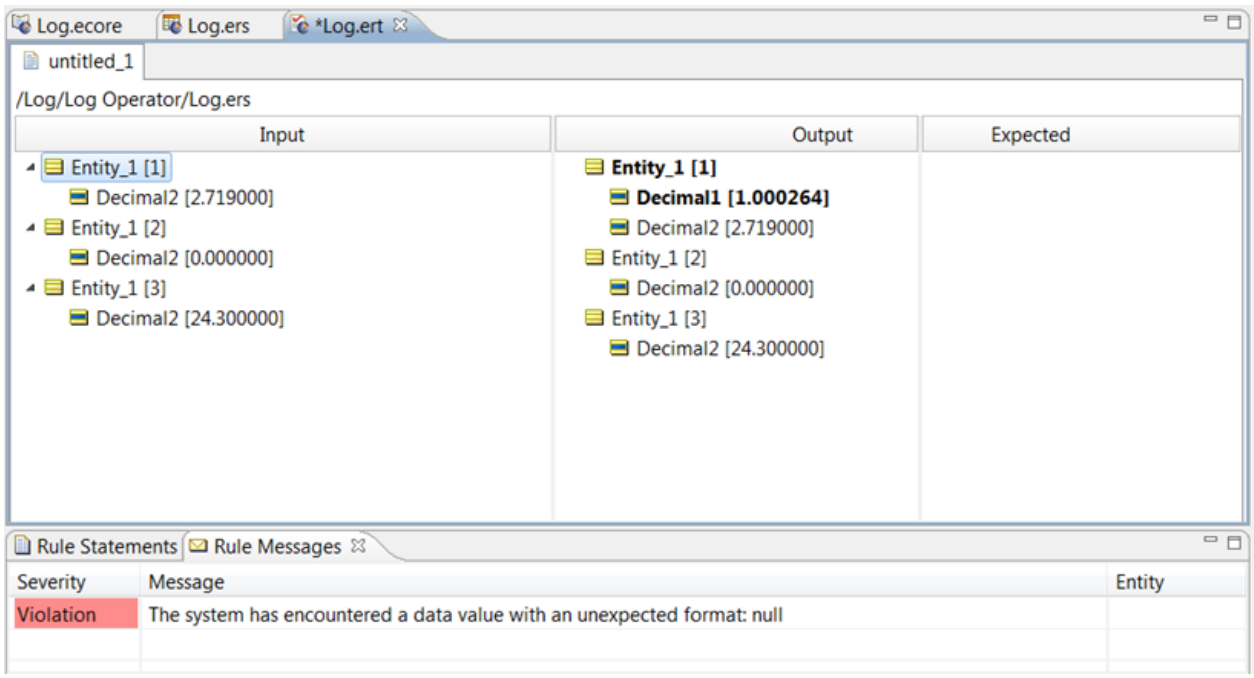
SAMPLE RULETEST 1

A sample Ruletest provides results for three examples of `decimal2`. Input and Output panels are shown below:



SAMPLE RULETEST 2

Another sample Ruletest for three examples of `decimal2` where one example is equal to zero (0). The resulting error is illustrated below:



New

SYNTAX

<Entity>.new[<Expression1>,<Expression2>...]

DESCRIPTION

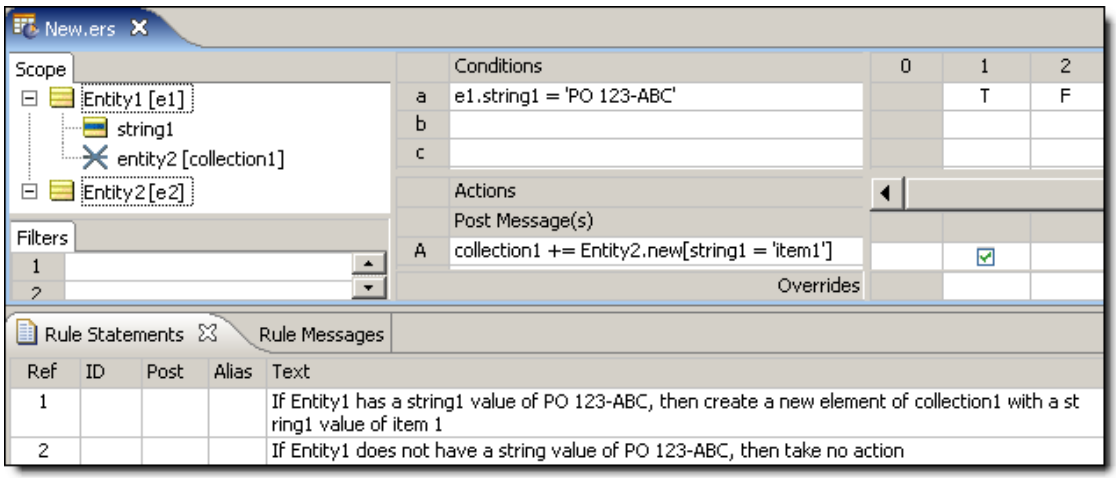
creates a new <Entity> with attribute values defined by optional <Expression>. Expressions (when present) should be written as assignments in the form: *attribute* = *value*. The attribute used in <Expression> (when present) must be an attribute of <Entity>.

USAGE RESTRICTIONS

The Operators row in the table of Summary Table of Vocabulary Usage Restriction does not apply. Special exceptions: **new** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

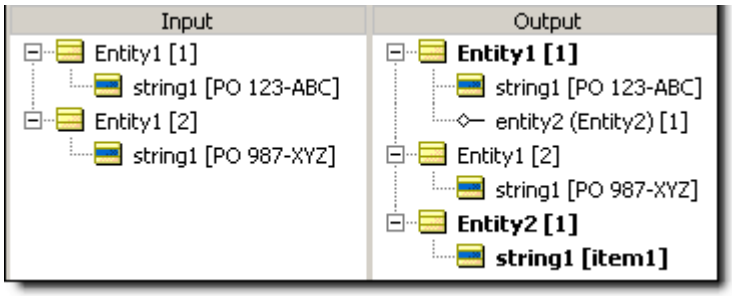
RULESHEET EXAMPLE

The following Rulesheet uses **.new** to create a new `Entity2` element in `collection1` when `Entity1` has a `string1` value equal to "`PO 123-ABC`". An alias is not required by the **.new** operator, because it is possible to create a new entity at the root level, without inserting it into a collection. The `collection1` alias used here is required by the += (Associate Element to collection) operator.



SAMPLE RULETEST

A sample Ruletest provides 2 collections of `Entity1`. Input and Output panels are illustrated below:



Behavior of the `.new` operator

The `.new` operator does not consider implied conditions of non-mandatory attributes (from the initialize expressions) during execution (in other words, a `.new` operator always fires when explicit conditions are met).

Each initialize expression within a `.new`... expression will be executed (or not) depending upon implied conditions; that is, if any input to the expression is null, the target attribute remains null. Another case where an implied condition would prevent a `.new` operator for executing is where the new entity is a target to an association assignment and the parent of that association does not exist.

The following examples assume that all attributes are not mandatory.

- Rule 1:

  ```
  IF entity1.attr1 > 10 THEN Entity2.new[attr1 = entity1.attr2]
  ```

  Executes only if `entity1` exists, `entity1.attr1` is not null, and `entity1.attr1 > 10`. The new`Entity2.attr1` will be left as null if `entity1.attr2` is null.

- Rule 2:

  ```
  Entity2.new[attr1 = entity1.attr1 + entity1.attr2]
  ```

  Will always execute. `Entity2.attr1` will remain null if `entity1` does not exist, or `entity1.attr1` is null, or `entity1.attr2` is null.

- Rule 3:

  ```
  entity1.assoc2 += Entity2.new[attr1 = entity1.attr1]
  ```

  Will execute only if `entity1` exists. `Entity2.attr1` will remain null if `entity1.attr1` is null.

- Rule 4:

  ```
  Entity2.new[attr1 = entity1.assoc1.attr1]
  ```

  This action will always fire. `entity2.attr1` will remain null if `entity1` does not exist, or `entity1.assoc1` does not exist, or `entity1.assoc1.attr1` is null. Note that this action will fire multiple times if `entity1.assoc1` contains multiple entities (once for each entity contained in the `entity1.assoc1` collection).

New unique

SYNTAX

<`Entity`>.newUnique[<`Expression1`>,<`Expression2`>...]

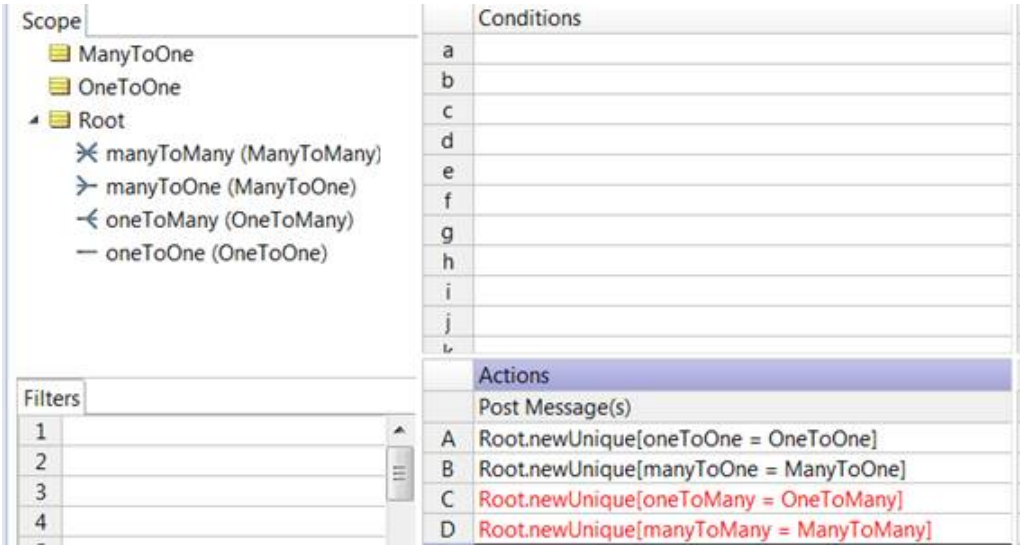
DESCRIPTION

newUnique is an unusual operator in that it contains both action *and* condition logic. When an Action containing this operator is executed, a new <`Entity`> will be created only if no other entity exists with the characteristics defined by <`Expression1`> **and** <`Expression2`>, etc. <`Expression1`> and <`Expression2`> are optional. If no expression is present within the square brackets `[..]`, the **newUnique** operator will create a new entity only if none currently exists in memory.

USAGE RESTRICTIONS

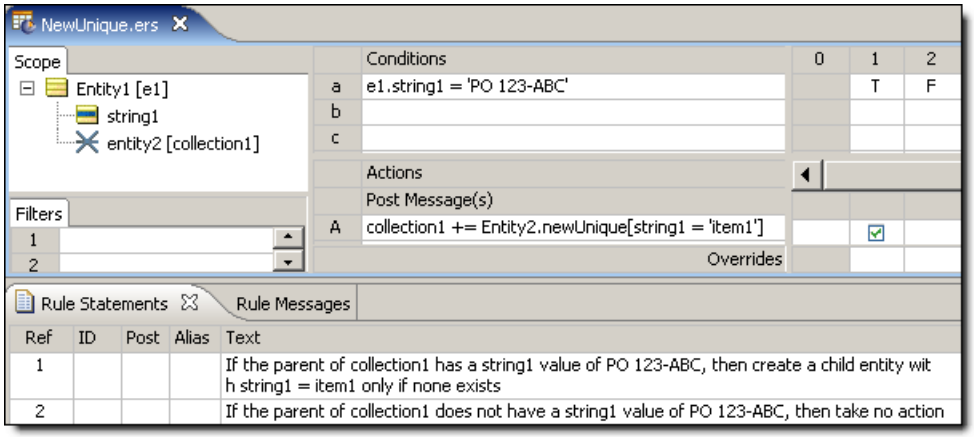
The Operators row in the table of Summary Table of Vocabulary Usage Restriction does not apply. Special exceptions: **newUnique** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

There is some restriction to using **newUnique** with associations. **newUnique** is valid for associations of multiplicity One to One or Many to One, but is invalid for associations One to Many or Many to Many, as illustrated:



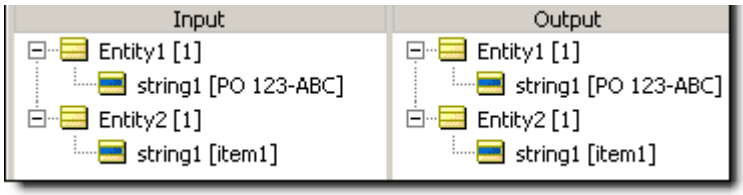
RULESHEET EXAMPLE

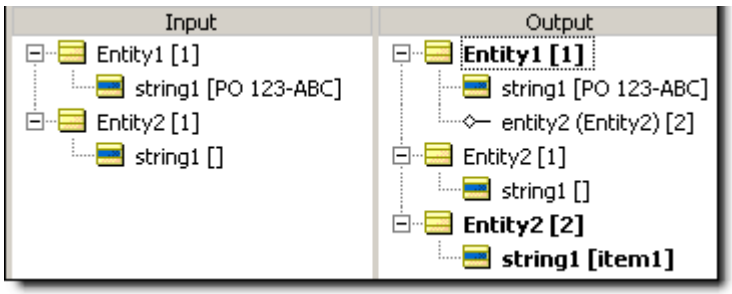
The following Rulesheet uses **.newUnique** to create a new `Entity2` element with `string1="item1"`, and add it to `collection1` only if no existing `Entity2` already has `string1="item1"`. A collection alias is not required by the **.newUnique** operator because it is possible to create a new entity at the root level, without inserting it into a collection. The collection alias used here is required by the += (Associate Element to collection) operator.

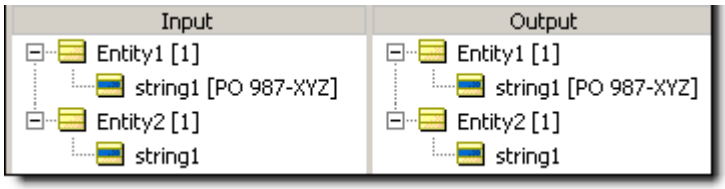


SAMPLE RULETEST 1

Each of three sample tests provides different combinations of `Entity1` and `Entity2`. Input and Output panels are illustrated below:







Not

SYNTAX

not <`Expression`>

DESCRIPTION

Returns the negation of the truth value of <`Expression`>.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies, with the following special exception: **not** may also be used in Conditional Cells.

RULESHEET EXAMPLE

The following Rulesheet uses **not** to negate the value of `A` in the Condition Cell of rule 2. **Not** may only be used in this manner if there is at least one other value (including other or null) present in the Condition Cells values drop-down list (in other words, there must be at least one alternative to the value negated by **not**).

Not.ers

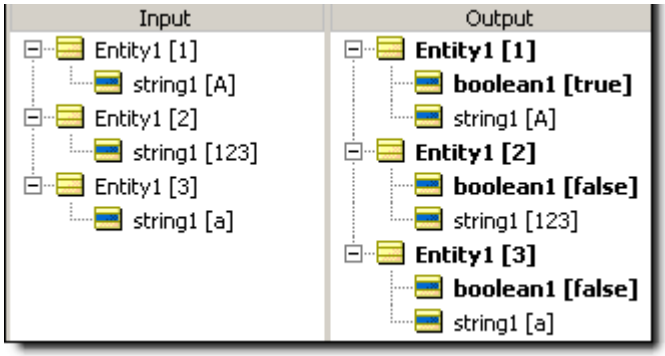
	Conditions	0	1	2
a	Entity1.string1		'A'	not 'A'
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If string1 is equal to A, then boolean1 is assigned the value of true
2				If string1 is not equal to A, then boolean1 is assigned the value of false

SAMPLE RULETEST

A sample Ruletest provides three examples of `string1`. Input and Output panels are shown below:



Limitations to using NOT in a Conditional cell

When you use **not** in a Conditional cell with an attribute name, the form is `not valueSet` which evaluates as `true` when the condition is not a member of an entry in the *valueSet*. Such entries in the *valueSet* must be literals (or partial expressions containing only literals); no variables or attributes may be included. Inclusion of an attribute reference in the *valueSet* is not valid.

Although `not attribute` is unsupported, it is not determined that it is invalid until it does not process. Then, it indicates that it is invalid.

Consider the following examples:

Table 1: Valid usage

Condition	Cell value
`foo.color`	`not 'red'`
`foo.color`	`<> 'red'`
`foo.color`	`<> bar.color`

Table 2: Invalid usage

Condition	Cell value
`foo.color`	`not bar.color`

Not empty

SYNTAX

<`Collection`> ->notEmpty

DESCRIPTION

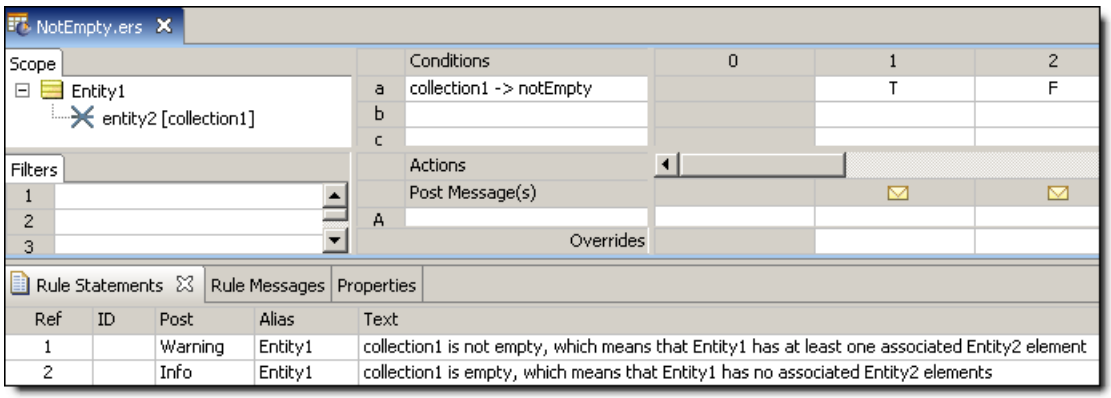
Returns a value of true if <`Collection`> contains *at least one* element. **->notEmpty** does not check for attribute values, but instead checks for the *existence of elements within a collection*. As such, it requires the use of a unique alias to represent the collection being tested.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

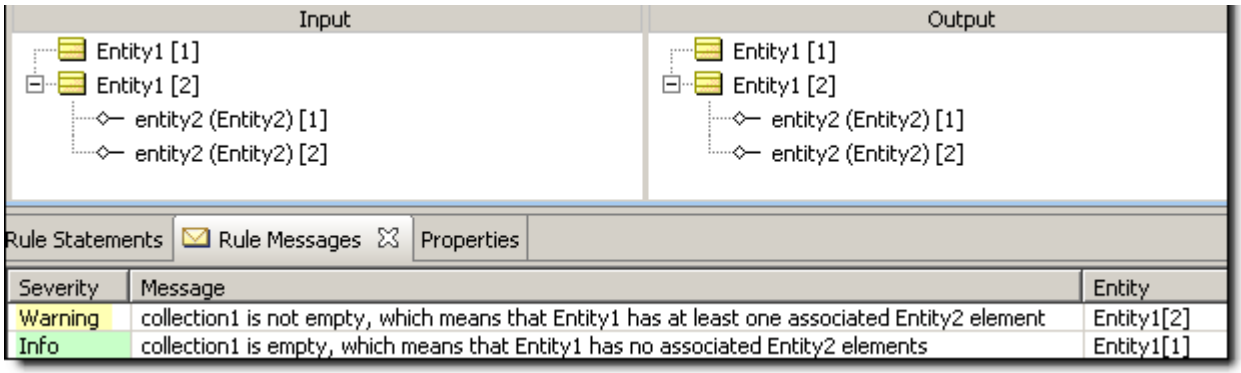
RULESHEET EXAMPLE

This sample Rulesheet uses the **->notEmpty** function to determine if `collection1` has elements. Note the use of unique alias `collection1` to represent the collection of `Entity2` associated with `Entity1`.



SAMPLE RULETEST

A sample Ruletest provides two collections. The following illustration shows Input and Output panels



Not equal to

SYNTAX

Boolean	`<Expression1> <> <Expression2>`
DateTime*	`<DateTime1> <> <DateTime2>`
Number	`<Number1> <> <Number2>`
String	`<String1> <> <String2>`

DESCRIPTION

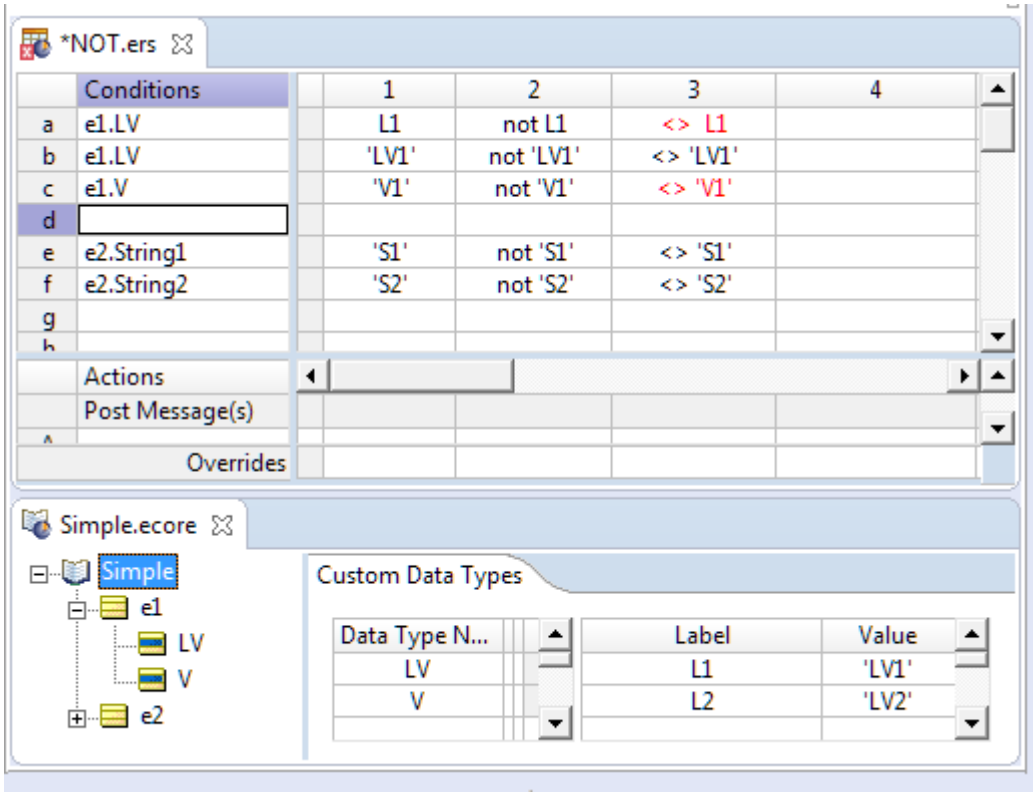
Boolean	Returns a value of true if `<Expression1>` does not have the same truth value as `<Expression2>`.
DateTime*	Returns a value of true if `<DateTime1>` does not equal `<DateTime2>`. This is equivalent to `<DateTime1>` not occurring “on” `<DateTime2>`
Number	Returns a value of true if `<Number1>` is not equal to `<Number2>`. Different numeric data types may be compared in the same expression.
String	Returns a value of true if `<String1>` is not equal to `<String2>`. Studio uses Character precedence: Unicode and Java Collator on page 189 to determine character precedence.

