# Contents

**Chapter 1 / Introduction to SAS Decision Manager** ........................................ 1  
- Enterprise Decision Management Systems .................................................. 1  
- About Business Rules ..................................................................................... 1  
- SAS Decision Manager Features ................................................................. 1  
- Workflow for Creating and Publishing Decisions ........................................... 2  
- Sign in to SAS Decision Manager ................................................................. 2  

**Chapter 2 / Working with Business Rules** ...................................................... 5  
- About Rules, Rule Sets, and Expressions ....................................................... 6  
- Create a New Rule Set .................................................................................... 7  
- Managing the Variables in a Rule Set .......................................................... 7  
- Add a Stand-Alone Assignment Statement ............................................... 10  
- Defining New Rules in a Rule Set ................................................................. 11  
- Defining Expressions in Rules and Assignment Statements ...................... 13  
- Managing Rules ............................................................................................ 20  
- Copy a Rule Set URL .................................................................................... 21  
- Managing Rule Sets ..................................................................................... 22  
- Managing Versions of Rule Sets .................................................................. 23  
- Testing a Rule Set .......................................................................................... 23  
- Publishing and Validating a Rule Set ............................................................ 28  

**Chapter 3 / Working with Decisions** ............................................................... 31  
- About Decisions ............................................................................................. 32  
- Create a Decision .......................................................................................... 32  
- Views for Editing a Decision ......................................................................... 32  
- Managing the Variables in a Decision ........................................................... 34  
- Using Custom Code Files .............................................................................. 37  
- Adding Objects to a Decision ......................................................................... 38  
- Mapping Variables within a Decision ............................................................ 40  
- Edit the Properties of a Decision Node ........................................................ 41  
- Reorder Objects in a Decision ....................................................................... 42  
- Delete an Object from a Decision ................................................................. 42  
- Open an Object from within a Decision ....................................................... 42  
- Copy a Decision URL ................................................................................... 42  
- Managing Decisions ...................................................................................... 43  
- Managing Versions of Decisions .................................................................. 44  
- Testing a Decision .......................................................................................... 44  
- Publishing and Validating a Decision ............................................................ 50  

**Chapter 4 / Using Lookup Tables and Functions** .......................................... 55  
- About Lookup Tables and Functions .............................................................. 55  
- Create a New Lookup Table .......................................................................... 56  
- Import or Refresh Lookup Table Entries ...................................................... 56  
- Export a Lookup Table .................................................................................. 57  
- Add Lookup Table Entries ........................................................................... 57  
- Edit Lookup Table Entries .......................................................................... 57  
- Delete Lookup Table Entries ...................................................................... 57  
- Copy a Lookup Table URL .......................................................................... 58  
- Managing Lookup Tables ............................................................................. 58  
- Managing Versions of Lookup Tables ......................................................... 59
Activate a Lookup Table ......................................................... 59
LOOKUP Function ............................................................... 60
LOOKUPVALUE Function ....................................................... 61
Introduction to SAS Decision Manager

Enterprise Decision Management Systems

Enterprise decision management systems can transform how businesses make decisions. They enable businesses to use the information they already have to make better decisions—decisions that are based on predictive analytics rather than on past history. Decision management systems automate the process of making decisions, particularly day-to-day operational decisions. They improve the speed, efficiency, and accuracy of routine business processes, in part by reducing the need for human intervention. By automating decisions, organizations in every industry can improve interactions with customers, partners, suppliers, and employees. In addition, organizations that are highly regulated, such as financial services, health care, and insurance, can more easily achieve compliance as a result of repeatable, traceable decisions.

SAS Decision Manager helps organizations manage data, business rules, analytical models, and optimization techniques. Rule management, model management, and data management are integrated into a consistent interface for easier accessibility.

About Business Rules

Business rules capture the logic of business decisions and are a core component of decision management systems. Business rules enable you to codify the decision-making process used by your organization. Business rules make the decision-making process transparent and adaptable, enabling organizations to respond quickly to new information about customers and markets. They enable organizations to identify and deal with fraud, avoid unnecessary risk, and find opportunities hidden in customer data.