*includes DateTime, Date, and Time data types

USAGE RESTRICTIONS

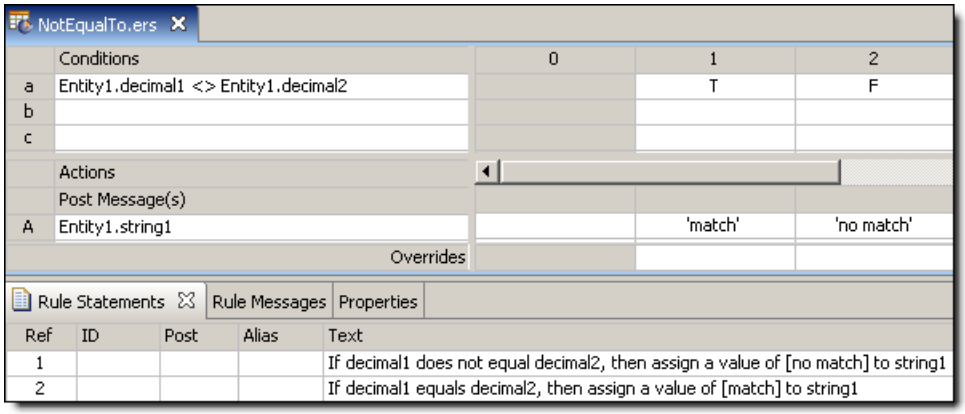
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

Note: Use of < > when using custom data types - If your Vocabulary uses custom data types, there are limits to the validity of < > in cells. In the following illustration, the `not` operator will validly work against a custom data type label, a value where a label is in use, and the value of a value-only definition. However, only the value where a label is in use is valid when < > is used.



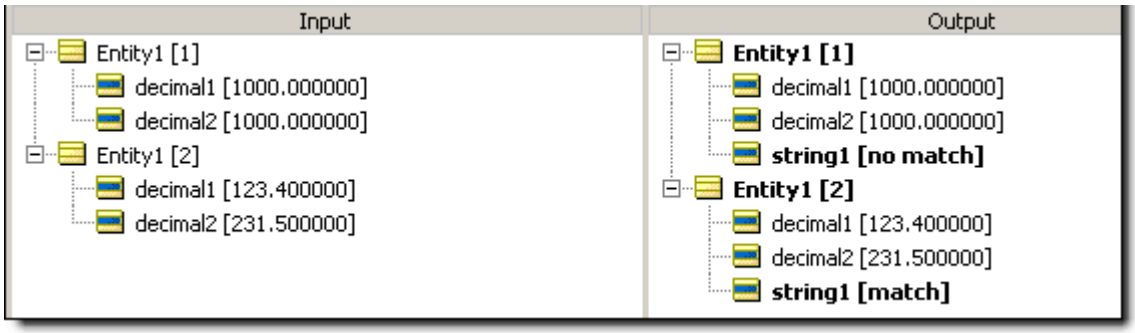
RULESHEET EXAMPLE

The following Rulesheet uses **not equal to** to test whether `decimal1` equals `decimal2`, and assign a value to `string1` based on the result of the comparison.



SAMPLE RULETEST

A sample Ruletest provides two examples. Input and Output panels are shown below:



Now

SYNTAX

now

DESCRIPTION

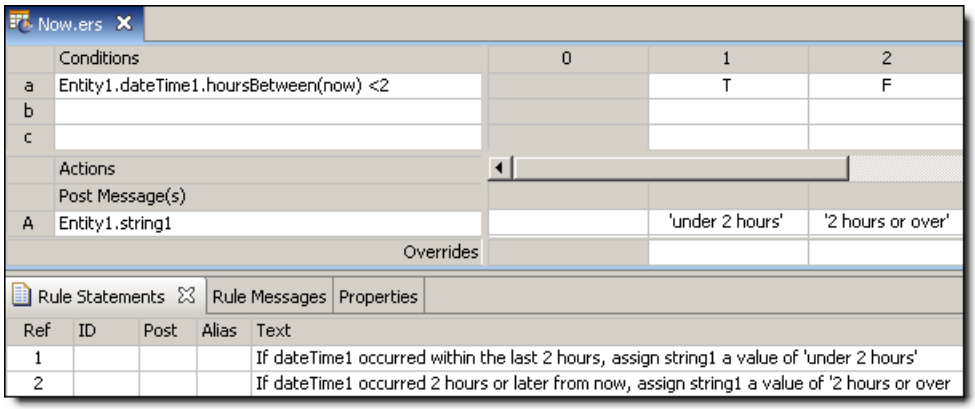
Returns the current system date and time when the rule is executed. This DateTime value is assigned the first time **now** is used in a Decision Service (Rule Set), then remains constant until the Decision Service finishes execution, regardless of how many additional times it is used. This means that every rule in a Rule Set containing **now** will use the same DateTime value.

USAGE RESTRICTIONS

The Literals row in the table of Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

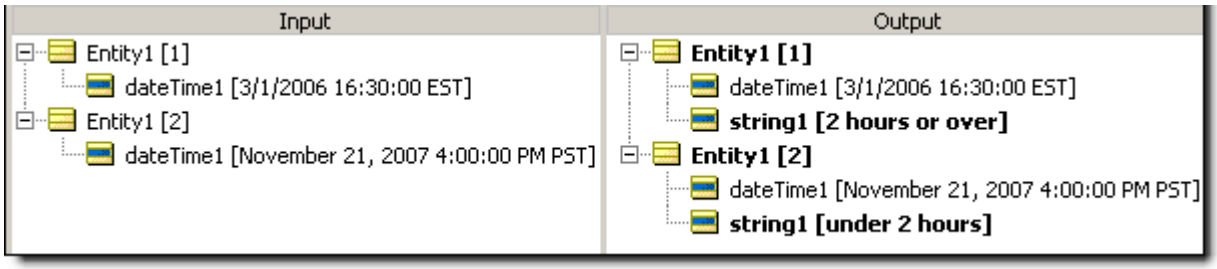
RULESHEET EXAMPLE

The following Rulesheet uses **now** to determine how many hours have elapsed between now and `dateTime1` (see .hoursBetween for more details on this operator), and assign a value to `string1` based on the result.



SAMPLE RULETEST

A sample Ruletest provides two examples of `dateTime1`. Assume **now** is equal to `Thursday,March 16, 2006 16:30:00 EST`. Input and Output panels are shown below. Notice the variation in DateTime masks (formats).



Null

SYNTAX

null

DESCRIPTION

The null value corresponds to one of three different scenarios:

1. the absence of an attribute in a Ruletest Input pane or request message
2. the absence of data for an attribute in a Ruletest (the value zero counts as data)
3. a business object (supplied by an external application) that has an instance variable of null

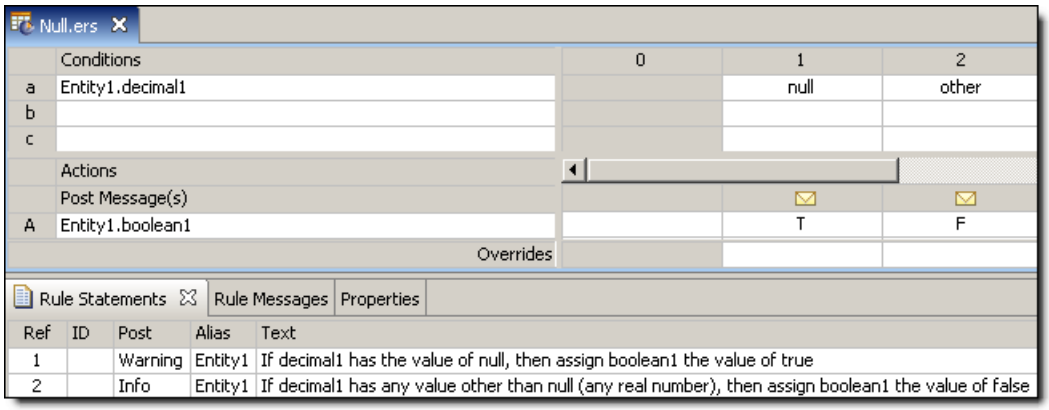
A **null** value is different from an empty String (for String data types) or zero for numeric data types. An empty String is represented in a Ruletest as [] -- open then close square brackets. Any attribute value, including any empty strings, may be reset to **null** in a Ruletest by right-clicking the attribute and choosing **Set to null**. Mandatory attributes (property set in the Vocabulary) may not have a null value.

USAGE RESTRICTIONS

The Literals row in the table of Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **null** to test for the existence of a real value in `decimal1`, and assign a value to `boolean1` as a result.



Null.ers

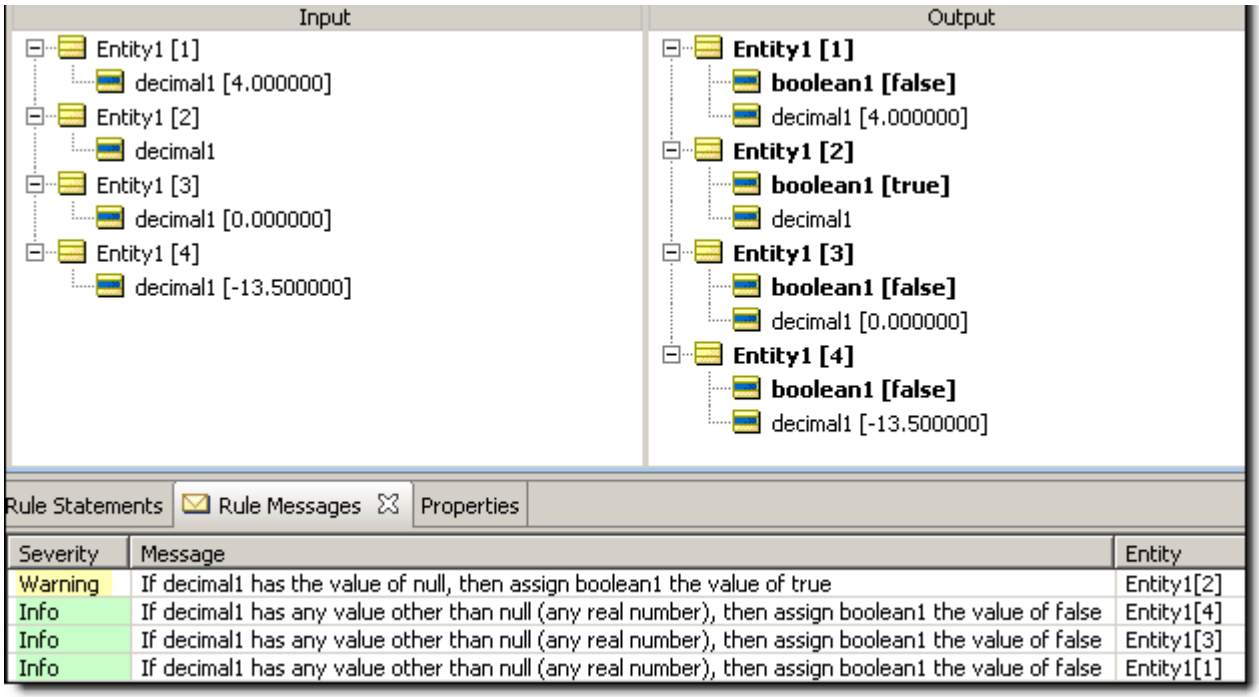
	Conditions	0	1	2
a	Entity1.decimal1		null	other
b				
c				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1		Warning	Entity1	If decimal1 has the value of null, then assign boolean1 the value of true
2		Info	Entity1	If decimal1 has any value other than null (any real number), then assign boolean1 the value of false

SAMPLE TEST

A sample Ruletest provides four examples of `decimal1`. Input and Output panels are illustrated below. Posted messages are not shown.



Other

SYNTAX

other

DESCRIPTION

When included in a condition's Values set (the drop-down list of values available in a Conditions Cell), **other** represents any value not explicitly included in the set, including null. If null is explicitly included in the Values set, then **other** does not include null.

USAGE RESTRICTIONS

The Literals row in the table of Summary Table of Vocabulary Usage Restriction does not apply. Special exception: **other** may only be used in Condition Cells (section 4 of the Sections of Rulesheet that correlate with usage restrictions) because it is a non-specific value used in comparisons.

RULESHEET EXAMPLE

The following Rulesheet uses **other** to test the value of `decimal1`. If `decimal1` has any value *other* than null, `boolean1` is assigned the value of `false`.

Other.ers

	Conditions	0	1	2
a	Entity1.decimal1		null	other
b				
	Actions			
	Post Message(s)			
A	Entity1.boolean1		T	F
B				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1		Warning	Entity1	If decimal1 has the value of null, then assign boolean1 the value of true
2		Info	Entity1	If decimal1 has any value other than null (any number), then assign boolean1 a value of false

SAMPLE TEST

A sample Ruletest provides three examples of `decimal1`. Ruletest Input and Output panels are shown below:

Input

- Entity1 [1]
  - decimal1 [0.000000]
- Entity1 [2]
  - decimal1
- Entity1 [3]
  - decimal1 [3.450000]

Output

- **Entity1 [1]**
  - **boolean1 [false]**
  - decimal1 [0.000000]
- **Entity1 [2]**
  - **boolean1 [true]**
  - decimal1
- **Entity1 [3]**
  - **boolean1 [false]**
  - decimal1 [3.450000]

Rule Statements | Rule Messages | Properties

Severity	Message	Entity
Warning	If decimal1 has the value of null, then assign boolean1 the value of true	Entity1[2]
Info	If decimal1 has any value other than null (any number), then assign boolean1 a value of false	Entity1[1]
Info	If decimal1 has any value other than null (any number), then assign boolean1 a value of false	Entity1[3]

Or

SYNTAX

`<Expression1>` or `<Expression2>` or ....

OR may also be used with ->forAll and ->exists expressions

DESCRIPTION

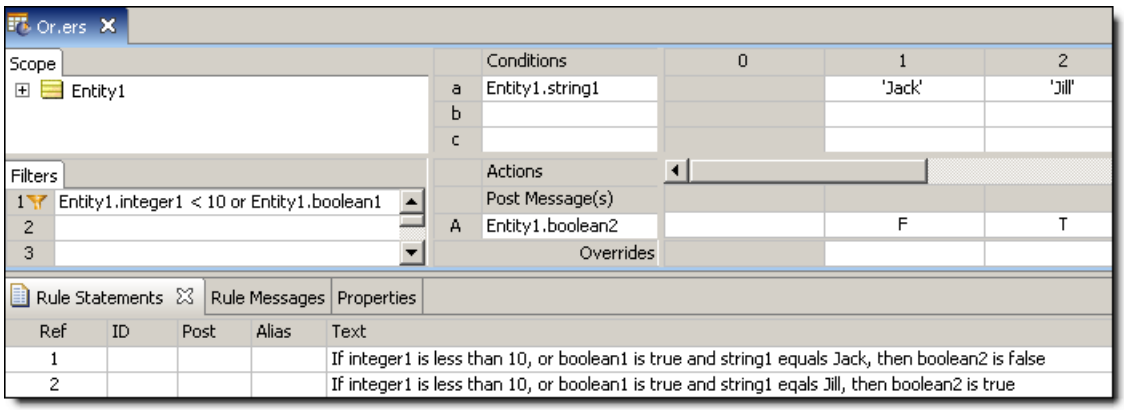
Returns a value of true if either `<Expression1>` or `<Expression2>` evaluates to true. When used between two or more expressions in the Preconditions section, creates a compound filter for the Rulesheet that follows. See *Rule Modeling Guide* for details on using Preconditions as filters. **OR** is not available in the Conditions section because the logical **OR** construction is implemented using multiple Columns in the decision table, or by value sets in Conditions Cells.

USAGE RESTRICTIONS

The Literals row in the table of Sections of Rulesheet that correlate with usage restrictions does not apply. Special exception: **or** may only be used in the Filters section of the Rulesheet to join 2 or more expressions, as shown above, or within ->forAll and ->exists expressions as described in those sections.

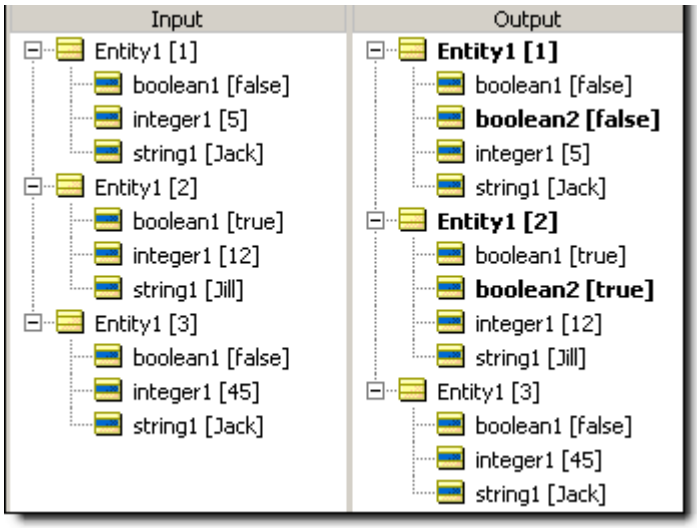
RULESHEET EXAMPLE

The following Rulesheet uses **or** to test the value of `integer1`, `boolean1`, and `string1` to set the value of `boolean2`



SAMPLE TEST

A sample Ruletest provides three examples. Input and Output panels are shown below:



Remove element

SYNTAX

<`Entity`>.remove

<`Collection`>.remove

DESCRIPTION

Removes <`Entity`> or removes elements from <`Collection`> and deletes it/them. If removing from a collection, then using a unique alias to represent the collection is optional since **.remove** is not a collection operator. If any elements in <`Collection`> have one-to-many associations with other entities, then those entities will also be deleted.

The **.remove** operator's impact on elements of a collection can be controlled:

- When the operator is written as `.remove`, `.remove()`, or `.remove(true)`, any lower-level associated entities are also removed. For an example of this behavior, see example 2 below.
- When the operator is written as `.remove(false)`, lower-level associated entities are promoted to root level. For an example of this behavior, see example 3 below.

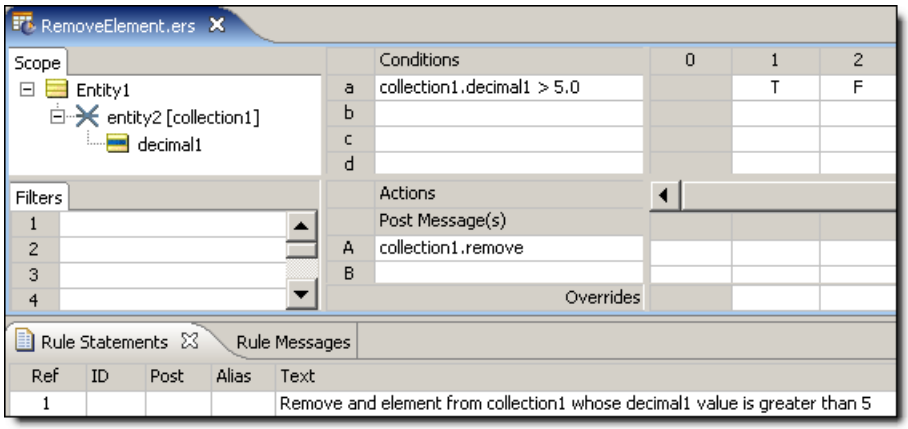
USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction does not apply. Special exceptions: **.remove** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

EXAMPLE 1: Remove an element from a collection

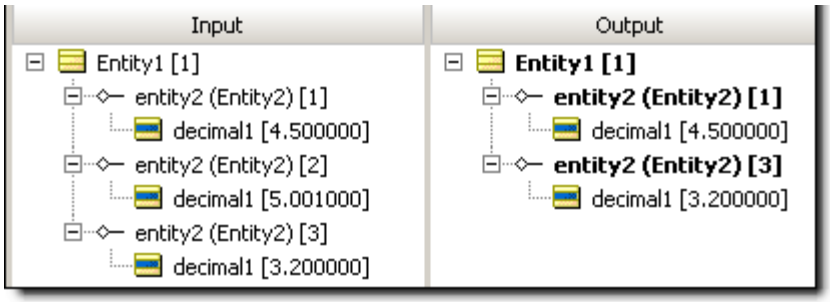
RULESHEET 1

This Rulesheet uses the operator to remove elements from `collection1` whose `decimal1` value is greater than `5`. Note the *optional* use of unique alias `collection1` to represent the collection of `Entity2` elements associated with `Entity1`.



RULETEST 1

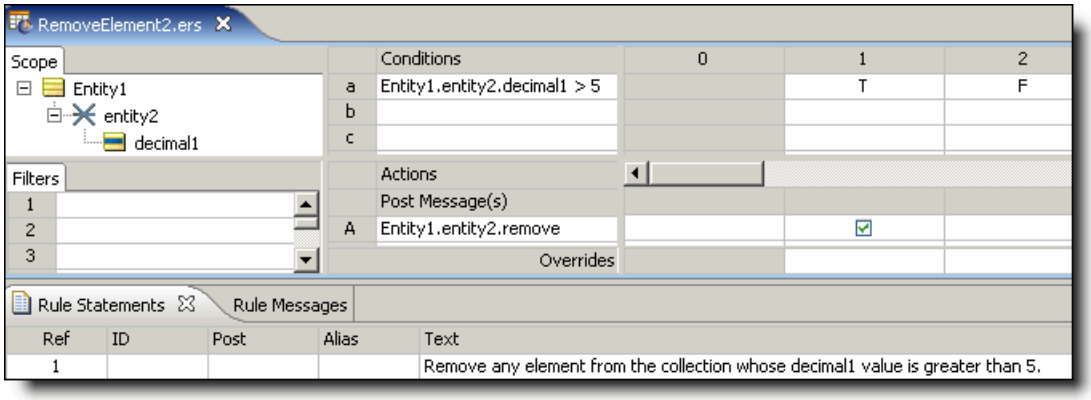
A sample Ruletest provides a collection with two elements. The illustration shows Ruletest Input and Output panels



EXAMPLE 2: Remove an entity and its children

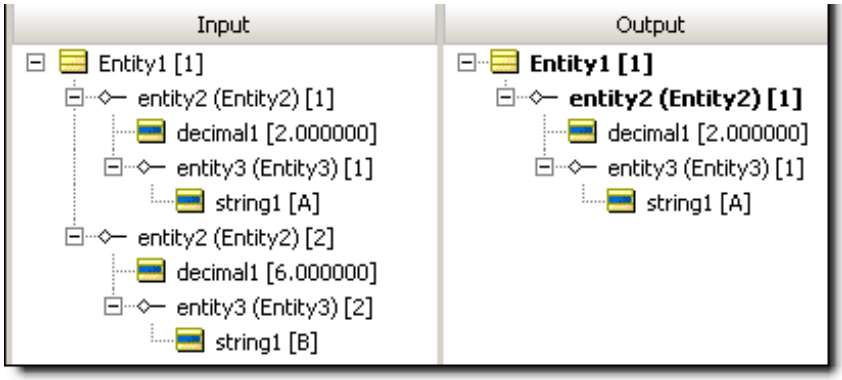
RULESHEET 2

This Rulesheet uses the operator, defaulting to `(true)`, to entirely remove elements from `Entity1.entity2` whose `decimal1` value is greater than `5`. Note that no unique alias has been used to represent the collection of `Entity2` elements associated with `Entity1`.



RULETEST 2

A sample Ruletest provides an `Entity1` with two `entity2`, each of which has an `entity3` child of its own. The illustration shows Ruletest Input and Output panels. Note that when an `entity2` is removed, its associated `entity3` is also removed.

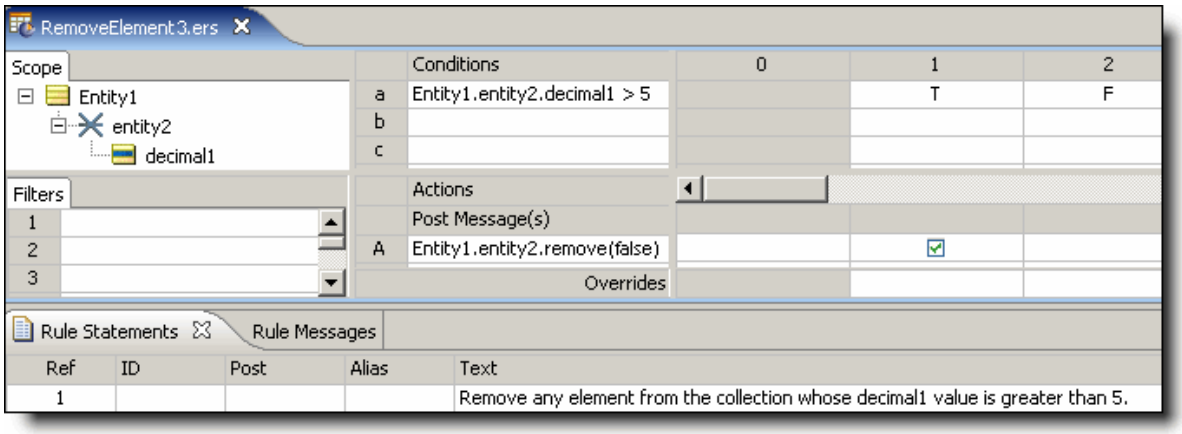


Note: Removing an entity and its children removes child entities from the work document only, not from working memory. If rules are written so as to access the child entities directly, they will still execute after the parent has been removed.

EXAMPLE 3: Remove an entity then promote its children

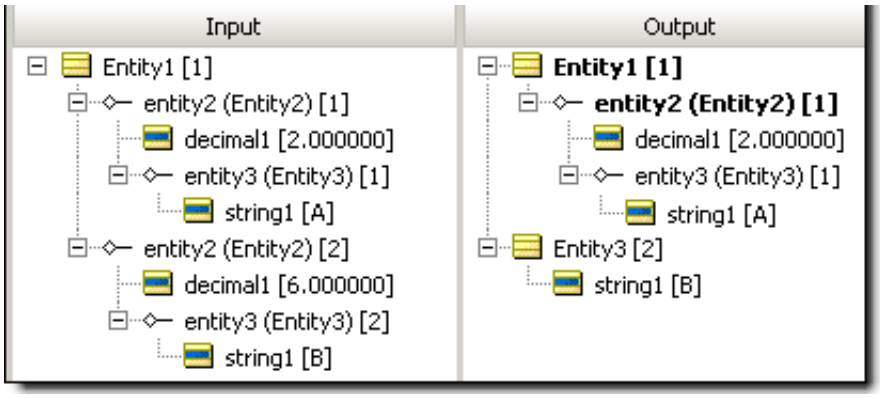
RULESHEET 3

This Rulesheet uses the operator with its `(false)` parameter to remove only the specified elements from `Entity1.entity2` whose `decimal1` value is greater than `5`. Note no unique alias has been used to represent the collection of `Entity2` elements associated with `Entity1`.



RULETEST 3

A sample Ruletest provides an `Entity1` with two `entity2`, each of which has an `entity3` child of its own. The illustration shows Ruletest Input and Output panels. Note that when an `entity2` is removed, its associated `entity3` is promoted to root level.



Replace element(s)

SYNTAX

`<Collection1>` = `<Collection2>`

`<Collection>` = `<Entity>`

DESCRIPTION

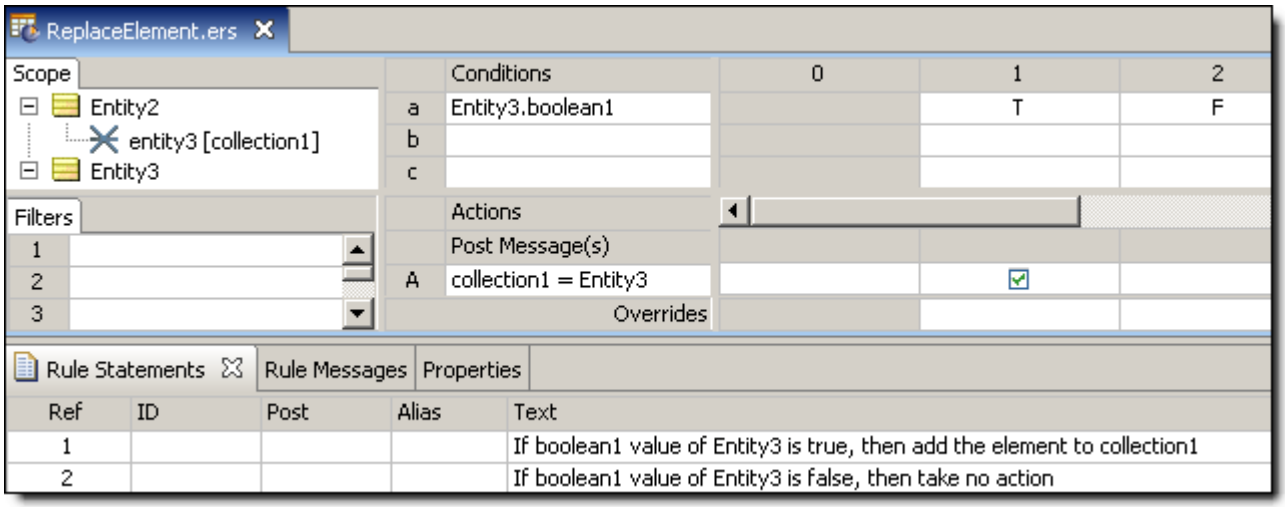
Replaces all elements in `<Collection1>` with the elements in `<Collection2>`, provided the association between the two is permitted by the Business Vocabulary. In the second syntax, `<Entity>` is associated with `<Collection>`, replacing the `<Entity>` already associated, when the association between the two is “one-to-one” in the Business Vocabulary. All collections must be expressed as unique aliases.

USAGE RESTRICTIONS

The Operators row in the table of Summary Table of Vocabulary Usage Restriction does not apply. Special exceptions: **replace elements** may only be used in Action Rows (section 5 in Sections of Rulesheet that correlate with usage restrictions).

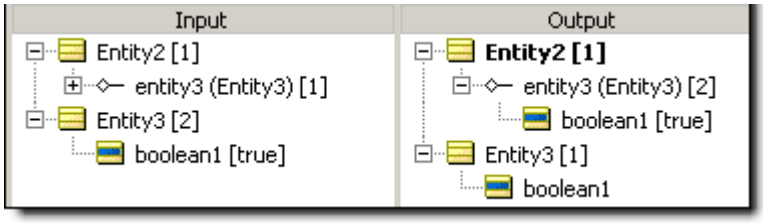
RULESHEET EXAMPLE

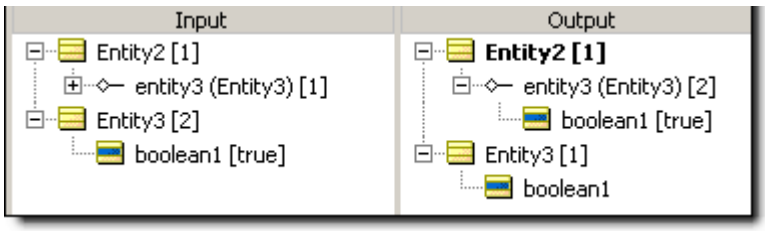
This sample Rulesheet uses the **replace element** operator to add `Entity3` to `collection1` if its `boolean1` value is `true`. Note the use of unique alias `collection1` to represent the collection of `Entity3` elements associated with `Entity2`. Recall from the generic Business Vocabulary, shown in Vocabulary used in this Language Guide on page 12, that the association between `Entity2` and `Entity3` has a cardinality of "one-to-one". This means that if multiple `Entity3` are present, only one will be added to `collection1`.

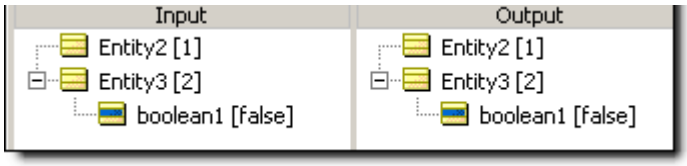


SAMPLE TEST

Four sample tests provide scenarios of two elements which share a one-to-one association. Input and Output panels are illustrated below:







Round

SYNTAX

`<Decimal>`.round(`<Integer>`)

DESCRIPTION

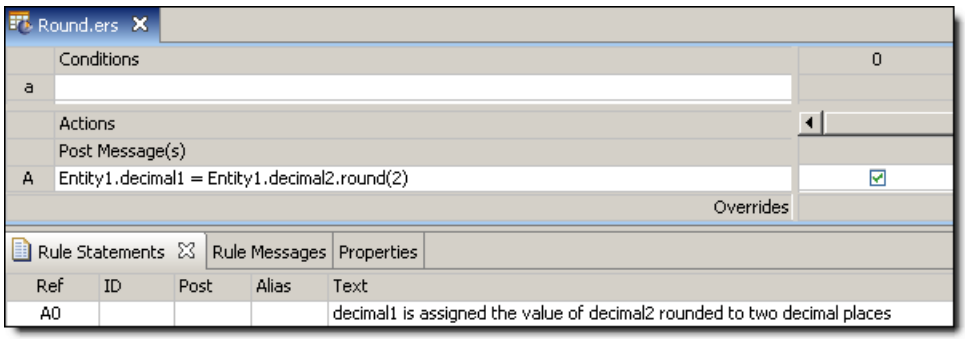
Rounds `<Decimal>` to the number of decimal places specified by `<Integer>`. Standard rounding conventions apply, meaning numbers ending with significant digits of 5 or more round up and numbers ending with significant digits less than 5 round down. `<Integer>` is optional – if no parameter is specified, then `<Decimal>` rounds to the nearest whole number of type Decimal.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

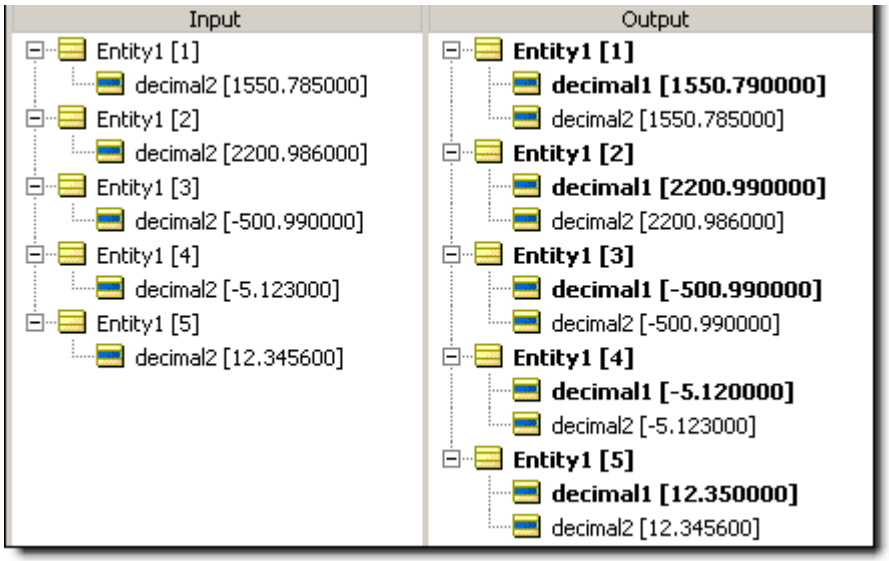
RULESHEET EXAMPLE

The following Rulesheet uses **.round** to round the value of `decimal2` to the 2nd decimal place, and assigns it to `decimal1`.



SAMPLE TEST

A sample Ruletest provides results for five examples of `decimal2`.



Second

SYNTAX

`<DateTime>`.sec

`<Time>`.sec

DESCRIPTION

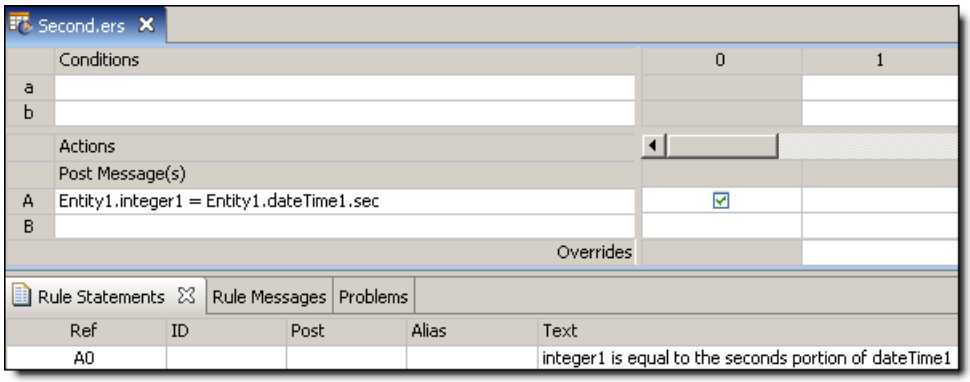
Returns the seconds portion of `<DateTime>` or `<Time>`. The returned value is an Integer between 0 and 59.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

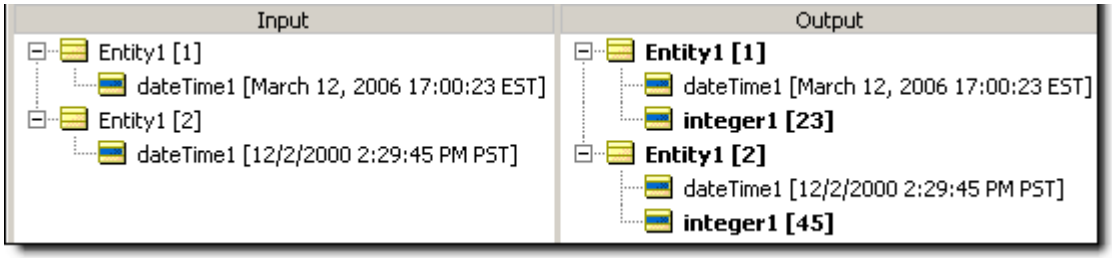
RULESHEET EXAMPLE

The following Rulesheet uses the **.sec** function to evaluate `dateTime1`, return the seconds value, and assign it to `integer1`.



SAMPLE TEST

A sample Ruletest provides results for two examples of `dateTime1`.



Seconds between

SYNTAX

`<DateTime1>`.secsBetween(`<DateTime2>`)

`<Time1>`.secsBetween(`<Time>`)

DESCRIPTION

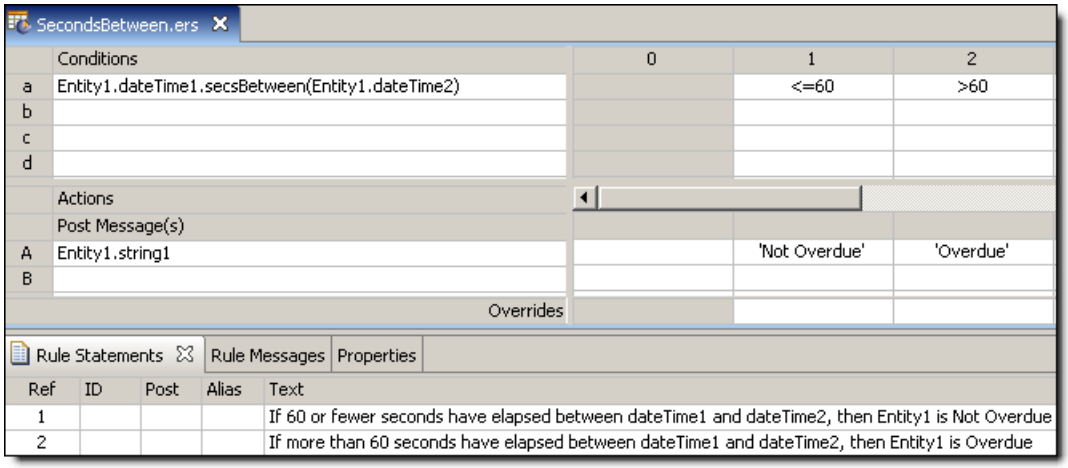
Returns the Integer number of seconds between DateTimes or between Times. The number of milliseconds in `<DateTime1>` is subtracted from that in `<DateTime2>`, and the result divided by 1000 (the number of milliseconds in a second). The result is truncated. This function returns a positive number if `<DateTime2>` is later than `<DateTime1>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

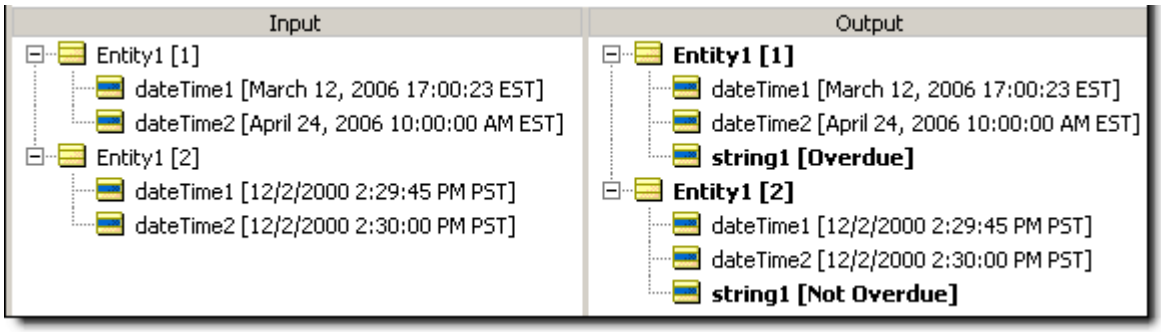
RULESHEET EXAMPLE

The following Rulesheet uses **.secsBetween** to determine the number of seconds that have elapsed between `dateTime1` and `dateTime2`, compare it to the Values set, and assign a value to `string1`.



SAMPLE TEST

A sample Ruletest provides `dateTime1` and `dateTime2` for two examples. Input and Output panels are shown below.



Size of string

SYNTAX

`<String>`.size

DESCRIPTION

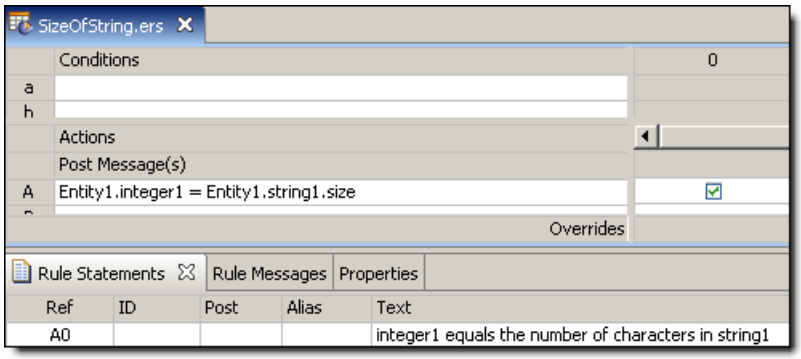
Returns the Integer number of characters in `<String>`. All characters, numbers, symbols, and punctuation marks are counted, including spaces before, within, and after words.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

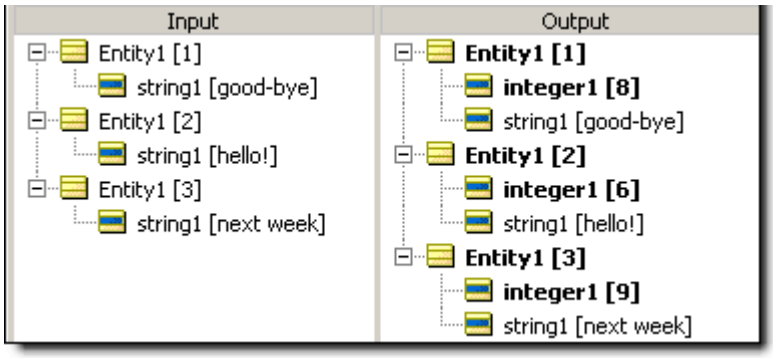
RULESHEET EXAMPLE

The following Rulesheet uses the **.size** function to determine the length of `string1` and assign it to `integer1`



SAMPLE TEST

A sample Ruletest provides three examples. Input and Output panels are shown below:



Size of collection

SYNTAX

`<Collection>` ->size

DESCRIPTION

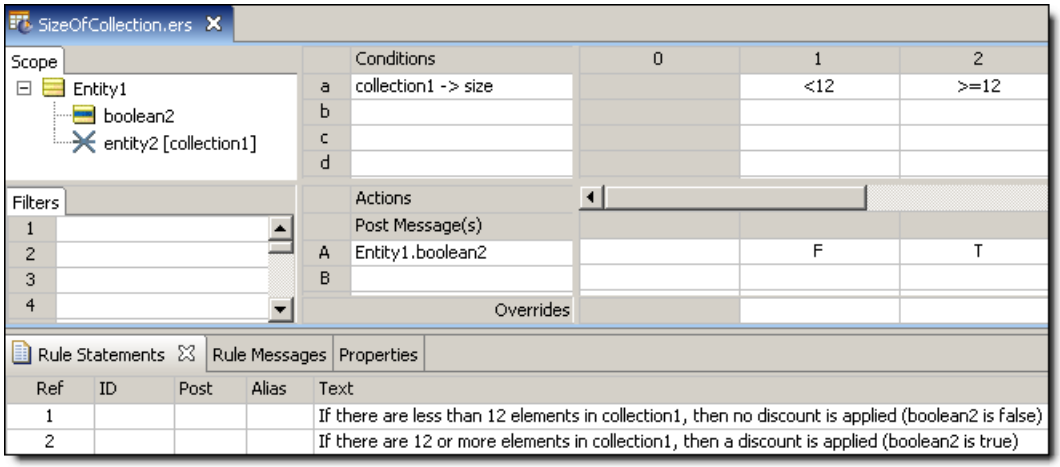
Returns the Integer number of elements in `<Collection>`. `<Collection>` must be expressed as a unique alias.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

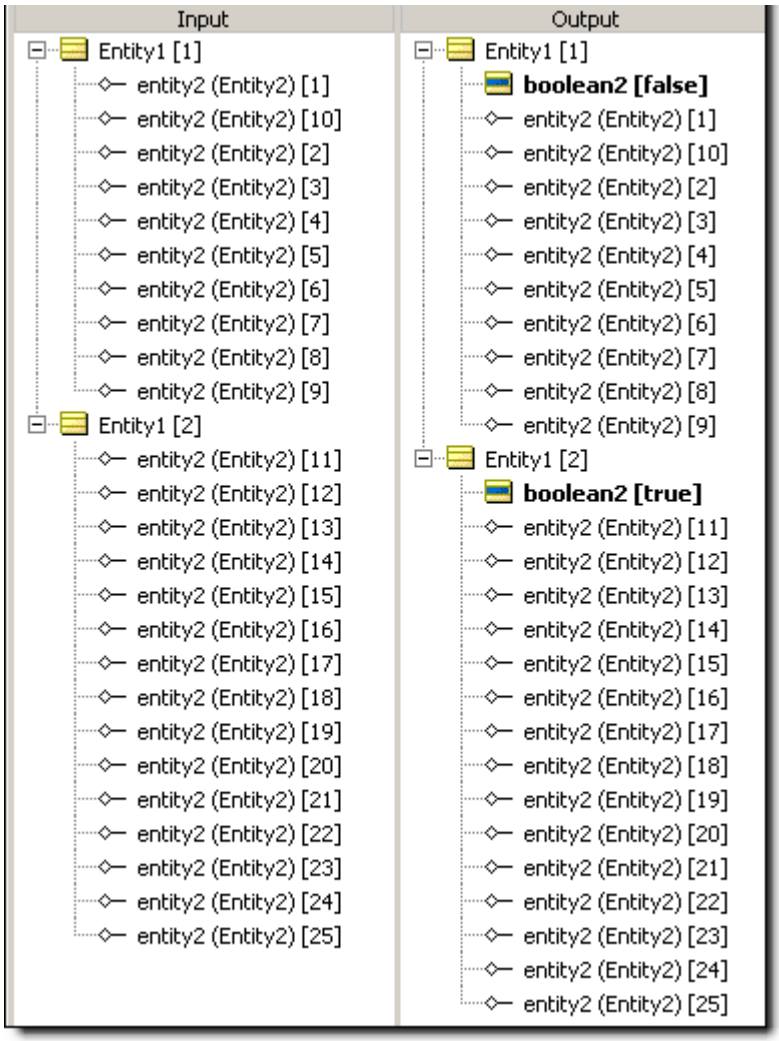
RULESHEET EXAMPLE

This sample Rulesheet uses **->size** to count the number of elements in `collection1`, and assign a value to `boolean2`. Note the use of unique alias `collection1` to represent the collection of `Entity2` associated with `Entity1`.