SAS Decision Manager Features

You can use SAS Decision Manager to create a database of business rules, combine those rules together into decisions, and publish the decisions for use by other applications. SAS Decision Manager provides the following capabilities:
business rule authoring
A business rule specifies conditions to be evaluated and action to be taken if those conditions are satisfied. For example, you can create a rule that determines whether a particular customer has a mortgage. That same rule can then add the outstanding balance of the mortgage to a running total of the customer’s debt. With SAS Decision Manager, you define the conditions and actions for each rule.

rule set management and publishing
A rule set is a logical collection of rules. A single rule set can have many rules, but it generally corresponds to a single step in a decision. For example, you can have a rule set that determines a customer’s asset balance and another rule set that determines a customer’s debt level. You can use SAS Decision Manager to easily create new rule sets, reorder the rules in a rule set, add new rules to existing rule sets, and so on. When a rule set is published, the versioning features of SAS Decision Manager create a static version of the rule set. This static version helps you enforce integrity and governance over the rules that are put into production.

decision authoring and publishing
SAS Decision Manager enables you to combine analytical models, rule sets, and conditional logic into decisions. You can investigate various scenarios, test and refine the decision logic, and then publish the decisions for use in batch applications and online transactions. Automating decisions with SAS Decision Manager provides a streamlined mechanism for controlling and monitoring the rules and processes used by your organization. After a decision has been published, it is available for use by other applications.

Workflow for Creating and Publishing Decisions
To create and publish decisions by using SAS Decision Manager:

1. Create rule sets.
2. (Optional) Test rule sets.
3. (Optional) Publish rule sets.
4. (Optional) Validate published rule sets.
5. Create decisions.
6. (Optional) Test decisions.
7. Publish decisions.
8. (Optional) Validate published decisions.

After you publish a rule set or decision, it is available for use by other applications. In a production environment, these applications map variables in the rule set or decision to columns in the input data. The output that is generated when a decision is executed is written to an output table. The location of the input and output data is specified by the application.

Sign in to SAS Decision Manager
Note: If you are already signed in to SAS Drive, you can access SAS Decision Manager by clicking ⌘ and selecting Manage Decisions.

To sign in to SAS Decision Manager:
1 In the address bar of your web browser, enter the URL for SAS Decision Manager and press **Enter**. The **Sign In** page appears.

   **Note:** Contact your system administrator if you need the URL for SAS Decision Manager. The default URL is `http://host_name/SASDecisionManager`.

2 Enter a user ID and password.

3 Click **Sign In**.

4 (Optional) If you have not previously signed in to SAS Decision Manager, SAS Decision Manager displays the Welcome to SAS window in which you can set up a profile. You can choose to enter a profile picture or select a theme. You can also set these properties in the Settings window. For more information, see “**Settings**” under General Usage in the Help Center.
Working with Business Rules

About Rules, Rule Sets, and Expressions ......................................................... 6
Create a New Rule Set ................................................................................. 7
Managing the Variables in a Rule Set ............................................................ 7
   About Variables and Mapping ................................................................. 7
   Import Variables from a Data Source ....................................................... 8
   Import Variables from a Rule Set or Decision .......................................... 9
   Create Custom Variables .................................................................... 9
   Delete Variables ................................................................................... 10
   Edit Variable Properties ..................................................................... 10
Add a Stand-Alone Assignment Statement .................................................. 10
Defining New Rules in a Rule Set ................................................................. 11
   Add a New Rule .................................................................................. 11
   Controlling Which Conditions Are Evaluated ....................................... 12
   How Rules Are Evaluated and When Rule-Fired Records Are Generated .. 13
Defining Expressions in Rules and Assignment Statements ......................... 13
   About Defining Expressions ................................................................ 13
   Using the Expression Editor .................................................................. 14
   Using the Lookup Expression Editor ..................................................... 15
   Punctuation for Data Values ................................................................. 17
   Operators for Use in Expressions .......................................................... 17
   Using the LIKE Operator ..................................................................... 18
   Using Functions in Expressions .............................................................. 20
   Working with Missing Values ................................................................. 20
   Delete Condition or Action Expressions ............................................... 20
Managing Rules .............................................................................................. 20
   Duplicate a Rule .................................................................................. 20
   Delete a Rule ....................................................................................... 20
   Rename a Rule .................................................................................... 20
   Reorder Rules ...................................................................................... 21
Copy a Rule Set URL ...................................................................................... 21
Managing Rule Sets ........................................................................................ 22
   Duplicate Rule Sets ............................................................................ 22
   Delete Rule Sets ................................................................................... 22
   Rename Rule Sets ............................................................................... 22
   Move Rule Sets to a Different Folder .................................................... 22
Managing Versions of Rule Sets ................................................................... 23
   Set the Displayed Version .................................................................... 23
   Create a New Version ................................................................. 23
About Rules, Rule Sets, and Expressions

A rule specifies conditions to be evaluated and actions to be taken if those conditions are satisfied. Rules are grouped together into rule sets. Rule sets are logical collections of rules that are grouped together because of interactions or dependencies between the rules or because they are processed together after they are published.

Most rules correspond to this form:

if condition_expressions then action_expressions

For example, suppose you have the following rule:

if customer_debt > customer_assets then app_status = 'Decline'

In this case, customer_debt > customer_assets is a condition expression, and app_status = "Decline" is an action expression.

For example, the following figure shows rule above as it appears in the rule set editor:

```
if ▼ customer_debts ▼ > ▼ ▼ customer_assets

Then Assign ▼ app_status ▼ ▼ 'Decline'
```

A single rule can contain multiple condition expressions and action expressions. Multiple condition expressions within the same rule are joined together with the AND operand. For example, suppose you define the following rule in SAS Decision Manager:

```
if ▼ customer_debts ▼ > ▼ ▼ customer_assets

credit_score ▼ < ▼ ▼ 750

isHomeowner ▼ = ▼ ▼ false

Then Assign ▼ approval_status ▼ ▼ 'Decline'
```

SAS Decision Manager generates the following rule:

```
if ((customer_debts > customer_assets) AND (credit_score < 750) AND (isHomeowner = false)) then approval_status = 'Decline'
```
Rule sets can also contain stand-alone assignment statements, which do not have conditions. Stand-alone assignment statements always execute unless a RETURN action stops the execution of the rule set before execution reaches the assignment statement. See Step 8 of “Add a New Rule” on page 11 for information about the RETURN action.

Create a New Rule Set

1. Click on the navigation bar.
3. Enter a name for the rule set if you do not want to use the default name. Rule set names are limited to 100 characters and must be unique within a folder.
4. (Optional) Enter a description for the new rule set. Descriptions are limited to 1000 characters.
   
   **TIP** You can edit the description at any time on the Properties tab.

5. Click , and select the folder where you want to save the rule set.
6. Click Save. SAS Decision Manager opens the new rule set and displays the Variables tab.

Managing the Variables in a Rule Set

To use a variable in an expression, you must either import the variable from another source or you must create it as a custom variable. You can import variables from data sources, rule sets, and decisions.

About Variables and Mapping

The Properties of a Variable

Table 2.1 describes the properties of a variable.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Variable names must start with a letter or an underscore (_), and they can contain only alphanumeric characters and the underscore. They can be up to 32 characters long and must be unique within a rule set.</td>
</tr>
</tbody>
</table>
SAS Decision Manager supports the following data types: Boolean, character, data grid, date, datetime, decimal, and integer.

For Boolean values, enter True and False. When SAS Decision Manager generates code, it represents Boolean values using the numbers one and zero.

Note: For information about data grid variables, see “Using Data Grids in SAS Decision Manager” in SAS Decision Manager: Using Data Grids.

A variable can be an input variable, an output variable, both, or neither (a temporary variable). See “Input Variables, Output Variables, and Temporary Variables” on page 8 for more information.

For character variables that are input-only variables or both input and output variables, the length is derived from the length of the column to which the variable is mapped when the rule set is run. The maximum length for character variables is 32767.

The length for Boolean and numeric variable types is set automatically.

Descriptions are limited to 256 characters.

For each variable used in a rule set, you must specify whether the variable is an input variable, an output variable, both an input and an output variable, or a temporary variable.