SAMPLE TEST

A sample Ruletest provides three examples of `collection1`. Input and Output panels are shown below.



Sorted by

SYNTAX

`<Collection>` ->sortedBy(`<Attribute2>`) -> *sequence operator*.`<Attribute1>`

DESCRIPTION

Sequences the elements of `<Collection>` in ascending order, using the value of `<Attribute2>` as the index, and returns the `<Attribute1>` value of the element in the sequence position determined by the sequence operator. A sequence must be created before any sequence operator (->first, ->last, or ->at) is used to identify a particular element. `<Attribute1>` and `<Attribute2>` must be attributes of `<Collection>`.

`<Attribute2>` may be any data type except Boolean. Strings are sorted according to character precedence – see Character precedence: Unicode and Java Collator on page 189. `<Collection>` must be expressed as a unique alias.

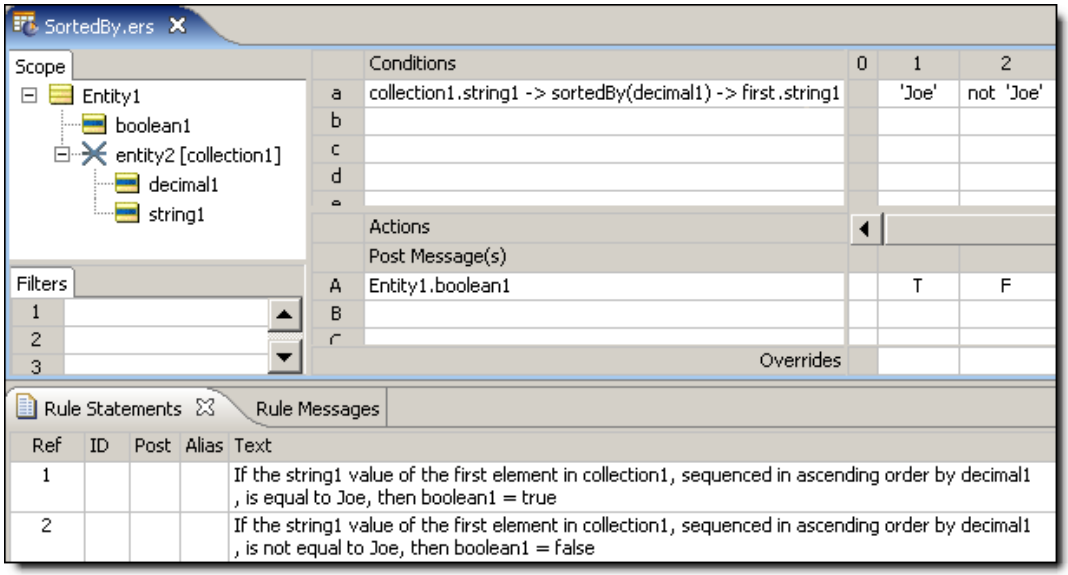
See *"Advanced collection sorting syntax"* and *"Statement blocks" in the Rule Modeling Guide* for more examples of usage.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

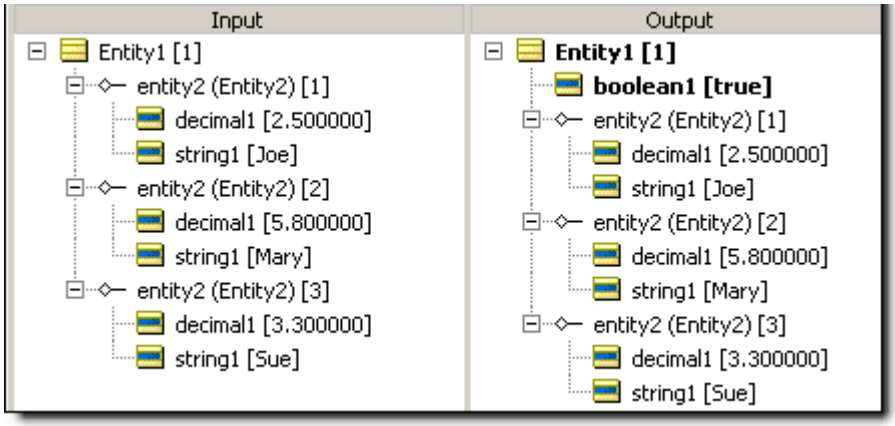
RULESHEET EXAMPLE 1 - USED IN A CONDITION

This sample Rulesheet uses **->sortedBy** in a conditional expression to create an ascending sequence from `collection` with `decimal1` as the index. `->first.string1` is used to return the value of the `string1` attribute of the first element of the sequence. If the value of `string1` is `Joe`, then `boolean1` attribute of `Entity1` is assigned the value of `true`.



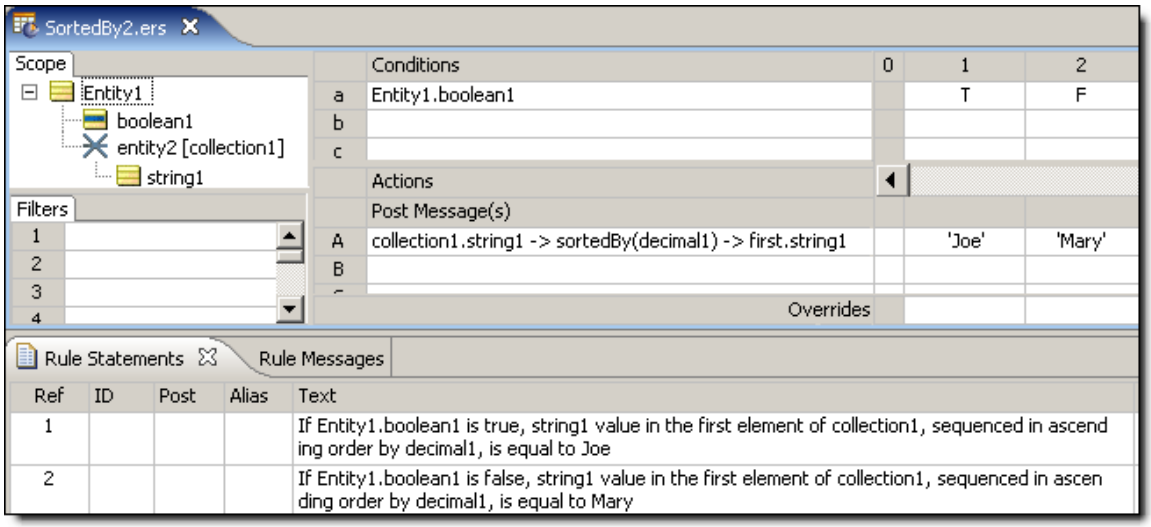
SAMPLE RULETEST 1

A sample Ruletest provides a collection of three elements, each with a `decimal1` and `string1` value. Input and Output panels are shown below.



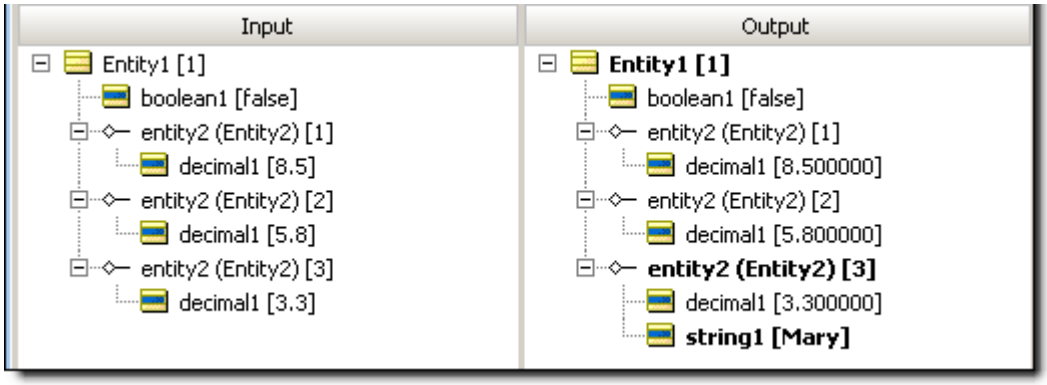
RULESHEET EXAMPLE 2 – USED IN AN ACTION

This sample Rulesheet uses **->sortedBy** in an action expression to create an ascending sequence from `collection` with `decimal1` as the index. `->first.string1` is used to return the value of the `string1` attribute of the first element of the sequence. The value of `string1` is assigned the value of `Joe` if `boolean1` attribute of `Entity1` is `true`, if `false` it is assigned the value of `Mary`.



SAMPLE RULETEST 2

A sample Ruletest provides a collection of three elements, each with a `decimal1` and `string1` value. Input and Output panels are shown below.



Sorted by descending

SYNTAX

`<Collection>` ->sortedByDesc(`<Attribute2>`) -> *sequence operator*.`<Attribute1>`

DESCRIPTION

Sequences the elements of `<Collection>` in descending order, using the value of `<Attribute2>` as the index, and returns the `<Attribute1>` value of the element in the sequence position determined by the sequence operator. A sequence must be created before any sequence operator (->first, ->last, or ->at) is used to identify a particular element. `<Attribute1>` and `<Attribute2>` must be attributes of `<Collection>`.

`<Attribute2>` may be any data type except Boolean. Strings are sorted according to their ISO character precedence – see Character precedence: Unicode and Java Collator on page 189. `<Collection>` must be expressed as a unique alias.

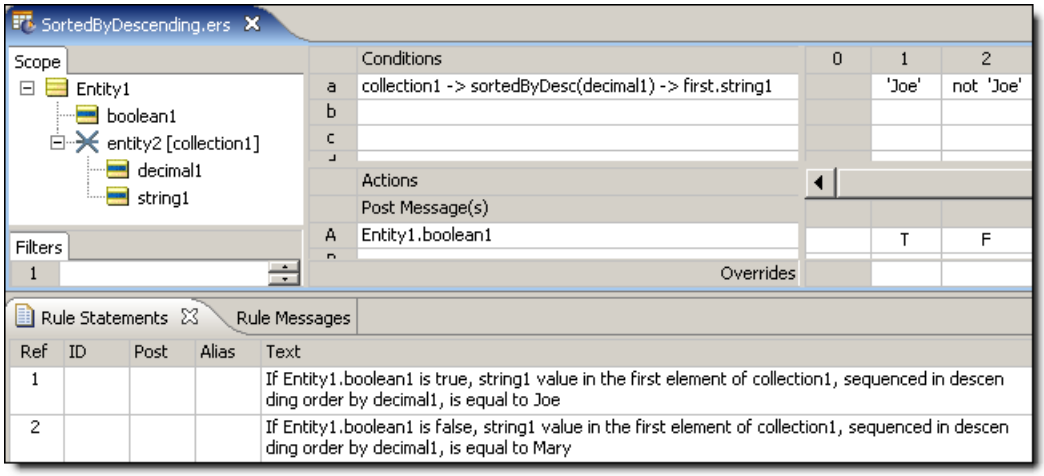
See *"Advanced collection sorting syntax"* and *"Statement blocks" in the Rule Modeling Guide* for more examples of usage.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

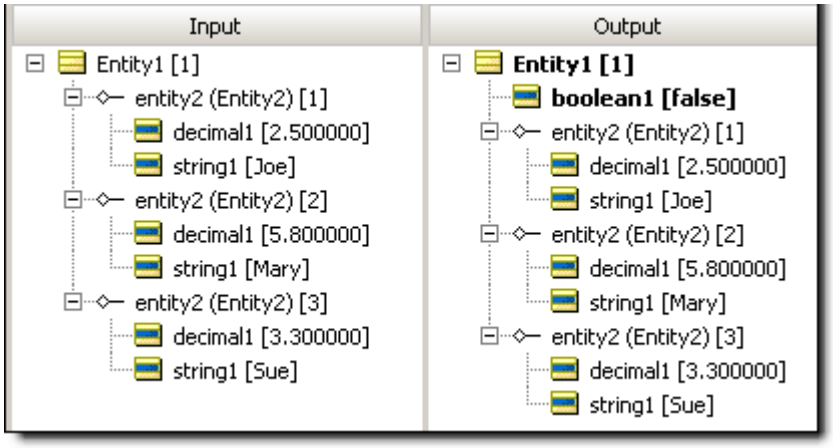
RULESHEET EXAMPLE 1 - USED IN A CONDITION

This sample Rulesheet uses **-> sortedByDesc** in a conditional expression to create an descending sequence from `collection` with `decimal1` as the index. `->first.string1` is used to return the value of the `string1` attribute of the first element of the sequence. If the value of `string1` is `Joe`, then `boolean1` attribute of `Entity1` is assigned the value of `true`.



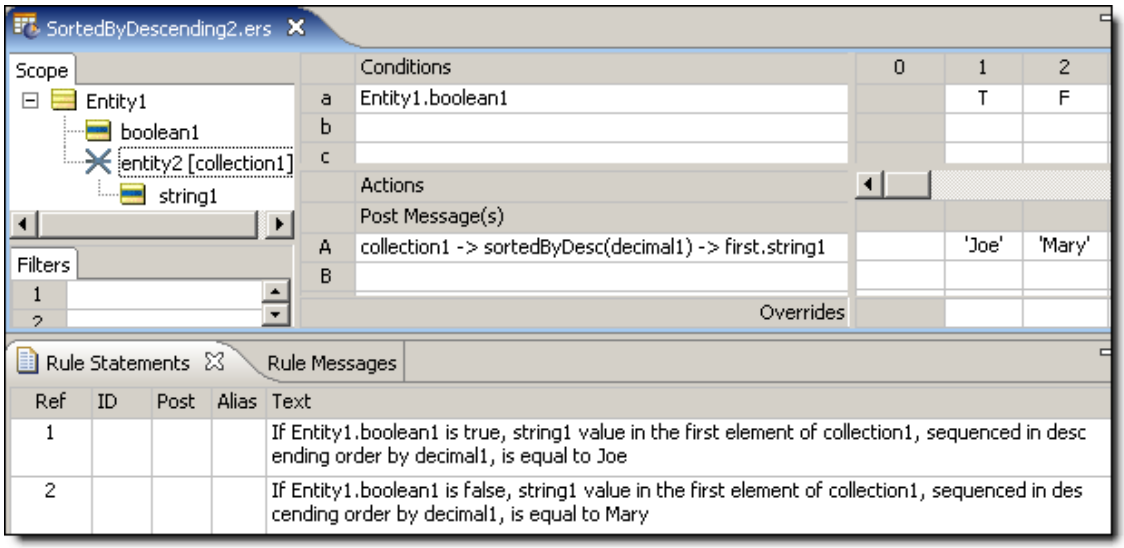
SAMPLE RULETEST 1

A sample Ruletest provides a collection of three elements, each with a `decimal1` value. Input and Output panels are shown below.



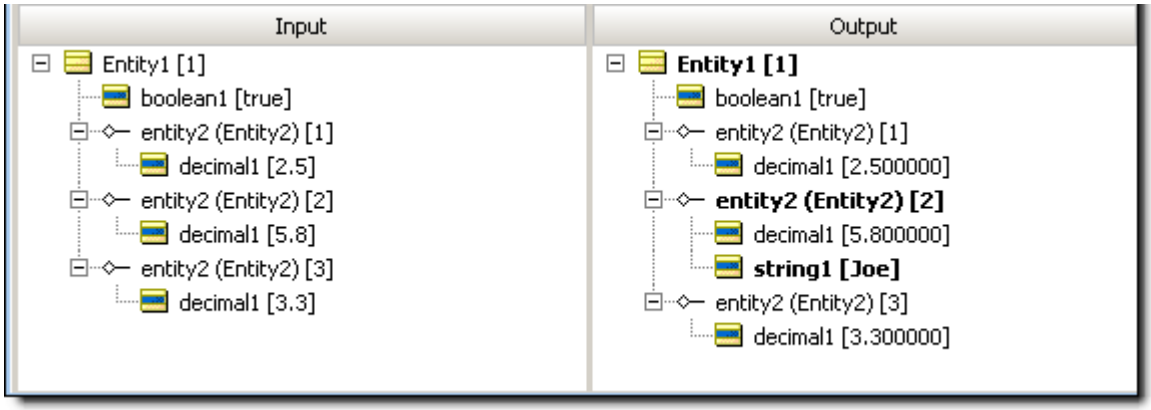
RULESHEET EXAMPLE 2 – USED IN AN ACTION

This sample Rulesheet uses **sortedByDesc** in an action expression to create an descending sequence from `collection` with `decimal1` as the index. `->first.string1` is used to return the value of the `string1` attribute of the first element of the sequence. The value of `string1` is assigned the value of `Joe` if `boolean1` attribute of `Entity1` is `true`, if `false` it is assigned the value of `Mary`.



SAMPLE RULETEST 2

A sample Ruletest provides a collection of three elements, each with a `decimal1` value. Input and Output panels are shown below.



Starts with

SYNTAX

`<String1>`.startsWith(`<String2>`)

DESCRIPTION

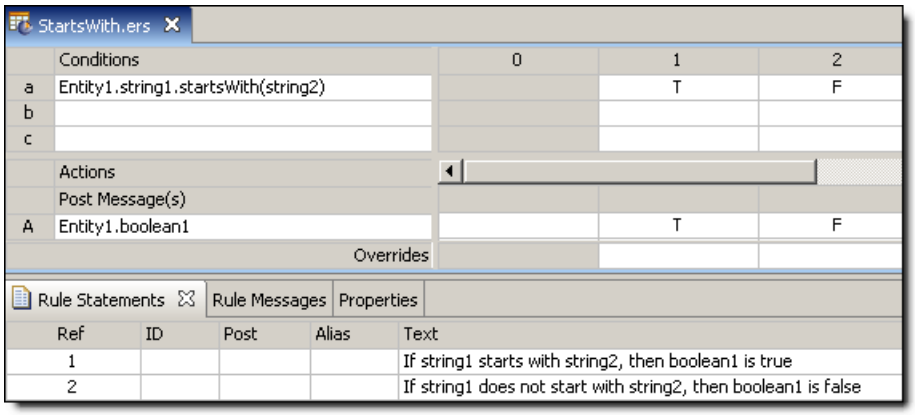
Returns a value of true if `<String1>` begins with the characters specified in `<String2>`. Comparisons are case-sensitive.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

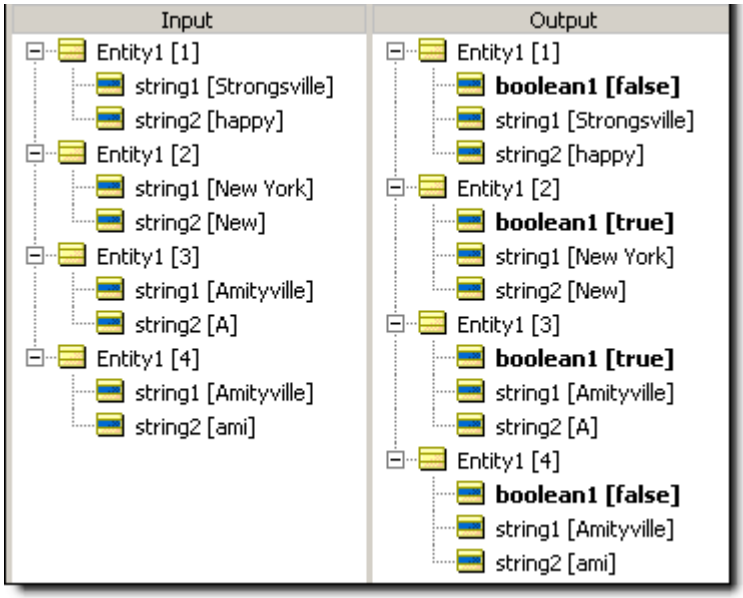
RULESHEET EXAMPLE

The following Rulesheet uses **.startsWith** to evaluate whether `string1` begins with the value of `string2` and assigns a different value to `boolean1` for each outcome.



SAMPLE TEST

A sample Ruletest provides `string1` and `string2` values for four examples. Input and Output panels are shown below.



SubSequence

SYNTAX

```
<Sequence> ->subSequence(integer1,integer2)
```

DESCRIPTION

Returns a Sequence containing all elements of <`Sequence`> between the positions *integer1* and *integer2*. Another operator, such as ->sortedBy or ->sortedByDesc, must be used to transform a <`Collection`> into a <`Sequence`> before **->subSequence** may be used. <`Sequence`> must be expressed as a unique alias. See *"Advanced collection sorting syntax" in the Rule Modeling Guide* for more examples of usage.

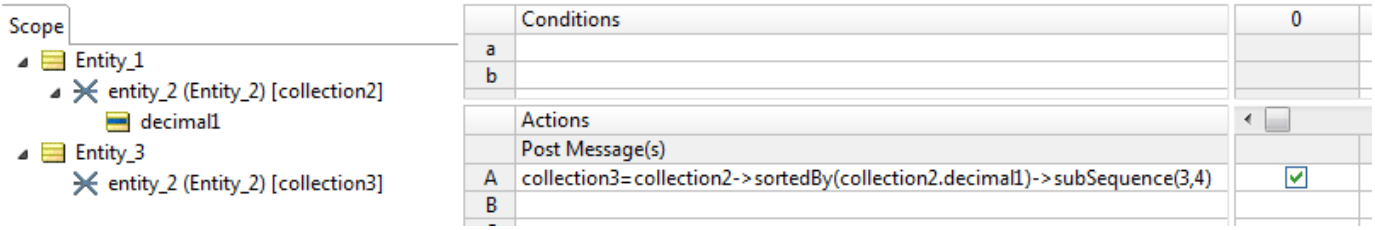
USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

Both integer values must be provided, separated by a comma. If *integer1* is larger than *integer2*, there are no results. When *integer1* is beyond the count of the collection, there are no results. When *integer2* is beyond the count of the collection, all data from *integer1* to the last entity is in the results collection. There are no results when both integers extend beyond the number of elements in the collection.

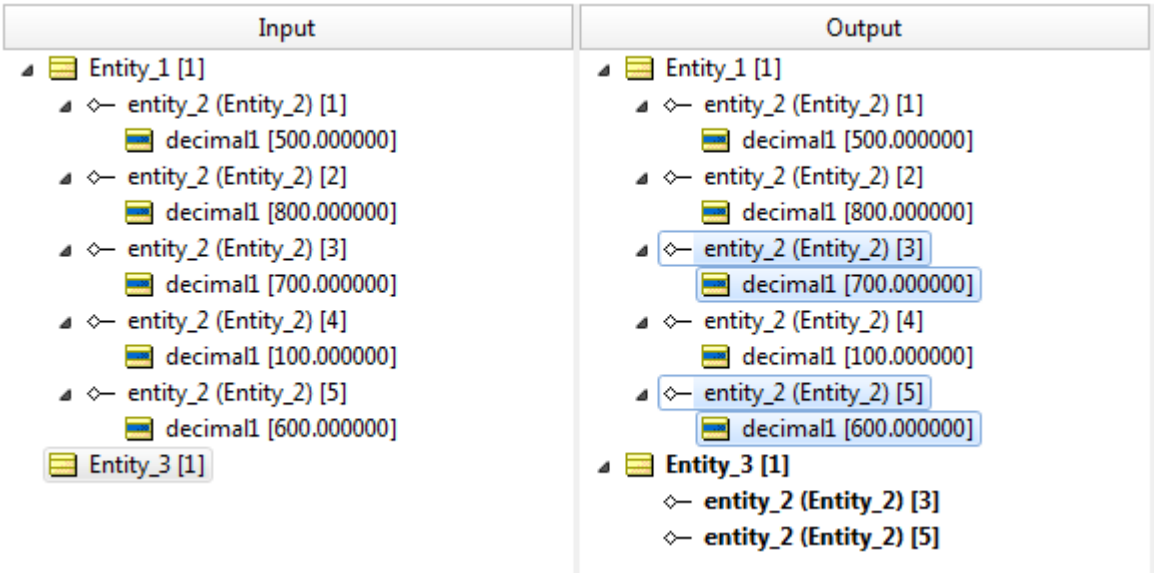
RULESHEET EXAMPLE

This sample Rulesheet uses **->subSequence(3,4)** to identify the 'middle' two elements of the sequence that resulted from the sortedBy operation.



SAMPLE RULETEST

A sample Ruletest provides a collection of five elements, each with a `decimal1` value. Input and Output panels are shown below.



Note: The selected entities and their values are highlighted to improve readability.

Substring

SYNTAX

`<String>`.substring(`<Integer1>`, `<Integer2>`)

DESCRIPTION

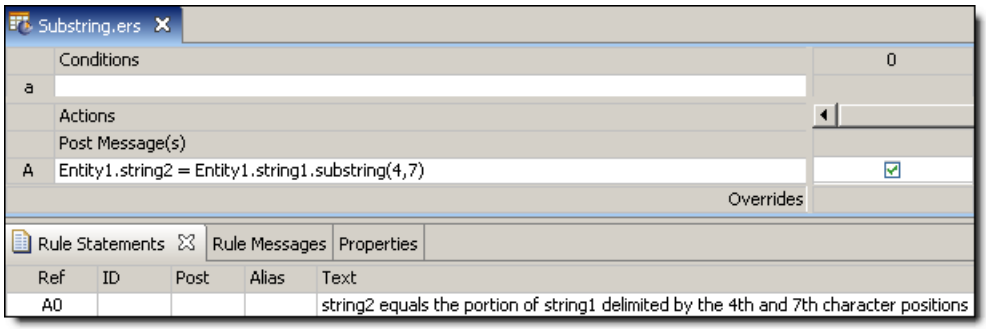
Returns the portion of `<String>` beginning with the character in position `<Integer1>` and ending with the character in position `<Integer2>`. The number of characters in `<String>` must be at least equal to `<Integer2>`, otherwise an error will be produced. Both `<Integer1>` and `<Integer2>` must be positive integers, and `<Integer2>` must be greater than `<Integer1>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

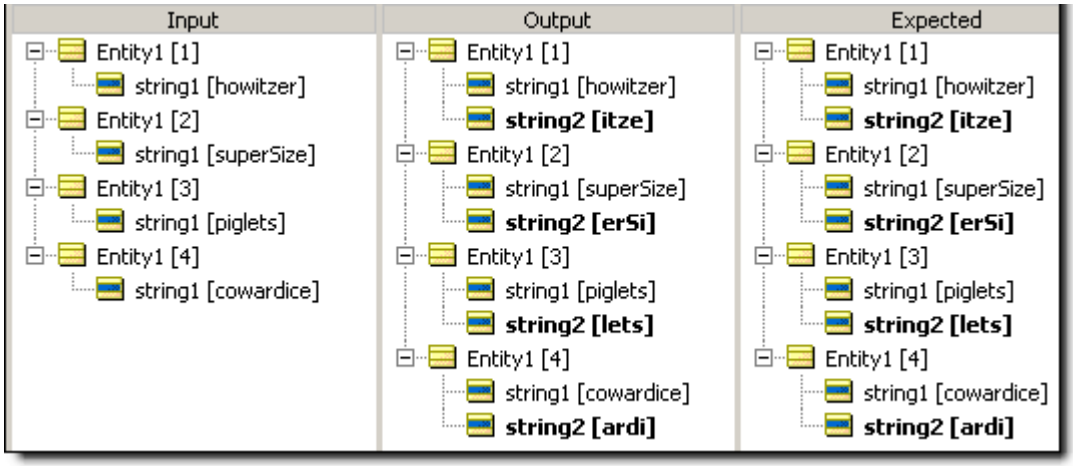
RULESHEET EXAMPLE

This sample Rulesheet uses **.substring** to return those characters of `string1` between positions `4` and `7` (inclusive), and assign the resulting value to `string2`.



SAMPLE RULETEST

A sample Ruletest provides `string1` values for four examples. Input and Output panels are shown below.



Subtract

SYNTAX

`<Number1> - <Number2>`

DESCRIPTION

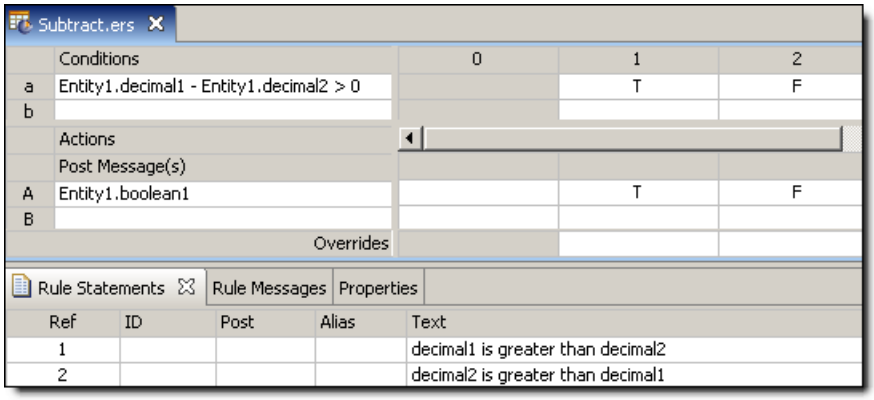
Subtracts the value of `<Number2>` from that of `<Number1>`. The resulting data type is the more expansive of those of `<Number1>` and `<Number2>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

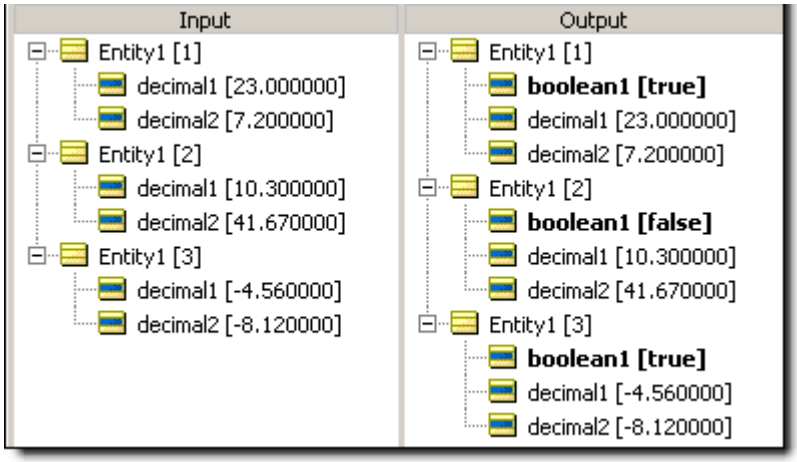
RULESHEET EXAMPLE

This sample Rulesheet uses **subtract** to reduce the value of `decimal1` by `decimal2`, compare the resulting value to zero, and assign a value to `boolean1`



SAMPLE TEST

A Ruletest provides three examples of `decimal1` and `decimal2`. Input and Output panels are shown below.



Sum

SYNTAX

`<Collection.attribute>` ->sum

DESCRIPTION

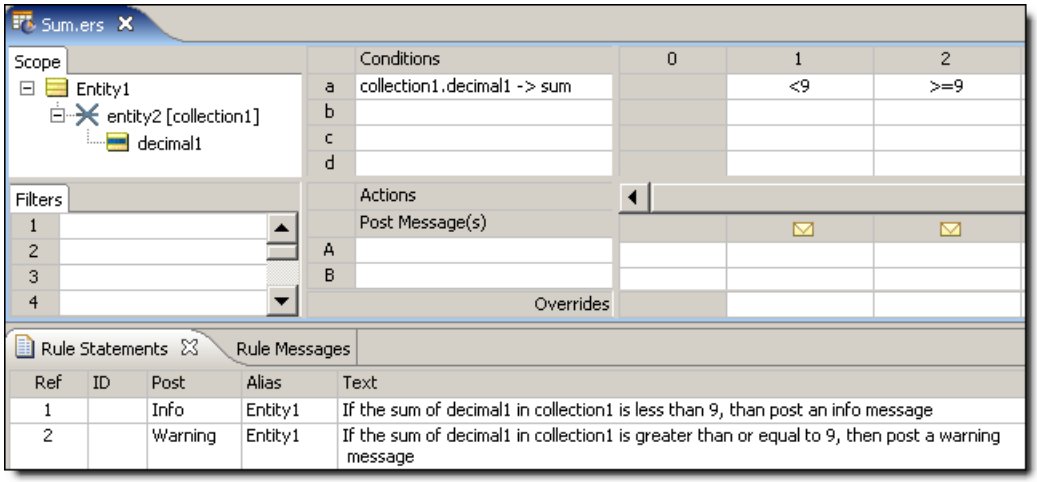
Sums the values of the specified `<attribute>` for all elements in `<Collection>`. `<attribute>` must be a numeric data type. `<Collection>` must be expressed as a unique alias.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

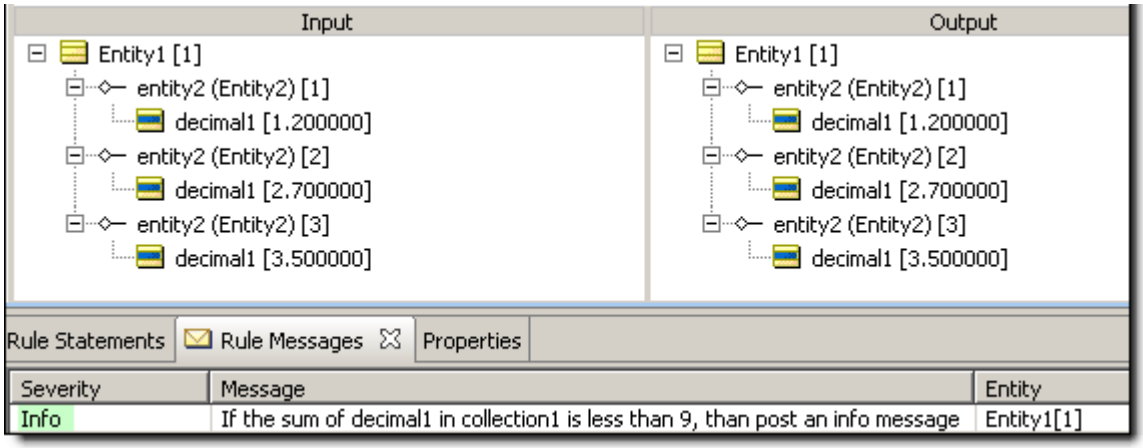
RULESHEET EXAMPLE

This Rulesheet uses the **->sum** function to add all `decimal1` attributes within `collection1`. Note the use of unique alias `collection1` to represent the collection of `Entity2` associated with `Entity1`



SAMPLE TEST

A sample Ruletest provides 3 elements in `collection1`. Input and Output panels are shown below.



Today

SYNTAX

today

DESCRIPTION

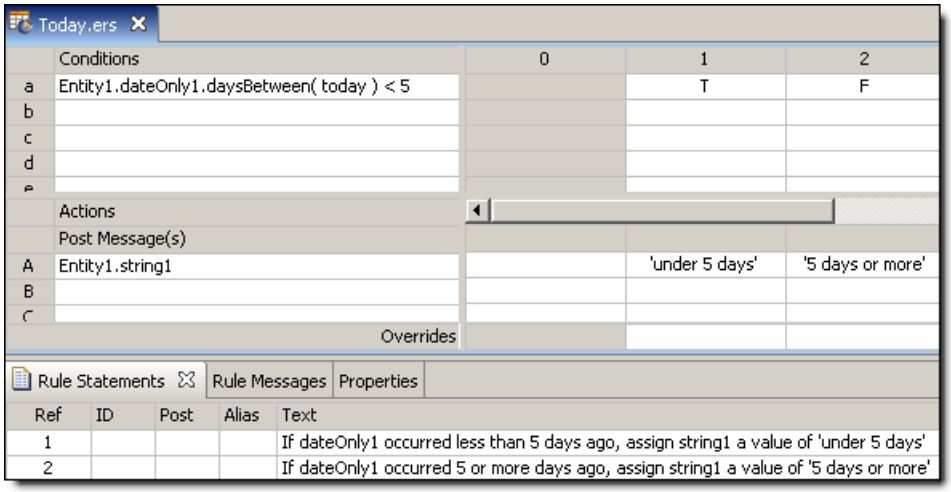
Returns the current system date when the rule is executed. This Date Only value is assigned the first time **today** is used in a Decision Service, then remains constant until the Decision Service finishes execution, regardless of how many additional times it is used. This means that every rule in a Rule Set using **today** will use the same Date Only value. No time portion is assigned

USAGE RESTRICTIONS

The Literals row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **today** to determine how many days have elapsed between today and `dateTime1`, and assign a value to `string1` based on the result.



Today.ers

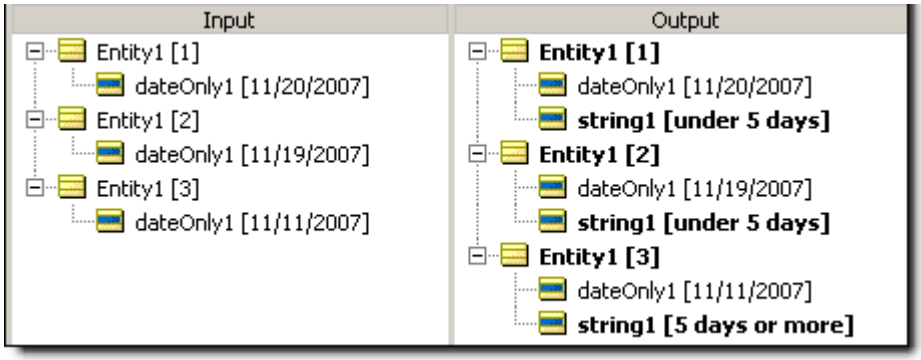
	Conditions	0	1	2
a	Entity1.dateOnly1.daysBetween(today) < 5		T	F
b				
c				
d				
e				
	Actions			
	Post Message(s)			
A	Entity1.string1		'under 5 days'	'5 days or more'
B				
C				
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If dateOnly1 occurred less than 5 days ago, assign string1 a value of 'under 5 days'
2				If dateOnly1 occurred 5 or more days ago, assign string1 a value of '5 days or more'

SAMPLE TEST

A sample Ruletest provides three examples of `dateOnly1`. Assume **today** is equal to `Friday,November 23,2007`. Input and Output panels are shown below:



Input	Output
Entity1 [1]	**Entity1 [1]**
dateOnly1 [11/20/2007]	dateOnly1 [11/20/2007]
Entity1 [2]	**string1 [under 5 days]**
dateOnly1 [11/19/2007]	**Entity1 [2]**
Entity1 [3]	dateOnly1 [11/19/2007]
dateOnly1 [11/11/2007]	**string1 [under 5 days]**
	Entity1 [3]
	dateOnly1 [11/11/2007]
	string1 [5 days or more]

To date: Casting a dateTime to a date

SYNTAX

`<DateTime>`.toDate

DESCRIPTION

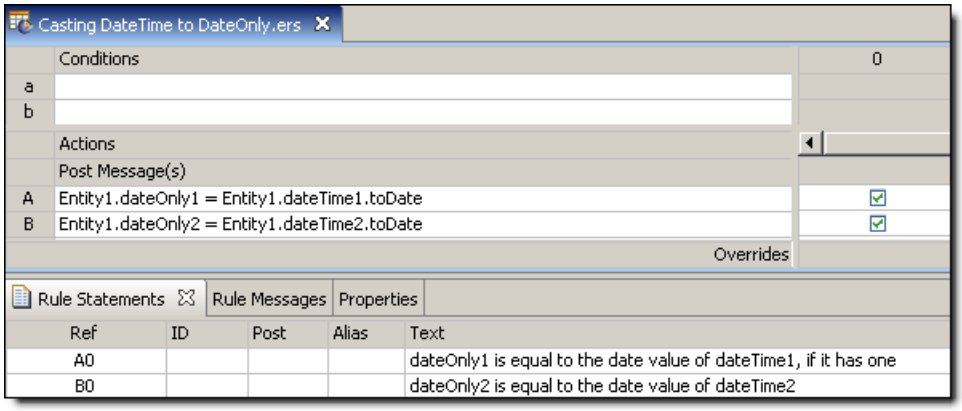
Converts the value in `<DateTime>` to a Date datatype, containing only the date portion of the DateTime. If `<DateTime>` contains no date information, then the system epoch is used.

USAGE RESTRICTIONS

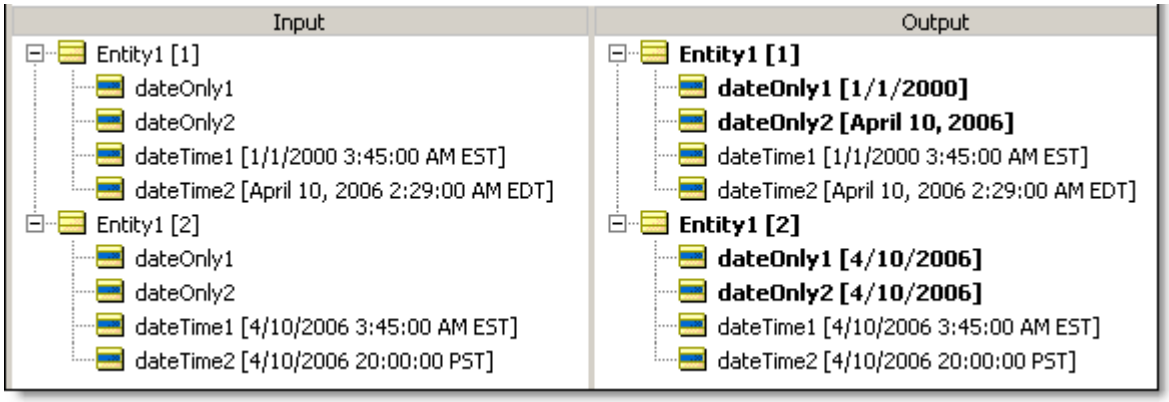
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toDate** to convert `dateTime1` and `DateTime2` to Date datatypes and assign the values to `dateTime1` and `dateTime2`.



SAMPLE TEST



To dateTime: Casting a string to a dateTime

SYNTAX

`<String>`.toDateTime

DESCRIPTION

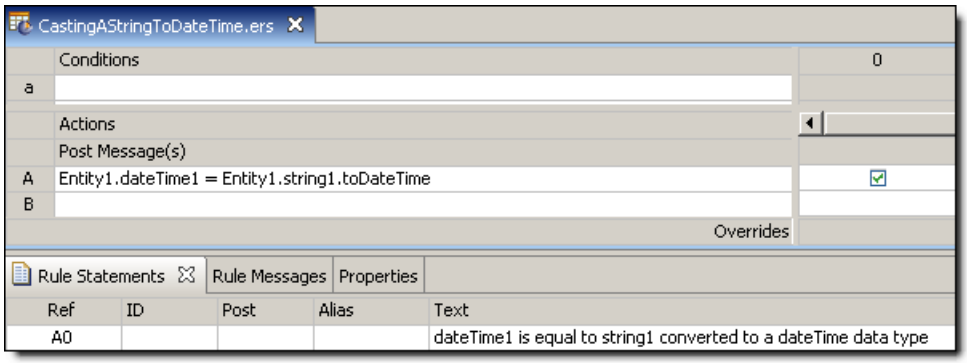
Converts the value in `<String>` to data type DateTime ONLY if all characters in `<String>` correspond to a valid Date, Time, or DateTime mask (format). For complete details on DateTime masks, see *Rule Modeling Guide*.