- Input variables are variables that are present in the input table for a rule set. When a rule set is deployed in a production system, all input variables must be mapped to table columns in input data. When you test a rule set in SAS Decision Manager, for each input variable, you must either map it to a table column or specify a constant as its input value. When you create or edit a variable, clear the Input check box for any variable that you do not want to be mapped to a column in an input table or for which you do not want to specify a value.

- Output variables are variables that are written to the output table that is created when a rule set is run. When you create or edit a variable, clear the Output check box for any variable that you want to exclude from the output data.

- Temporary variables are variables that are not present in the input data and they are not written to the output table. To create a temporary variable for use only while a rule set is executing, clear both the Input and Output check boxes.

When you create a new variable, it is created as both an input and output variable by default.

1. On the Variables tab, click Add from Data Source, or click Add Variable and select Data Source. The Choose a Data Source window appears.
2. Select the table from which you want to import variables, and click OK. The Add Variables window appears.
3. Select the variables that you want to import and click OK. To import all of the variables in the table, click OK.
4. Click OK.
5. On the Variables tab, select or clear the Input and Output check boxes as necessary. See “Input Variables, Output Variables, and Temporary Variables” on page 8 for more information.
Import Variables from a Rule Set or Decision

1. To enable the ability to import variables from a rule set or decision, you must first create a custom variable or import variables from a data source. For more information, see “Import Variables from a Data Source” on page 8 and “Create Custom Variables” on page 9.

2. On the Variables tab, click Add Variable, and select Rule set or Decision. The Add Variables window appears.

3. Select the rule set or decision from which you want to import variables.

4. Select the variables that you want to import and click . To import all of the variables in the table, click .

5. Click OK.

6. On the Variables tab, select or clear the Input and Output check boxes as necessary. See “Input Variables, Output Variables, and Temporary Variables” on page 8 for more information.

Create Custom Variables

Create a Decimal Variable Dynamically

To create a variable of type Decimal, you can enter the new variable name in any field of an expression in which you can enter a variable name. If you enter the name in a condition expression field, SAS Decision Manager creates the variable as both an input and output variable. If you enter the name in an action expression field, SAS Decision Manager creates the variable as an output variable. For example, you can create a Decimal variable named daysLate by entering it in variable field:

Create Custom Variables on the Variables Tab

Note: For information about data grid variables, see “Defining Data Grid Variables” in SAS Decision Manager: Using Data Grids.

To create custom variables on the Variables tab:

1. Click Add Custom Variables, or click Add Variable and select Custom variable. The Add Variables window appears.

2. Complete these steps for each variable that you want to add:

   a. Enter the name of the new variable, and select the data type of the variable. See Table 2.1 on page 7 for additional information.

   b. (Optional) Click to display the Length and Description fields.

   c. (Optional) Enter a length and description for the new variable. See Table 2.1 on page 7 for additional information.

   d. Click Add. SAS Decision Manager adds the new variable to the table of variables. By default, variables are added to the table as both input and output variables.

   e. (Optional) Clear the check boxes in the Input or Output columns.
Clear the **Input** check box for any variable that you do not want to be mapped to a column in an input table or for which you do not want to specify a value.

- Clear the **Output** check box for any variable that you want to exclude from the output data.
- Clear both the **Input** and **Output** check boxes to create a temporary variable.

See Table 2.1 on page 7 for additional information.

3 Click **OK** to add the variables and close the Add Variables window.

### Delete Variables

On the **Variables** tab, select the check box for the variables that you want to delete, click ➡️ and select **Delete**.

**Note:** You cannot delete a variable if it is used in a rule set or decision.

### Edit Variable Properties

On the **Variables** tab, click on the variable name of the variable that you want to edit. The Edit Variable window appears. Edit the properties as needed, and then click **Save**. See Table 2.1 on page 7 for additional information.

### Add a Stand-Alone Assignment Statement

Stand-alone assignment statements always execute unless a RETURN action stops the execution of the rule set before execution reaches the assignment statement. Rule-fired data is not generated for standalone assignment statements.

1 Create or open the rule set.

2 Click **Add assignment** if the rule set is empty or, if the rule set contains at least one statement, select **Add** ➡️ **Add assignment.** The application adds an assignment statement to the top of the rule set, below any existing assignment statements.