USAGE RESTRICTIONS

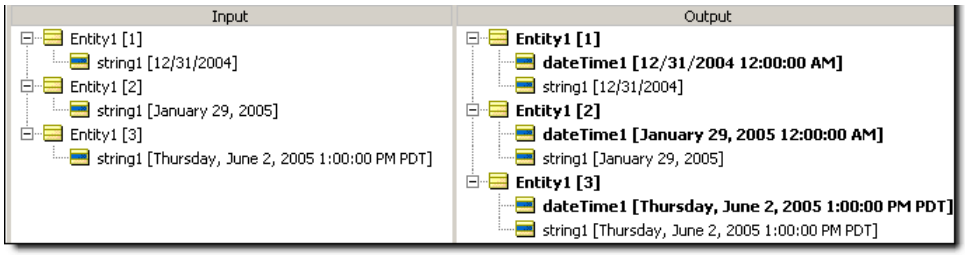
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toDateTime** to convert `string1` to type DateTime and assign the value to `dateTime1`.



SAMPLE TEST



To dateTime: Casting a date to a dateTime

SYNTAX

`<Date>`.toDateTime

DESCRIPTION

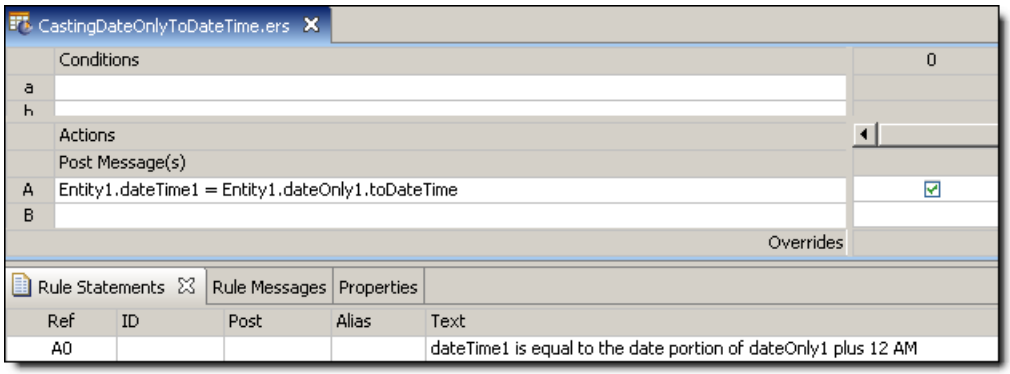
Converts the value in `<Date>` to data type DateTime. The date portion is the same as the `<Date>` value and the time portion is set to `12:00:00 AM` in the current timezone.

USAGE RESTRICTIONS

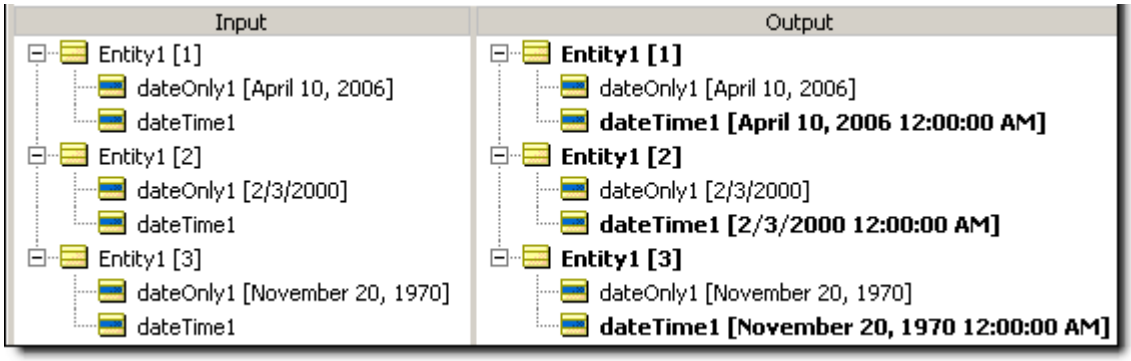
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toDateTime** to convert `dateOnly1` to type DateTime and assign the value to `dateTime1`.



SAMPLE TEST



To dateTime: Casting a time to a dateTime

SYNTAX

`<Time>`.toDateTime

DESCRIPTION

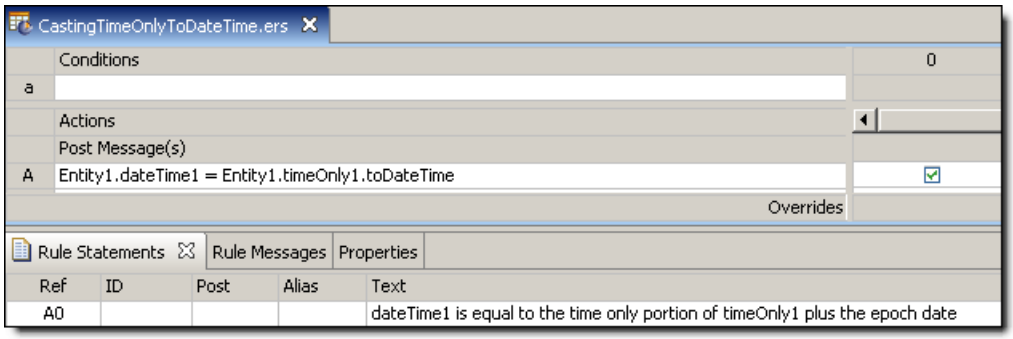
Converts the value in `<Time>` to data type DateTime ONLY if all characters in `<Time>` correspond to a valid DateTime mask (format). The time portion is the same as the `<Time>` value and the date portion is the epoch (see .toTime operator)

USAGE RESTRICTIONS

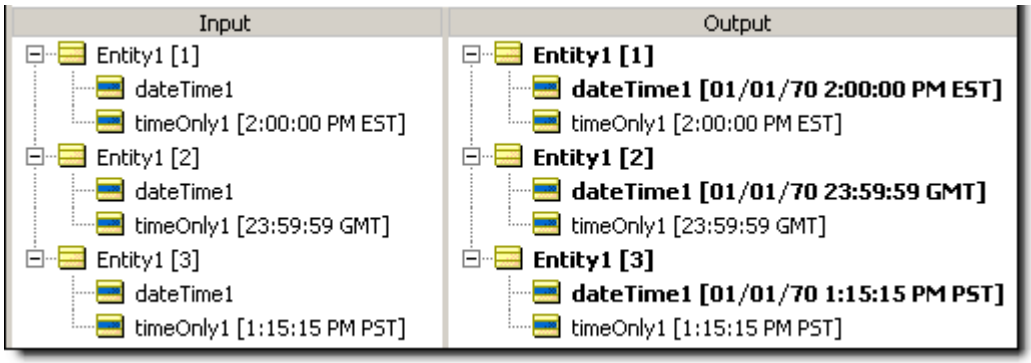
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toDateTime** to convert `timeOnly1` to type DateTime and assign the value to `dateTime1`.



SAMPLE TEST



To dateTime: Timezone offset

SYNTAX

`<Date>`.toDateTime(`<String>`)

DESCRIPTION

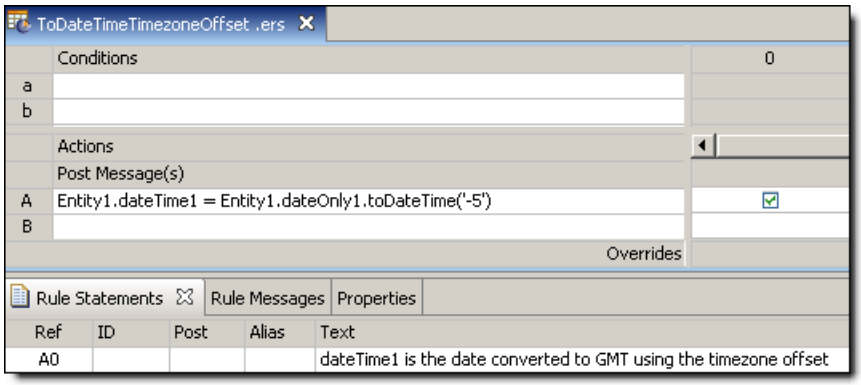
Converts the value in `<Date>` to data type DateTime ONLY if all characters in `<Date>` correspond to a valid DateTime mask (format). The date portion is the same as the `<Date>` value and the time portion is set to `00:00:00` in the timezone specified by `<String>`, which is the timeZoneOffset. The timeZoneOffset must take the form of a valid timezone offset such as `'-08:00'`, `'+03:30'`, `'01:45'`

USAGE RESTRICTIONS

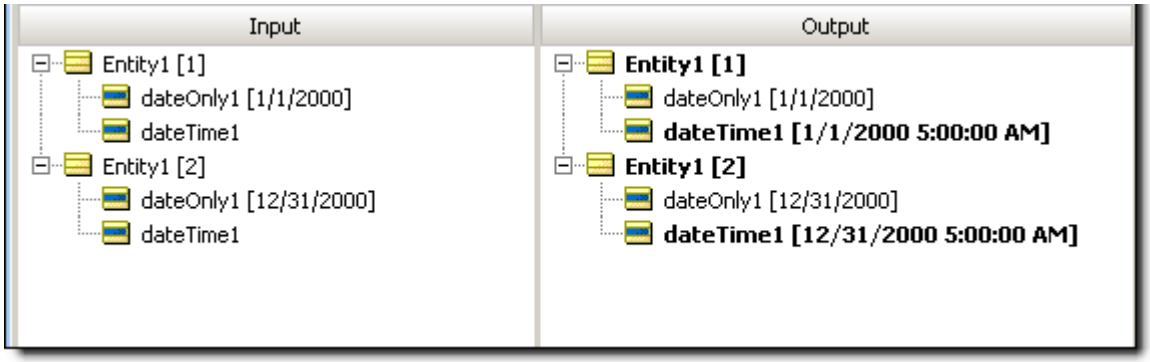
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toDateTime** to convert `dateOnly1` to type DateTime and assign the value to `dateTime1`, with a timezone offset of `-5`.



SAMPLE TEST



To decimal

SYNTAX

`<Integer>`.toDecimal

`<String>`.toDecimal

DESCRIPTION

Converts the value in `<Integer>` or all characters in `<String>` to data type Decimal. Converts a String to Decimal ONLY if all characters in `<String>` are numeric and contain not more than one decimal point. If any non-numeric characters are present in `<String>` (other than the single decimal point or a leading minus sign), no value is returned by the function.

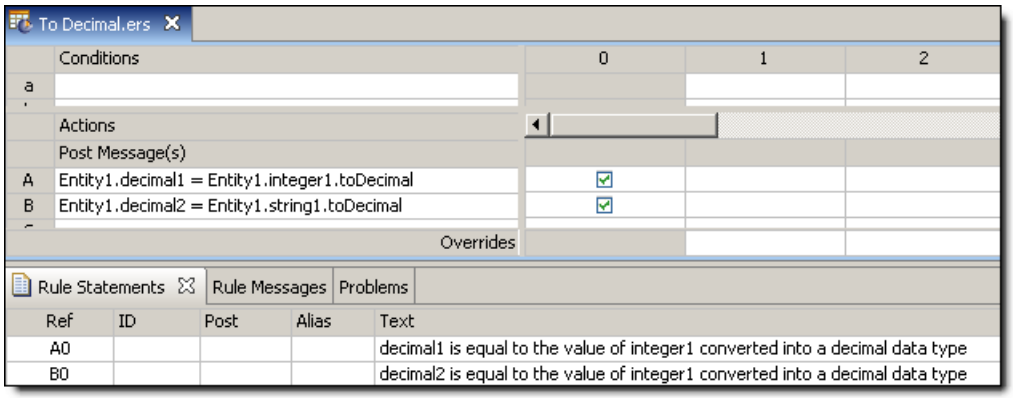
Note: Integer values may be assigned directly to Decimal data types without using the **.toDecimal** operator because a Decimal data type is more expansive than an Integer.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toDecimal** to convert `integer1` and `string1` to type Decimal and assign them to `decimal1` and `decimal2`, respectively.



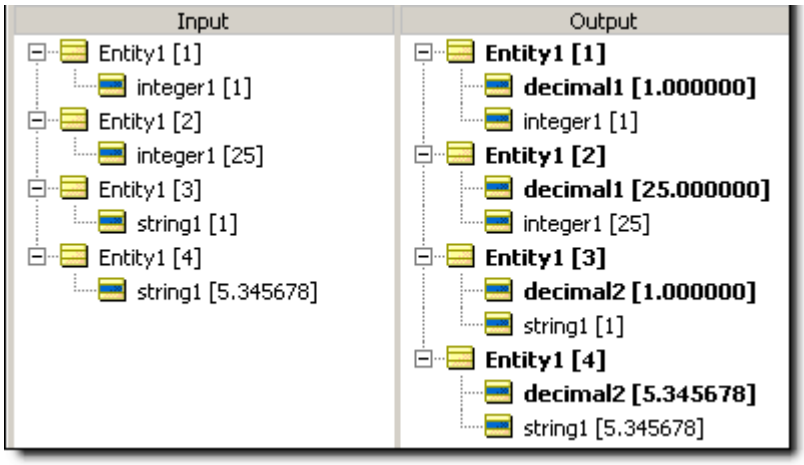
To Decimal.ers

	Conditions	0	1	2
a				
	Actions			
	Post Message(s)			
A	Entity1.decimal1 = Entity1.integer1.toDecimal	☑		
B	Entity1.decimal2 = Entity1.string1.toDecimal	☑		
	Overrides			

Rule Statements | Rule Messages | Problems

Ref	ID	Post	Alias	Text
A0				decimal1 is equal to the value of integer1 converted into a decimal data type
B0				decimal2 is equal to the value of integer1 converted into a decimal data type

SAMPLE TEST



Input	Output
Entity1 [1]	**Entity1 [1]**
integer1 [1]	**decimal1 [1.000000]**
Entity1 [2]	integer1 [1]
integer1 [25]	**Entity1 [2]**
Entity1 [3]	**decimal1 [25.000000]**
string1 [1]	integer1 [25]
Entity1 [4]	**Entity1 [3]**
string1 [5.345678]	**decimal2 [1.000000]**
	string1 [1]
	Entity1 [4]
	decimal2 [5.345678]
	string1 [5.345678]

To integer

SYNTAX

`<Decimal>`.toInteger

`<String>`.tointeger

DESCRIPTION

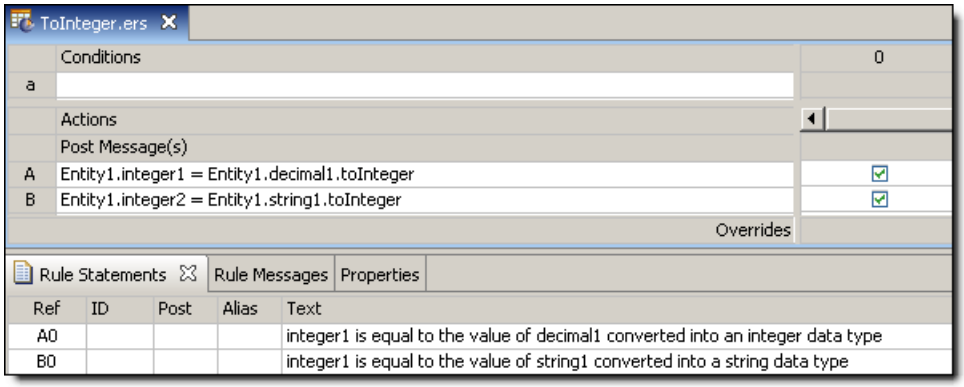
Converts the value in `<Decimal>` or all characters in `<String>` to data type Integer. All decimals have fractional portions truncated during the conversion. Strings are converted ONLY if all characters in `<String>` are numeric, without a decimal point. If any non-numeric characters (with the sole exception of a single leading minus sign for negative numbers) are present in `<String>`, no value is returned by the function. Do not use on String values of `null` or empty String (`''`) -- a pair of single quote marks -- as this will generate an error message.

USAGE RESTRICTIONS

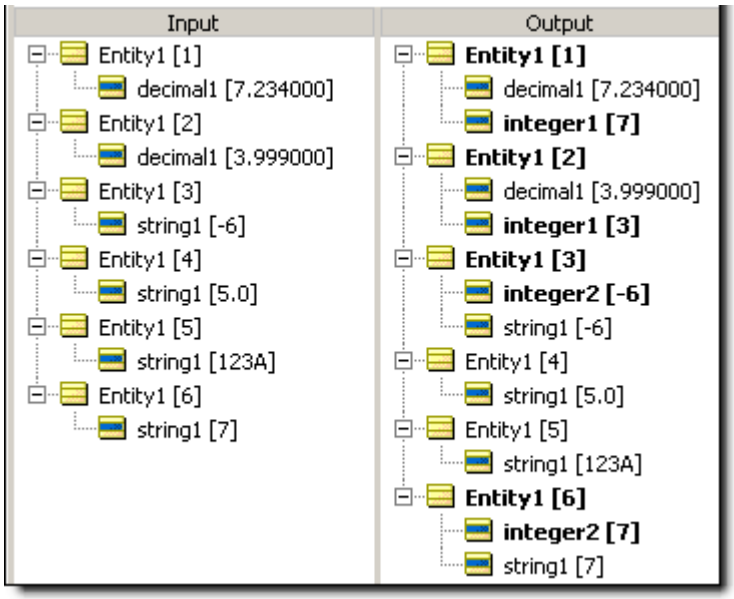
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toInteger** to convert `decimal1` and `string1` to type Integer and assign them to `integer1` and `integer2`, respectively.



SAMPLE TEST



To string

SYNTAX

`<Number>`.toString

`<DateTime*>`.toString

*includes DateTime, Date, and Time data types

DESCRIPTION

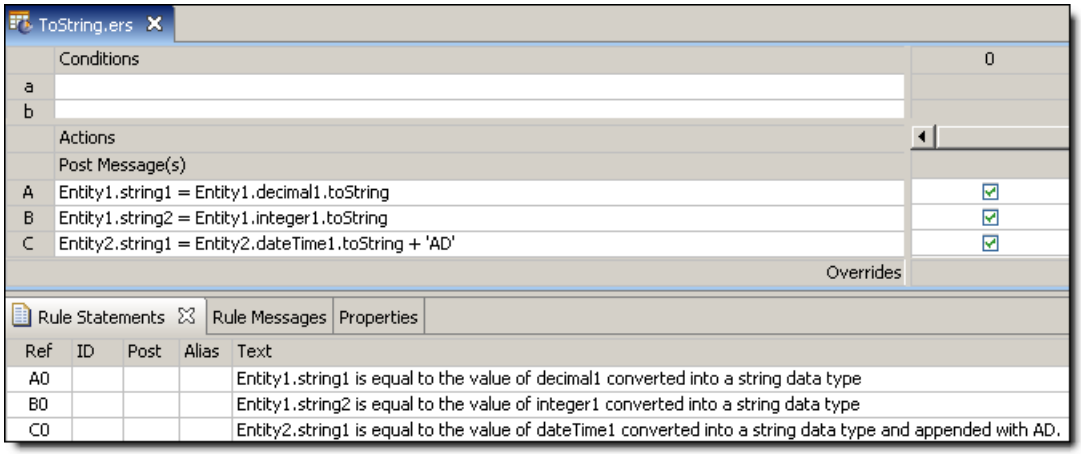
Converts a value to a data type of String.

USAGE RESTRICTIONS

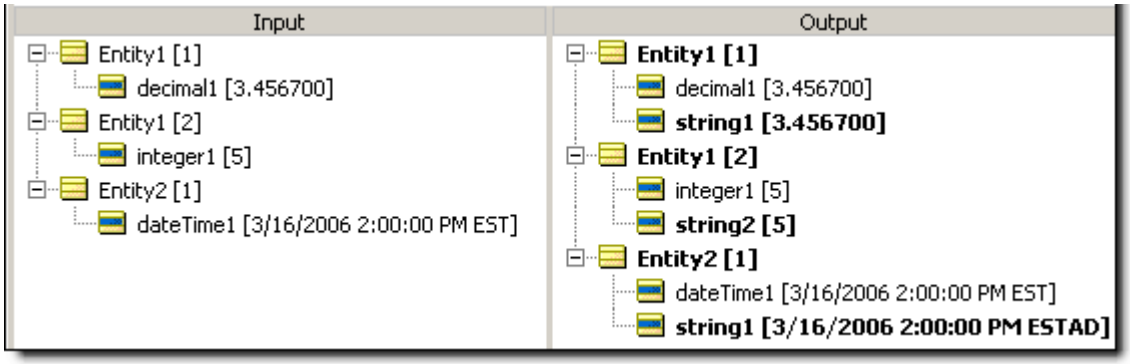
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toString** to convert 3 data types to strings. Rule N.3 also uses the alternative String concatenation syntax. See Add Strings for details.



SAMPLE TEST



To time: Casting a dateTime to a time

SYNTAX

`<DateTime>`.toTime

DESCRIPTION

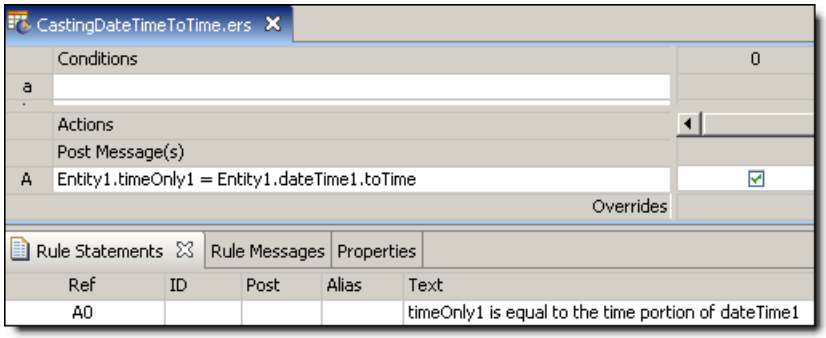
Converts the value in `<DateTime>` to a Time data type, containing only the time portion of the full DateTime. If `<DateTime>` contains no time information, then the time portion is set to `12:00:00 AM` in the current timezone.

USAGE RESTRICTIONS

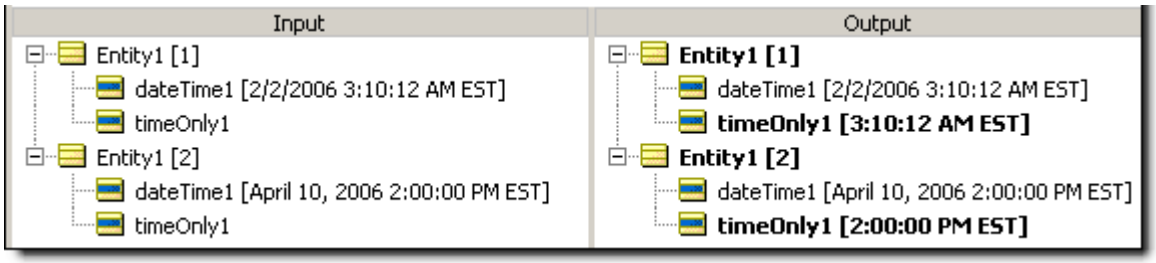
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.toTime** to convert `dateTime1` to Time and assign the value to `TimeOnly1`.



SAMPLE TEST



Trend

SYNTAX

`<Collection.attribute>` -> `<Sequence>`.trend

DESCRIPTION

Returns one of the following 4-character strings depending on the trend of `<Collection.attribute>` once sequenced by the same or different attribute in `<Collection>`. `<Sequence>` is an ordered set of `<Collection>` in the form $\{x_1, x_2, x_3 \ldots x_n\}$, where

`INCR`	the value of `<attribute>` of element x_{n+1} is greater than or equal to the value of `<attribute>` of element x_n for every element. At least one `<attribute>` value of element x must be greater than that of x_{n-1}
`DECR`	the value of `<attribute>` of element x_{n+1} is less than or equal to the value of `<attribute>` of element x_n for every element. At least one `<attribute>` value of element x must be less than that of x_{n-1}
`CNST`	the value of `<attribute>` of element x_{n+1} is equal to the value of `<attribute>` for element x_n for every element.
`NONE`	any `<sequence>` with elements not meeting the requirements for `INCR`, `DECR`, or `CNST`

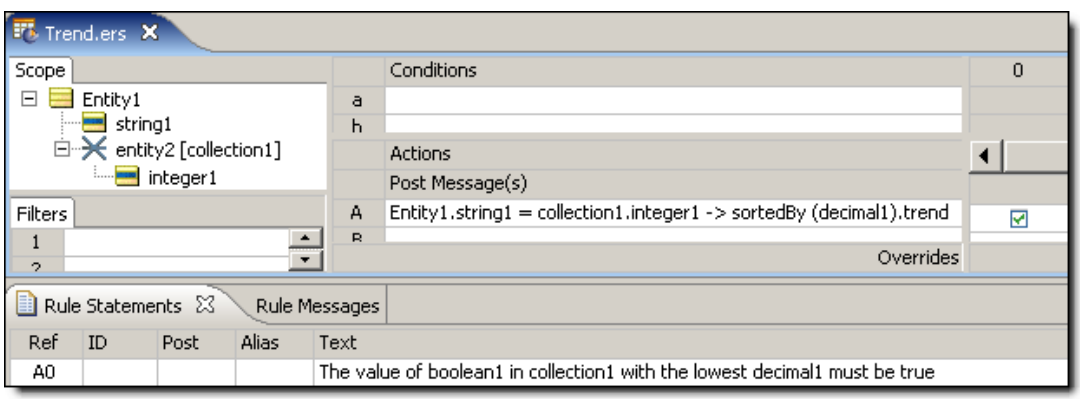
An alternative way to understand this operator is to view the index attribute used to sequence the collection as the *independent* variable (traditionally plotted along the “x” axis in a standard x-y graph) in a set of data pairs. The attribute evaluated by the **.trend** operator, `<Collection.attribute>`, is the *dependent* variable, plotted along the “y” axis. When so plotted, the 4-character words returned by **.trend** correspond to curves with positive, negative, zero (constant), or arbitrary slopes.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

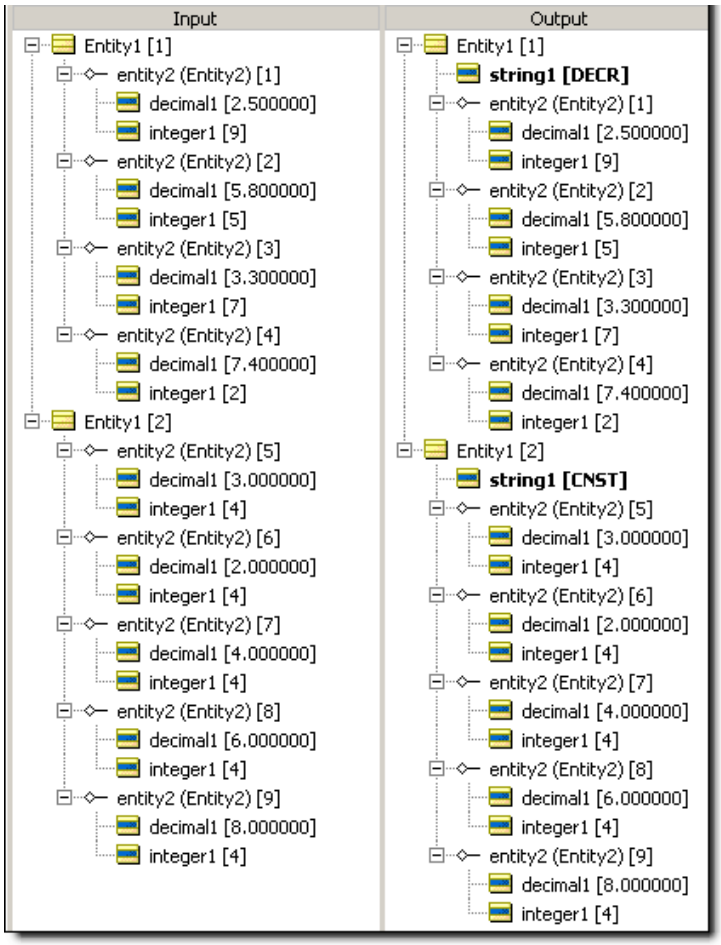
RULESHEET EXAMPLE

This Rulesheet uses the **.trend** function to analyze `integer1` attributes within `collection1` sorted by `decimal1`. The resulting trend value is assigned to `string1`.



SAMPLE TEST

Two sample tests provide two collections of elements, each with a `decimal1` and `integer1` values. Input and Output panels are shown below.



Note: Technically, the slope of an `INCR` curve need not be positive everywhere, but must have a first derivative (instantaneous slope) that is positive at some point along the curve and never be negative. The slope of a `CNST` curve must be zero everywhere.

True

SYNTAX

true or T

DESCRIPTION

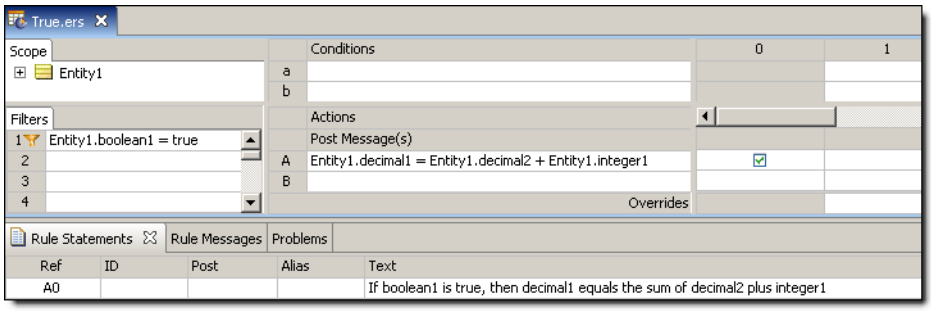
Represents Boolean value true. Recall from the discussion oftruth values that an `<expression>` is evaluated for its truth value, so the expression `Entity1.boolean1=true` will evaluate to `true` only if `boolean1=true`. But since `boolean1` is Boolean and has a truth value all by itself without any additional syntax, we do not actually need the "`=true`" piece of the expression. Many examples in the documentation use explicit syntax like `boolean1=true` or `boolean2=false` for clarity and consistency, even though `boolean1` or `not boolean2` are equivalent logical expressions.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

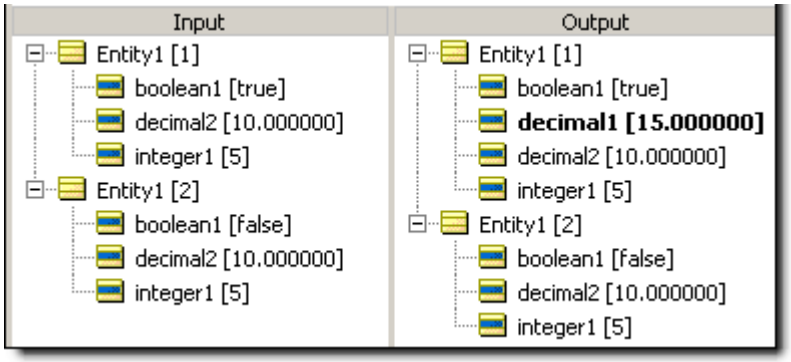
RULESHEET EXAMPLE

The following Rulesheet uses **true** in a Precondition to Ruletest whether `boolean1` is true, and perform the Nonconditional computation if it is. As discussed above, the alternative expression `Entity1.boolean1` is logically equivalent.



SAMPLE TEST

A sample Ruletest provides three examples. Assume `decimal2=10.0` and `integer1=5` for all examples. Input and Output panels are shown below:



Uppercase

SYNTAX

`<String>`.toUpper

DESCRIPTION

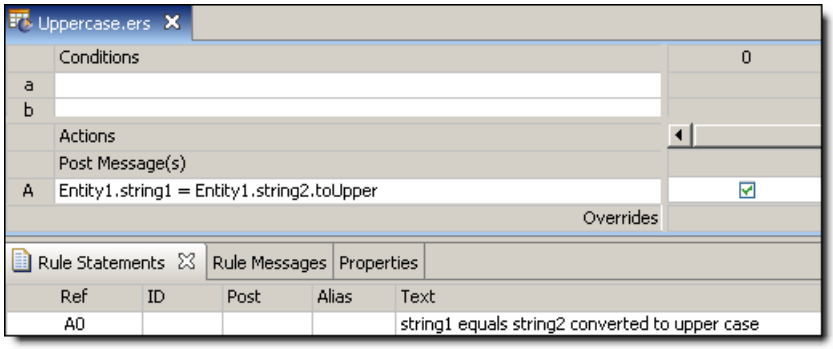
Converts all characters in `<String>` to uppercase.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

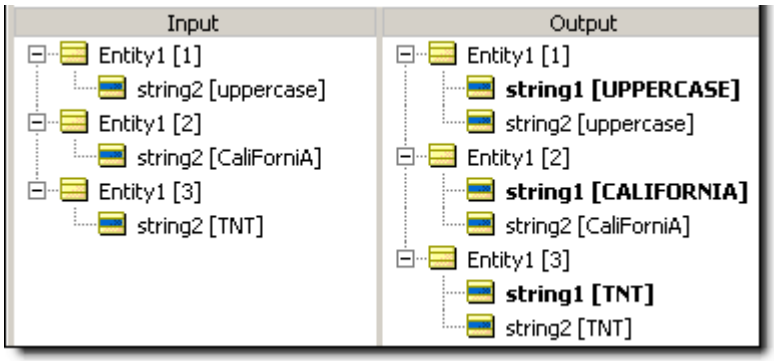
RULESHEET EXAMPLE

The following Rulesheet uses **.toUpper** to convert `string2` to uppercase and assign it to `string1`.



SAMPLE TEST

A sample Ruletest provides three examples. Input and Output panels are shown below:



Week of month

SYNTAX

`<DateTime>`.weekOfMonth

`<Date>`.weekOfMonth

DESCRIPTION

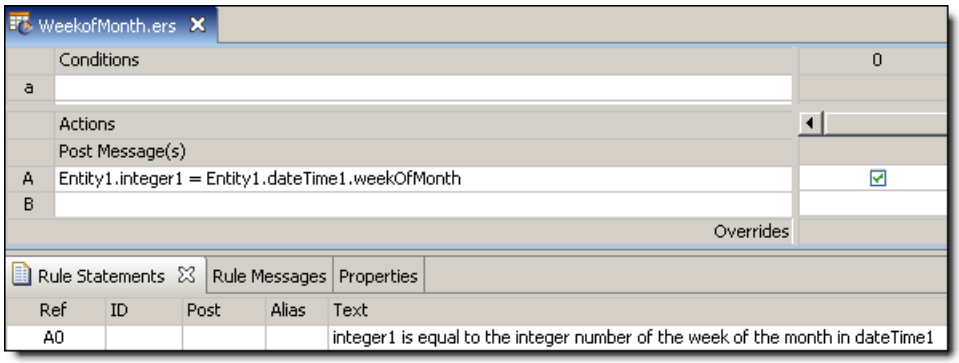
Returns an Integer from 1 to 6, equal to the week number within the month in `<DateTime>` or `<Date>`. A week begins on Sunday and ends on Saturday.

USAGE RESTRICTIONS

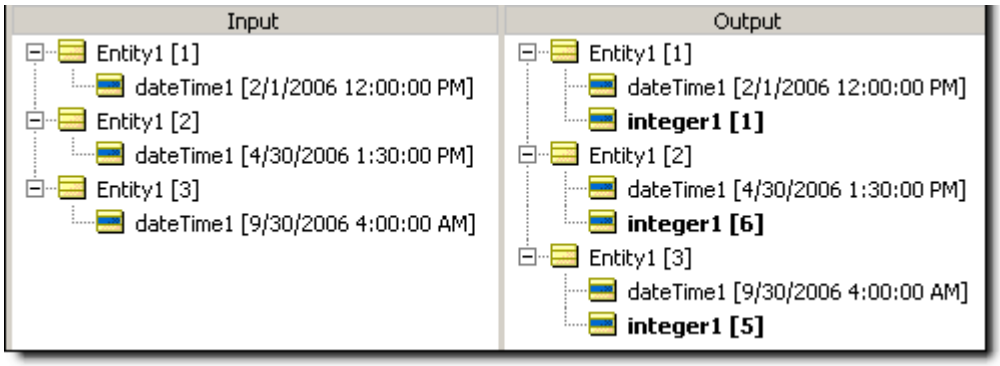
The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.weekOfMonth** to assign a value to `integer1`.



SAMPLE TEST



Week of year

SYNTAX

`<DateTime>`.weekOfYear

`<Date>`.weekOfYear

DESCRIPTION

Returns an Integer from 1 to 52, equal to the week number within the year in `<DateTime>` or `<Date>`. A week begins on Sunday and ends on Saturday. When a year ends between Sunday and the next Friday, or in other words when a new year begins between Monday and the next Saturday, the final day(s) of December will be included in week 1 of the new year. For example, 12/29/2013 fell on a Sunday, so 12/29-31 are included in week 1 of 2014.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.weekOfYear** to assign a value to `integer1`.

Week of Year.ers

	Conditions	0	1
a			
b			
-			
	Actions		
	Post Message(s)		
A	Entity1.integer1 = Entity1.dateTime1.weekOfYear	☑	
B			
	Overrides		

Rule Statements | Rule Messages | Problems

Ref	ID	Post	Alias	Text
A0				integer1 is equal to the integer number of the week of the year in dateTime1

SAMPLE TEST

Input	Output
Entity1 [1]	**Entity1 [1]**
dateTime1 [12/30/2013 2:00:00 PM]	dateTime1 [12/30/2013 2:00:00 PM]
integer1	**integer1 [1]**
Entity1 [2]	**Entity1 [2]**
dateTime1 [8/25/2014 11:45:00 AM]	dateTime1 [8/25/2014 11:45:00 AM]
integer1	**integer1 [35]**
Entity1 [3]	**Entity1 [3]**
dateTime1 [3/16/2016 10:30:00 PM]	dateTime1 [3/16/2016 10:30:00 PM]
integer1	**integer1 [12]**

Year

SYNTAX

`<DateTime>`.year

`<Date>`.year

DESCRIPTION

Returns the century/year portion of `<DateTime>` or `<Date>`. The returned value is a four digit Integer.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.year** to evaluate `dateTime1` and `dateOnly1` and assign the year values to `integer1` and `integer2`, respectively.

Year.ers

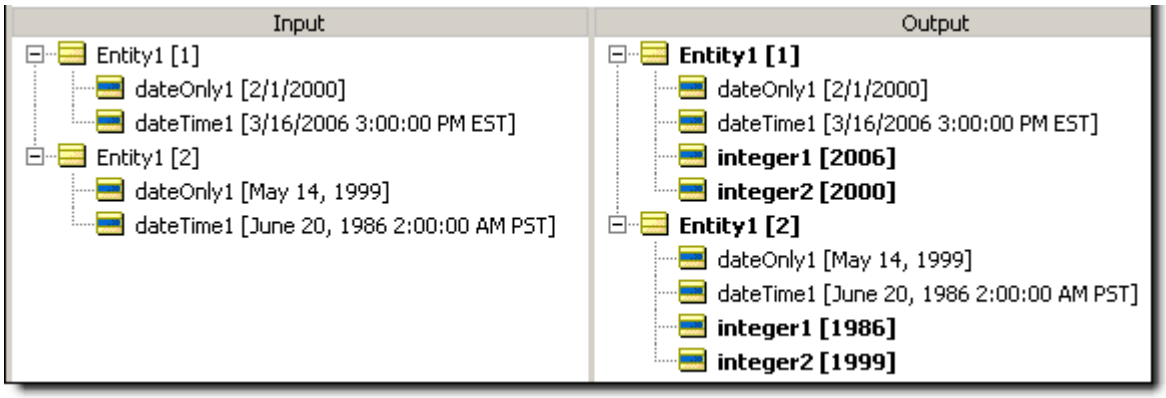
	Conditions	0
a		
b		
	Actions	
	Post Message(s)	
A	Entity1.integer1 = Entity1.dateTime1.year	☑
B	Entity1.integer2 = Entity1.dateOnly1.year	☑
	Overrides	

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
A0				integer1 equals the year value in dateTime1
B0				integer2 equals the year value in dateOnly1

SAMPLE TEST

A sample Ruletest provides three examples of `dateTime1` and `dateOnly1`. Input and Output panels are shown below:



Years between

SYNTAX

`<DateTime1>`.yearsBetween(`<DateTime2>`)

`<Date1>`.yearsBetween(`<Date2>`)

DESCRIPTION

Returns the Integer number of years between DateTimes or between Dates. The number of months in `<DateTime2>` is subtracted from the number of months in `<DateTime1>`, and the result is divided by 12 and truncated. This function returns a positive number if `<DateTime2>` is later than `<DateTime1>`.

USAGE RESTRICTIONS

The Operators row of the table in Summary Table of Vocabulary Usage Restriction applies. No special exceptions.

RULESHEET EXAMPLE

The following Rulesheet uses **.yearsBetween** to determine the number of months that have elapsed between `dateTime1` and `dateTime2`, compare it to the Values set, and assign a value to `string1`.

YearsBetween.ers

	Conditions	0	1	2
a	Entity1.dateTime1.yearsBetween(Entity1.dateTime2)		<=3	>3
b				
	Actions			
	Post Message(s)			
A	Entity1.string1		'Not Overdue'	'Overdue'
	Overrides			

Rule Statements | Rule Messages | Properties

Ref	ID	Post	Alias	Text
1				If 3 or fewer years have elapsed between dateTime1 and dateTime2, then Entity1 is not overdue
2				If more than 3 years have elapsed between dateTime1 and dateTime2, then Entity1 is overdue

SAMPLE TEST

A sample Ruletest provides `dateTime1` and `dateTime2` for two examples. Input and Output panels are shown below.

Input	Output
Entity1 [1]	**Entity1 [1]**
dateTime1 [Tuesday, May 9, 2006 2:30:00 PM EST]	dateTime1 [Tuesday, May 9, 2006 2:30:00 PM EST]
dateTime2 [Thursday, February 5, 2004 5:30:00 PM EST]	dateTime2 [Thursday, February 5, 2004 5:30:00 PM EST]
Entity1 [2]	**string1 [Not Overdue]**
dateTime1 [3/10/1992 2:00:00 PM PST]	**Entity1 [2]**
dateTime2 [7/1/2006 11:30:00 AM PST]	dateTime1 [3/10/1992 2:00:00 PM PST]
	dateTime2 [7/1/2006 11:30:00 AM PST]
	string1 [Overdue]

A

Standard Boolean constructions

For details, see the following topics:

- Boolean AND
- Boolean NAND
- Boolean OR
- Boolean XOR
- Boolean NOR
- Boolean XNOR

Boolean AND

In a decision table, a rule with **AND'**ed Conditions is expressed as a single column, with values for each Condition aligned vertically in that column. For example:

1. If a person is 45 or older and smokes, then classify the person as high risk

PolicyApplicantBoolean.ers

	Conditions	0	1
a	Applicant.age >=45	-	T
b	Applicant.smoker	-	T
	Actions		
	Post Message(s)		
A	Applicant.riskRating		'high'
	Overrides		

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older and smokes, then classify the applicant as high risk

In this scenario, each Condition has a set of 2 possible values:

person is 45 or older: `{true, false}`

person is a smoker: `{true, false}`

and the outcome may also have two possible values:

person's risk rating: `{low, high}`

These Conditions and Actions yield the following truth table:

age >= 45	smoker	risk rating
true	true	high
true	false	
false	true	
false	false	

Note that we have only filled in a single value of risk rating, because the business rule above only covers a single scenario: where `age >= 45` and `smoker = true`. A Completeness Check quickly identifies the remaining 3 scenarios:

PolicyApplicantBoolean.ers

	Conditions	0	1	2	3	4
a	Applicant.age >=45	-	T	T	F	
b	Applicant.smoker	-	T	F	-	
	Actions					
	Post Message(s)					
A	Applicant.riskRating		'high'			
	Overrides					

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older and smokes, then classify the applicant as high risk

Completing the truth table and the Rulesheet requires the definition of 2 additional business rules:

PolicyApplicantBoolean.ers

	Conditions	0	1	2	3
a	Applicant.age >=45	-	T	T	F
b	Applicant.smoker	-	T	F	-
	Actions				
	Post Message(s)				
A	Applicant.riskRating		'high'	'low'	'low'
	Overrides				

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older and smokes, then classify the applicant as high risk
2				If an applicant is 45 or older and does NOT smoke, then classify the applicant as low risk
3				If an applicant is NOT 45 or older, then ignore whether or not the applicant smokes and classify the applicant as low risk

and updating the truth table, we recognize the classic **AND** Boolean function.

age >= 45	smoker	risk rating
true	true	high
true	false	low
false	true	low
false	false	low

Once the basic truth table framework has been established in the Rulesheet by the Completeness Checker – in other words, all logical combinations of Conditions have been explicitly entered as separate columns in the Rulesheet – we can alter the outcomes to implement other standard Boolean constructions. For example, the **NAND** construction has the following truth table:

Boolean NAND

age >= 45	smoker	risk rating
true	true	low
true	false	high
false	true	high
false	false	high

Also known as “Not And”, this construction is shown in the following Rulesheet:

NAND.ers

	Conditions	0	1	2	3	4	5	6
a	Applicant.age>=45		T	T	F	F		
b	Applicant.smoker		T	F	T	F		
	Actions							
	Post Message(s)							
A	Applicant.riskRating		'low'	'high'	'high'	'high'		
	Overrides							

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older AND smokes, then classify the applicant as low risk
2				If an applicant is 45 or older AND does NOT smoke, then classify the applicant as high risk
3				If an applicant is younger than 45 AND smokes, then classify the applicant as high risk
4				If an applicant is younger than 45 AND does NOT smoke, then classify the applicant as high risk

Boolean OR

age >= 45	smoker	risk rating
true	true	high
true	false	high
false	true	high
false	false	low

PolicyApplicantBooleanOr

	Conditions	0	1	2	3	4
a	Applicant.age >=45	-	T	T	F	F
b	Applicant.smoker	-	T	F	T	F
	Actions					
	Post Message(s)					
A	Applicant.riskRating		'high'	'high'	'high'	'low'
	Overrides					

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older and smokes, then classify the applicant as high risk
2				If an applicant is 45 or older and does NOT smoke, then classify the applicant as high risk
3				If an applicant is younger than 45 and smokes, then classify the applicant as high risk
4				If an applicant is younger than 45 and does NOT smoke, then classify the applicant as low risk

Boolean XOR

Using “Exclusive Or” logic, `riskRating` is high whenever the age or smoker test, but not both, is satisfied. This construction is shown in the following Rulesheet:

age >= 45	smoker	risk rating
true	true	low
true	false	high
false	true	high
false	false	low

XOR.ers

	Conditions	0	1	2	3	4
a	Applicant.age>=45		T	T	F	F
b	Applicant.smoker		T	F	T	F
	Actions					
	Post Message(s)					
A	Applicant.riskRating		'low'	'high'	'high'	'low'
	Overrides					

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older AND smokes, then classify the applicant as low risk
2				If an applicant is 45 or older AND does NOT smoke, then classify the applicant as high risk
3				If an applicant is younger than 45 AND smokes, then classify the applicant as high risk
4				If an applicant is younger than 45 AND does NOT smoke, then classify the applicant as low risk

Boolean NOR

Also known as “Not Or”, this construction is shown in the following Rulesheet:

age >= 45	smoker	risk rating
true	true	low
true	false	low
false	true	low
false	false	high

PolicyApplicantBooleanNOR

	Conditions	0	1	2	3	4
a	Applicant.age >=45	-	T	T	F	F
b	Applicant.smoker	-	T	F	T	F
	Actions					
	Post Message(s)					
A	Applicant.riskRating		'low'	'low'	'low'	'high'
	Overrides					

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older and smokes, then classify the applicant as low risk
2				If an applicant is younger than 45 AND does NOT, then classify the applicant as low risk
3				If an applicant is younger than 45 AND smokes, then classify the applicant as low risk
4				If an applicant is younger than 45 AND does NOT smoke, then classify the applicant as high risk

Boolean XNOR

Also known as “Exclusive NOR”, this construction is shown in the following Rulesheet:

age >= 45	smoker	risk rating
true	true	high
true	false	low
false	true	low
false	false	high

PolicyApplicantBooleanXOR.ers

	Conditions	0	1	2	3	4
a	Applicant.age < 45	-	F	T	F	T
b	Applicant.smoker	-	F	T	T	F
	Actions					
	Post Message(s)					
A	Applicant.riskRating		'high'	'high'	'low'	'low'
	Overrides					

Rule Statements | Rule Messages

Ref	ID	Post	Alias	Text
1				If an applicant is 45 or older AND does NOT smoke, then classify the applicant as high risk
2				If an applicant is younger than 45 AND does smoke, then classify the applicant as high risk
3				If an applicant 45 or older AND smokes, then classify the applicant as low risk
4				If an applicant is younger than 45 AND does NOT smoke, then classify the applicant as low risk

B

Character precedence: Unicode and Java Collator

The Unicode standard assigns a 4 digit (hexadecimal) code to every character, including many that can't be typed on standard keyboards. Java (and hence Progress Corticon software) uses a special method named `Collator` to sort these characters in specific sequences based on the I18n locale of the user.