3 Import or create any variables that are required for the assignment statement that have not already been added to the rule set. You can add or create the variables on the **Variables** tab, or you can define variables dynamically as you author the statement. See “Managing the Variables in a Rule Set” on page 7 for more information.

4 Select the variable to which you want to assign a value.

5 Enter the expression for the variable in the expression field. See “About Defining Expressions” on page 13 for additional information.

6 (Optional) Move the assignment statement to a different position in the rule set. To move the statement, click ‹ or ›.

7 Click ✎ to save the rule set. SAS Decision Manager validates the syntax of the expressions. If it does not detect any problems, it saves the rule set.
Defining New Rules in a Rule Set

Add a New Rule

1. Create or open the rule set. If no variables are defined in the rule set, SAS Decision Manager displays the Variables tab. Otherwise, it displays the Rule Set tab.

2. Import or create any variables that are required for the new rule that have not already been added to the rule set. You can add or create the variables on the Variables tab, or you can define variables dynamically as you author the rule. See “Managing the Variables in a Rule Set” on page 7 for more information.

3. Click the Rule Set tab.

4. Click Add rule if the rule set is empty or, if the rule set contains at least one statement, select one of the following options:
   - Add ▷ Add rule
     Adds a new IF-THEN rule to the end of the rule set.
   - Add ▷ Add assignment
     Adds a new assignment statement to the top of the rule set.

5. Define the condition expression for the rule. See “About Defining Expressions” on page 13 for additional information.
   To add additional condition expressions to the selected rule, select Add ▷ Condition.

6. Define the action expressions for the rule. See “About Defining Expressions” on page 13 for additional information.
   To add additional action expressions to the selected rule, select Add ▷ Action.

   **TIP** To move condition or action expressions up or down within an IF or ELSE clause, select the expression and click ⇧ or ⇩.

7. (Optional) Change the rule operator to Else. If the rule is the first rule in a rule set, the rule operator must be IF.
   When you change the operator on a rule from IF to ELSE, the condition expression is preserved, and the rule becomes an ELSE clause with an IF condition. For more information, see “Controlling Which Conditions Are Evaluated” on page 12.

8. (Optional) Change the operator on the THEN clause from Assign to Return. The RETURN action stops the execution of any additional statements in the rule set. See “Controlling Which Conditions Are Evaluated” on page 12 for more information.

9. (Optional) Select Add ▷ Else rule to add an ELSE clause to the currently selected rule. The ELSE clause does not have a condition, but you can add one by selecting Add ▷ Condition.

10. (Optional) Define the condition and action expressions for the ELSE clause.

11. (Optional) Change the order of the rules. Rules are evaluated sequentially. To move a rule up or down within a rule set, select the rule and click ⇧ or ⇩.

12. (Optional) Change the name of the rule. Rule names are limited to 100 characters and must be unique within a rule set. For instructions, see “Rename a Rule” on page 20.
Assigning logical names to the rules makes it easier to determine which rules fired when you review rule-fired data.

(Optional) Clear the Record rule-fired data check box if you do not want a rule-fired record to be written each time this rule fires. See “How Rules Are Evaluated and When Rule-Fired Records Are Generated” on page 13 for more information.

Click ☑️ to save the rule set. SAS Decision Manager validates the syntax of the expressions. If it does not detect any problems, it saves the rule set.

Controlling Which Conditions Are Evaluated

By default, rules are assigned the IF rule operator, which means that the rule’s conditions are evaluated regardless of the results of previous rules. You can control whether condition expressions are evaluated by using the RETURN action and the ELSE operator.

The RETURN action stops the execution of any remaining rules in a rule set. If you are executing a single rule set, execution ends. If you are executing a decision, control moves to the next object in the decision. For example, the rule in the following figure stops the execution of any remaining rules in the rule set if the value of the Order_Quantity variable is missing.