While sorting by locale allows for regional variations of language-specific characters like accents, the combination of these two systems can also make determining character precedence very complicated. The Unicode code and Java Collator sequence for standard keyboards in US-English locale is shown in the table below.

Sequences for other languages and/or locales may differ, and many other Unicode characters are available but are not shown in the table. We recommend http://www.unicode.org/charts for more information on the Unicode system and http://java.sun.com/docs/books/tutorial/i18n/text/locale.html for more information on the Java Collator method.

- `'Z'='z'` evaluates to `false`.
- `'C & S' < 'C and S'` evaluates to `true` because character `a` has a higher precedence than `&` (26 < 44). These characters are decisive because they are the first different characters encountered as the two strings are compared beginning with characters in position 1.
- `'B' > 'aardvark'` evaluates to `true` because character `B` has a higher precedence than `a` (45 > 44).
- `'Marilynn' < 'Marilyn'` evaluates to `false` because character `n` has a higher precedence than `<space>` (57 > 1). The first seven characters of each String are identical, so the final character comparison is decisive.

character	name	precedence	Unicode 5.0 code
	typed space	1	0020

character	name	precedence	Unicode 5.0 code
-	dash or minus sign	2	002D
_	underline or underscore	3	005F
,	comma	4	002C
;	semicolon	5	003B
:	colon	6	003A
!	exclamation point	7	0021
?	question mark	8	003F
/	slash	9	002F
.	period	10	002E
`	grave accent	11	0060
^	circumflex	12	005E
~	tilde	13	007E
‘	apostrophe	14	0027
“	quotation marks	15	0022
(	left parenthesis	16	0028
)	right parenthesis	17	0029
[	left bracket	18	005B
]	right bracket	19	005D
{	left brace	20	007B
}	right brace	21	007D
@	at symbol	22	0040
$	dollar sign	23	0024
*	asterisk	24	002A
\	backslash	25	005C
&	ampersand	26	0026
#	number sign or hash sign	27	0023

character	name	precedence	Unicode 5.0 code
%	percent sign	28	0025
+	plus sign	29	002B
<	less than sign	30	003C
=	equals sign	31	003D
>	greater than sign	32	003E
|	vertical line	33	007C
0..9	numbers 1 through 9	34-43	0031-0039
a, A	letter a, small and capital	44	0061, 0041
b, B	letter b, small and capital	45	0062, 0042
c, C	letter c, small and capital	46	0063, 0043
d, D	letter d, small and capital	47	0064, 0044
e, E	letter e, small and capital	48	0065, 0045
f, F	letter f, small and capital	49	0066, 0046
g, G	letter g, small and capital	50	0067, 0047
h, H	letter h, small and capital	51	0068, 0048
I, I	letter I, small and capital	52	0069, 0049
j, J	letter j, small and capital	53	006A, 004A
k, K	letter k, small and capital	54	006B, 004B
l, L	letter l, small and capital	55	006C, 004C
m, M	letter m, small and capital	56	006D, 004D
n, N	letter n, small and capital	57	006E, 004E
o, O	letter o, small and capital	58	006F, 004F
p, P	letter p, small and capital	59	0070, 0050
q, Q	letter q, small and capital	60	0071, 0051
r, R	letter r, small and capital	61	0072, 0052
s, S	letter s, small and capital	62	0073, 0053

character	name	precedence	Unicode 5.0 code
t, T	letter t, small and capital	63	0074, 0054
u, U	letter u, small and capital	64	0075, 0055
v, V	letter v, small and capital	65	0076, 0056
w, W	letter w, small and capital	66	0077, 0057
x, X	letter x, small and capital	67	0078, 0058
y, Y	letter y, small and capital	68	0079, 0059
z, Z	letter z, small and capital	69	007A, 005A

C

Precedence of rule operators

The precedence of operators affects the grouping and evaluation of expressions. Expressions with higher-precedence operators are evaluated first. Where several operators have equal precedence, they are evaluated from left to right. The following table summarizes Corticon's operator precedence.

Operator precedence	Operator	Operator Name	Example
1	( )	Parenthetic expression	(5.5 / 10)
2	-	Unary negative	-10
	not	Boolean test	not 10
3	*	Arithmetic: Multiplication	5.5 * 10
	/	Arithmetic: Division	5.5 / 10
	**	Arithmetic: Exponentiation (Powers and Roots)	5 ** 2 25 ** 0.5 125 ** (1.0/3.0)
4	+	Arithmetic: Addition	5.5 + 10
	-	Arithmetic: Subtraction	10.0 – 5.5
5	<	Relational: Less Than	5.5 < 10
	<=	Relational: Less Than Or Equal To	5.5 <= 5.5
	>	Relational: Greater Than	10 > 5.5
	>=	Relational: Greater Than Or Equal To	10 >= 10
	=	Relational: Equal	5.5=5.5
	<>	Relational: Not Equal	5.5 <> 10
6	(*expression*, *expression*)	Logical: AND	(>5.5,<10)
	(*expression* or *expression*)	Logical: OR	(<5.5 or >10)

Note: While expressions within parentheses that are separated by logical AND / OR operators are valid, the component expressions are not evaluated individually when testing for completeness, and might cause unintended side effects during rule execution. Best practice within a Corticon Rulesheet is to represent AND conditions as separate condition rows and OR conditions as separate rules -- doing so allows you to get the full benefit of Corticon's logical analysis.

Note: It is recommended that you place arithmetic exponentiation expressions in parentheses.

D

Formatting Date, Time, and DateTime properties

DateTime information may take many different formats. Corticon Studios use a common source of acceptable DateTime, Date Only, and Time Only formats, also known as masks.

For example, a date mask may specify `yyyy-MM-dd` as an acceptable date format, which means that an attribute of type DateTime (or Date) may hold or contain data that conforms to this format. `'2013-04-12'` conforms to this mask; `'April 12th,2013'` does not.

For proper execution, it is important to ensure that date formats used during rule development and testing (and are included in the rule builders' Corticon Studio installations) are also present in the Corticon Server's installation.

Most commercial databases represent dates as DateTimes. Such DateTimes are frequently stored as UTC, namely the number of milliseconds that have transpired from an arbitrary epoch (for example, 1/1/1970 00:00:00 GMT); this is not a universal standard but is a very popular convention. UTC dates can be *rendered* in the user's local time zone, *but this is merely a matter of presentation*. A UTC represents a simultaneous point in time for two observers regardless of where on earth they reside.

However, some date or time concepts, such as *holiday*, cannot be expressed conveniently as a discrete time point. *Christmas* (12/25/XX) actually denotes different time frames depending on the observers' time zones; thus, Corticon *carries* (that is, holds in memory) all dates in GMT with the time portion zeroed (that is, midnight). This approach addresses the holiday problem because a user can enter holiday dates into the database and not have them shift when they are rendered in the user's local time zone.

Carrying GMT dates should be transparent to the user. Dates expressed as strings in incoming XML are parsed and the proper data type is inferred; for dates, they are immediately instantiated as GMT and rendered back in GMT with no conversion.

Setting and modifying masks

Date/time masks are stored as a set of defaults that can be replaced by listing preferred values in the `brms.properties` file located at your work directory root – or, in Studio, the preferred location specified in **Preferences**.Corticon Studio's `DateTime` datatype uses both date and time data. The `Date` datatype handles only date information, and the `Time` datatype handles only time information.

The Corticon XML Translator will maintain the consistency of `DateTime`, `Date`, and `Time` values from input to output documents as long as the masks that are used are contained in the lists.

Note: Property settings you list in your `brms.properties` do not *append* to an existing list, they *replace* the default values. For example, if you want to add a new `DateTime` mask to the built-in list, be sure to include all the masks you intend to use, not just the new one. If your `brms.properties` file contains only the new mask, then it will be the only mask Corticon uses.

There is only one Date datatype. It handles dates, times, and date/times. A Date attribute is designated as date, time, or date/time depending on which of the masks below are matched. This designation changes the behavior of Date comparison operators.

The `dateformat`, `timeformat`, and `datetimeformat`, Date masks process incoming date/times on request XML payloads, insert date/times into output response XML payloads, parse entries made in the Studio Rulesheets, Vocabulary, and Testsheets, and to display any date/time in Studio.

The first entry for each `dateformat`, `datetimeformat`, and `timeformat` is the default mask. For example, the built-in operator `today` always returns the current date in the default `dateformat` mask.

The function `now` returns the current date in the default `datetimeformat`.The entries can be altered but must conform to the patterns/masks supported by the Java class `SimpleDateFormat` in the `java.text` package.

```
com.corticon.crml.OclDate.dateformat=
MM/dd/yy;
MM/dd/yyyy;
M/d/yy;
M/d/yyyy;
yyyy/MM/dd;
yyyy-MM-dd;
yyyy/M/d;
yy/MM/dd;
yy/M/d;
MMM d, yyyy;
MMMMM d, yyyy


com.corticon.crml.OclDate.datetimeformat=
MM/dd/yy h:mm:ss a;
MM/dd/yyyy h:mm:ss a;
M/d/yy h:mm:ss a;
M/d/yyyy h:mm:ss a;
yyyy/MM/dd h:mm:ss a;
yyyy/M/d h:mm:ss a;
yy/MM/dd h:mm:ss a;
yy/M/d h:mm:ss a;
MMM d, yyyy h:mm:ss a;
MMMMM d, yyyy h:mm:ss a;

MM/dd/yy H:mm:ss;
MM/dd/yyyy H:mm:ss;
M/d/yy H:mm:ss;
M/d/yyyy H:mm:ss;
yyyy/MM/dd H:mm:ss;
yyyy/M/d H:mm:ss;
yy/MM/dd H:mm:ss;
yy/M/d H:mm:ss;
MMM d, yyyy H:mm:ss;
```

```
MMMMM d, yyyy H:mm:ss;

MM/dd/yy hh:mm:ss a;
MM/dd/yyyy hh:mm:ss a;
M/d/yy hh:mm:ss a;
M/d/yyyy hh:mm:ss a;
yyyy/MM/dd hh:mm:ss a;
yyyy/M/d hh:mm:ss a;
yy/MM/dd hh:mm:ss a;
yy/M/d hh:mm:ss a;
MMM d, yyyy hh:mm:ss a;
MMMMM d, yyyy hh:mm:ss a;

MM/dd/yy HH:mm:ss;
MM/dd/yyyy HH:mm:ss;
M/d/yy HH:mm:ss;
M/d/yyyy HH:mm:ss;
yyyy/MM/dd HH:mm:ss;
yyyy/M/d HH:mm:ss;
yy/MM/dd HH:mm:ss;
yy/M/d HH:mm:ss;
MMM d, yyyy HH:mm:ss;
MMMMM d, yyyy HH:mm:ss;

MM/dd/yy h:mm:ss a z;
MM/dd/yyyy h:mm:ss a z;
M/d/yy h:mm:ss a z;
M/d/yyyy h:mm:ss a z;
yyyy/MM/dd h:mm:ss a z;
yyyy/M/d h:mm:ss a z;
yy/MM/dd h:mm:ss a z;
yy/M/d h:mm:ss a z;
MMM d, yyyy h:mm:ss a z;
MMMMM d, yyyy h:mm:ss a z;

MM/dd/yy H:mm:ss z;
MM/dd/yyyy H:mm:ss z;
M/d/yy H:mm:ss z;
M/d/yyyy H:mm:ss z;
yyyy/MM/dd H:mm:ss z;
yyyy/M/d H:mm:ss z;
yy/MM/dd H:mm:ss z;
yy/M/d H:mm:ss z;
MMM d, yyyy H:mm:ss z;
MMMMM d, yyyy H:mm:ss z;

MM/dd/yy hh:mm:ss a z;
MM/dd/yyyy hh:mm:ss a z;
M/d/yy hh:mm:ss a z;
M/d/yyyy hh:mm:ss a z;
yyyy/MM/dd hh:mm:ss a z;
yyyy/M/d hh:mm:ss a z;
yy/MM/dd hh:mm:ss a z;
yy/M/d hh:mm:ss a z;
MMM d, yyyy hh:mm:ss a z;
MMMMM d, yyyy hh:mm:ss a z;

MM/dd/yy HH:mm:ss z;
MM/dd/yyyy HH:mm:ss z;
M/d/yy HH:mm:ss z;
M/d/yyyy HH:mm:ss z;
yyyy/MM/dd HH:mm:ss z;
yyyy/M/d HH:mm:ss z;
yy/MM/dd HH:mm:ss z;
yy/M/d HH:mm:ss z;
```

```
MMM d, yyyy HH:mm:ss z;
MMMMM d, yyyy HH:mm:ss z
```

```
com.corticon.crml.OclDate.timeformat=
h:mm:ss a;
h:mm:ss a z;
H:mm:ss;
H:mm:ss z;
hh:mm:ss a;
hh:mm:ss a z;
HH:mm:ss;
HH:mm:ss z
```

When `com.corticon.crml.OclDate.locale=true`, it will override the default datetime mask and use the locale mask as the date style type defined by `com.corticon.crml.OclDate.datetype` and the time style type defined by `com.corticon.crml.OclDate.timetype`value for `datetype` and `timetype` are defined as values of `java.text.DateFormat` enums: `FULL = 0, LONG = 1, MEDIUM = 2, SHORT = 3` .

```
com.corticon.crml.OclDate.locale=false
com.corticon.crml.OclDate.datetype=3
com.corticon.crml.OclDate.timetype=2
```

If `permissive` is true (default), then the Corticon date/time parser will be lenient when handling incoming or entered date/times, trying to find a match even if the pattern is not contained in the mask lists. If false, then any incoming or entered date/time must strictly adhere to the patterns defined by `dateformat`, `datetimeformat, timeformat`.

Default patterns are for United States and other countries that follow the US conventions on date/times.

```
com.corticon.crml.OclDate.permissive =true
```

By default, when the value of `now` is pinned, the milliseconds are set to zero. This property can specify how to deal with the nano seconds (which can affect the milliseconds).

- Value of `ZERO_MILLIS` sets the nanos to 0 (which also sets milliseconds to zero)
- Value of `ZERO_NANOS` sets only the last 3 digits of the nanos to zero (which does not modify millis)
- Value of `NO_ZERO` does not modify the nanos (This has shown some rare side effects where datetime appears equal however the hidden nanos values cause comparison to be not equal)

Default value is `ZERO_MILLIS`

```
com.corticon.crml.OclDate.nanos=ZERO_MILLIS
```

If `maskliterals` is true (default), the system will parse strings and dates more quickly by checking for the presence of mask literals (for example, “/”, “-”, “:” or “,”) before consulting the date masks (an expensive process). If a string does not contain any of the mask literal characters, it can be immediately deemed a string (as opposed to a date).

```
com.corticon.crml.OclDate.maskliterals =true
```

Mask patterns

To take advantage of this feature, all user-specified date masks must contain at least one literal character. If any user-specified masks contain exclusively date pattern characters (for example, "MMddyy"), `maskliterals` must be set to false in order to prevent the system from misinterpreting date literals (for example, '123199') as simple strings.

These properties deal with the way Corticon Studio and Corticon Server handle date/time formats. Preset formats -- referred to as *masks* - are used to:

- Process incoming date/times on request XML payloads.
- Insert date/times into output response XML payloads.
- Parse entries made in the Corticon Studio Rulesheets, Vocabulary, and Tests.
- To display any date/time in Corticon Studio.

Masks are divided into 3 categories: `dateformat`, `datetimeformat`, `timeformat`.

Use the following chart to decode the date mask formats:

The following symbols are used in date/time masks:

Symbol	Meaning	Presentation	Patterns
`G`	Era designator	Text	G = {AD, BC}
`y`	Year	Number	yy = {00..99} yyyy = {0000..9999}
`Y`	Week year	Number	YY = {00..99} YYYY = {0000..9999}
`M`	Month in year	Text or Number	M = {1..12} MM = {01..12} MMM = {Jan..Dec} MMMM = {January..December}
`w`	Week in year	Number	w = {1..53} ww = {01..53}
`W`	Week in month	Number	W = {1..6}
`D`	Day in year	Number	D = {0..366} DDD = {000..366}
`d`	Day in month	Number	d = {1..31} dd = {01..31}
`F`	Day of week in month	Number	F = {0..6}

Symbol	Meaning	Presentation	Patterns
E	Day name in week	Text	E, EE, or EEE = {Sun..Sat} EEEE = {Sunday..Saturday}
u	Day number of week (1 = Monday, ..., 7 = Sunday)	Number	u = {1..7}
a	AM/PM marker	Text	a = {AM, PM}
H	Hour in 24-hour format (0-23)	Number	H = {0..23} HH = {00..23}
k	Hour in day (1-24)	Number	k = {1..24} kk = {01..24}
K	Hour in AM/PM (0-11)	Number	K = {1..12} KK = {01..12}
h	Hour in AM or PM	Number	h = {1..12} hh = {01..12}
m	Minute in hour	Number	m = {0..59} mm = {00..59}
s	Second in minute	Number	s = {0..59} ss = {00..59}
S	Millisecond in minute	Number	S = {0..999} SSS = {000..999}
z	General time zone	Text	z, zz, or zzz = abbreviated time zone zzzz = full time zone
Z	RFC 822 time zone	Text	Z,ZZ, or ZZZ = abbreviated time zone ZZZZ = full time zone
X	ISO 8601 time zone	Text	X, XX, or XXX = abbreviated time zone XXXX = full time zone
`	escape character used to insert text	Delimiter	
'	single quote	Literal	'

Any characters in the pattern that are not in the ranges of [a..z] and [A..Z] will be treated as quoted text. For instance, characters like {:, ., <space>, #, @} will appear in the resulting time text even they are not embraced within single quotes. A pattern containing any invalid pattern letter will result in a thrown exception during formatting or parsing.

Examples:

Sample Pattern	Resulting Formatted Date
`yyyy.MM.dd G 'at' hh:mm:ss z`	2013.07.10 AD at 15:08:56 PDT
`EEE, MMM d, ''yy`	Wed, Jul 10, '13
`h:mm a`	12:08 PM
`hh 'o''clock' a, zzzz`	12 o'clock PM, Pacific Daylight Time
`K:mm a, z`	0:00 PM, PST
`yyyy.MMMM.dd G h:mm a`	2013.July.10 AD 12:08 PM

Note: See SimpleTimeFormat Javadocs for more detailed information.

E

Corticon 5.7.2 Online Tutorials and Documentation

TUTORIALS: Learn about Corticon from online lessons at the Corticon Learning Center.

DOCUMENTATION: About this release	
What's New in Corticon Online Help PDF	Describes the enhancements and changes to the product since its last point release.
Corticon Installation Guide Online Help PDF	Step-by-step procedures for installing Corticon Studio and Servers in this release on Windows and Linux platforms.

DEVELOPMENT DOCUMENTATION: Define and Model Business Rules	
Rule Modeling Guide Online Help PDF	Introduces how business rules are modeled in Corticon Studio including the creation of Vocabularies, Rulesheets, Ruleflows, and Ruletests. This is the starting point for new rule modelers.
Quick Reference Guide Online Help PDF	Reference guide to the Corticon Studio user interface, including descriptions of all menu options, buttons, and actions.
Rule Language Guide Online Help PDF	Reference information for all operators available in the Corticon Studio Vocabulary.

Extensions Guide Online Help PDF	Detailed technical information about the Corticon extension framework for extended operators and service callouts.
Javadoc for Extensions API Javadoc	Complete Java API reference for Corticon Extensions.

DEPLOYMENT DOCUMENTATION: Run Decision Services on Servers	
Integration and Deployment Guide Online Help PDF	Provides details on deploying and managing Corticon Decision Services. Start here to learn about the options for deploying Corticon, the best practices for managing your deployment, and the APIs for integrating Corticon with clients executing rules.
Data Integration Guide Online Help PDF	Provides details on how to integrate Corticon with external data sources and how to use Corticon for batch rule processing. Includes details on Corticon EDC and ADC features for accessing data from Decision Services.
Web Console Guide Online Help PDF	Presents the Corticon Web Console which can be used to manage your Corticon deployment. This GUI interface simplifies the management and monitoring of Corticon servers and Decision Services.
Deploying Web Services with Java Online Help PDF	Provides details on deploying Corticon as a REST or SOAP web service on Java application servers.
Deploying Web Services with .NET Online Help PDF	Provides details on deploying Corticon as a REST or SOAP web service on Microsoft IIS.
Javadoc for Corticon Server API Javadoc	Complete Java API reference for Corticon Server.