If you set a clause’s operator to ELSE, then the clause’s conditions are evaluated only if the previous clause’s conditions evaluated to false. For example, given the rule set shown the following figure, if Order_Quantity is 9, the condition for the IF clause evaluates to false, and the condition for the first ELSE clause evaluates to true. Therefore, the action for first ELSE clause is executed, and the condition for the last ELSE clause is not evaluated. The value of Offer_Percent is set to 5.
How Rules Are Evaluated and When Rule-Fired Records Are Generated

By default, the condition expressions for all rules in a rule set are evaluated sequentially regardless of the results of previous rules. However, you can use the ELSE operator and the RETURN action to control whether condition expressions are evaluated. See "Controlling Which Conditions Are Evaluated" on page 12 for more information.

If a rule’s condition expressions evaluate to True, SAS Decision Manager executes the rule’s action expressions. The rule is said to have fired.

By default, every time a rule fires, it generates a rule-fired record. You can control when rule-fired records are generated by using the Record rule-fired data check boxes. See Step 13 in "Add a New Rule" on page 11.

Note: Stand-alone assignment statements always execute unless a RETURN action stops the execution of the rule set before execution reaches the assignment statement. Rule-fired data is not generated for standalone assignment statements.

Defining Expressions in Rules and Assignment Statements

About Defining Expressions

Expressions can be up to 1024 characters long. They can contain numeric constants, character strings, variables, operators, SAS DS2 functions, and the SAS Decision Manager LOOKUP and LOOKUPVALUE
functions. Action expressions can only be assignment statements. You can enter expressions directly into the expression fields, or you can use the Expression Editor to create and edit expressions.

**TIP** Use caution when you test for equality by using scientific notation. Two numbers that appear to be the same might evaluate to different numbers because of the precision involved in scientific notation.

For more information about entering expressions, see the following topics:

- “Using the Expression Editor” on page 14
- “Using the Lookup Expression Editor” on page 15
- “Punctuation for Data Values” on page 17
- “Operators for Use in Expressions” on page 17
- “Using the LIKE Operator” on page 18
- “Using Functions in Expressions” on page 20
- “Working with Missing Values” on page 20
- “Using Data Grid Functions” in SAS Decision Manager: Using Data Grids

### Using the Expression Editor

You can use the Expression Editor to enter expressions that do not use the LOOKUP or LOOKUPVALUE functions. You must use the Expression Editor to enter expressions that use the OR operator, the concatenation (||) operator, or the exponent operator (**).

To open the Expression Editor, select an expression, and click `Expression Editor`.
You can enter expressions directly into the expression field, or you can use the lists of operators, function names, and variable names to add them to the expression.

- To add an operator, click the operator in the rows above the expression field.
- To add a variable, click the **Variables** tab, and double-click the variable name.
- To add a function call, click the **Functions** tab, select a function name, and click ✿.

You can click **Validate** at any time to check the syntax of the expression that you are building. Click **Clear** to clear the expression field.

When you are finished building the expression, click **Save**. The Expression Editor adds the expression to the rule set.

**Note:** When you use the Expression Editor to enter an expression, the expression field on the **Rule Set** tab is disabled. You can edit it only by using the Expression Editor. To return to the default view of the field, click ✿. However, if you revert to the default view, any changes that you made in the Expression Editor are discarded.

### Using the Lookup Expression Editor

The Lookup Expression Editor enables you to enter expressions that use either the LOOKUP or LOOKUPVALUE functions.

**Note:** You can enter the LOOKUP function only in condition expressions, and you can enter the LOOKUPVALUE function only in action expressions.

To open the Lookup Expression Editor, select the expression, and click ✿. The following figure shows the Lookup Expression Editor for a condition expression.
The Lookup Expression Editor for an action expression is the same except that it specifies the LOOKUPVALUE function:

LookUpValue("Lookup table", inputVariable)

You can enter the expression directly into the expression field, or you can use the lists on the Lookup Tables and Variables tabs to enter the expression.

- To add the lookup table name, select the Lookup Tables tab, and double-click the table name.
- To add the input variable name, select the Variables tab, and double-click the variable name.

You can click Validate at any time to check the syntax of the expression that you are building.

**TIP** When you select values on the tabs, the hint text in the expression field is automatically replaced. You do not need to select that text in order to replace it.

When you are finished building the expression, click Save. The Lookup Expression Editor adds the expression to the rule set.

**Note:** When you use the Lookup Expression Editor to enter an expression, the expression field is disabled and can be edited by using the Lookup Expression Editor only. To return to the default view of the field, click \( \text{ } \). However, if you revert to the default view, any changes that you made in the Lookup Expression Editor are discarded.
# Punctuation for Data Values

Depending on whether you use the Expression Editor or enter expressions directly into the expression fields, you must enter some values differently.

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Punctuation Needed</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Character</td>
<td>Enclose character strings in single quotation marks. For embedded quotation marks, use two single quotation marks.</td>
<td>'Gold Account'</td>
</tr>
<tr>
<td>Date</td>
<td>In the rule set editor, enter Date values by using the format DDMMMYYYY. Enclose each value in single quotation marks followed by 'd'.</td>
<td>'01AUG2017'd</td>
</tr>
<tr>
<td></td>
<td>In the Expression Editor, use the DS2 function TO_DOUBLE and specify the DATE data type in order to cast the Date value so that it can be compared correctly to other variables. See SAS DS2 Programmer’s Guide for information about date, time, and timestamp values, and see SAS DS2 Language Reference for information about the TO_DOUBLE function.</td>
<td>to_double(date '2017-11-04')</td>
</tr>
<tr>
<td>Datetime</td>
<td>In the rule set editor, enter Datetime values by using the format DDMMMMYYYY:HH:MM:SS. Use 24-hour clock notation. Enclose each value in single quotation marks followed by 'dt'.</td>
<td>'31AUG2017:15:00:00'dt</td>
</tr>
<tr>
<td></td>
<td>In the Expression Editor, use the DS2 function TO_DOUBLE and specify the TIMESTAMP data type in order to cast the Datetime value so that it can be compared correctly to other variables. See SAS DS2 Programmer’s Guide for information about date, time, and timestamp values, and see SAS DS2 Language Reference for information about the TO_DOUBLE function.</td>
<td>to_double(timestamp '2017-11-04 10:54:34.012')</td>
</tr>
<tr>
<td>Boolean</td>
<td>In the rule set editor, Boolean values are not enclosed in quotation marks. Enter only the values.</td>
<td>True</td>
</tr>
<tr>
<td></td>
<td>In the Expression Editor, enclose Boolean values in single quotation marks.</td>
<td>'True'</td>
</tr>
</tbody>
</table>

# Operators for Use in Expressions

The following table lists the operators that you can use in an expression. Do not enter a space between the elements of the operators <=, >=, or ^=. Some mnemonic equivalents for these operators cannot be used in SAS Decision Manager expressions. See SAS DS2 Programmer’s Guide for more information about specifying operators in expressions.
### Table 2.2 Operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>Multiply</td>
<td>$0.085 \times \text{sales}$</td>
</tr>
<tr>
<td>/</td>
<td>Divide</td>
<td>$\text{amount} / 5$</td>
</tr>
<tr>
<td>+</td>
<td>Add</td>
<td>$\text{num} + 3$</td>
</tr>
<tr>
<td>-</td>
<td>Subtract</td>
<td>$\text{sale} - \text{discount}$</td>
</tr>
<tr>
<td>**</td>
<td>Raises the first operand to the power of the second operand</td>
<td>$\text{num1}^{\text{num2}}$</td>
</tr>
<tr>
<td>=</td>
<td>Equal to</td>
<td>$\text{tries} = \text{maxTriesAllowed}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>!=</td>
<td>Not equal to</td>
<td>$\text{insufficientFunds} \neq \text{True}$</td>
</tr>
<tr>
<td>^=</td>
<td>Not equal to</td>
<td>$\text{balance} \leftarrow 'low'$</td>
</tr>
<tr>
<td>&gt;</td>
<td>Greater than</td>
<td>$\text{daysLate} &gt; 5$</td>
</tr>
<tr>
<td>&gt;=</td>
<td>Greater than or equal to</td>
<td>$\text{balance} \geq 1000$</td>
</tr>
<tr>
<td>&lt;=</td>
<td>Less than or equal to</td>
<td>$\text{balance} \leq 250$</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>The maximum of the left and right operands</td>
<td>$\text{num1} &lt;&gt; \text{num2}$</td>
</tr>
<tr>
<td>IN (value-list)</td>
<td>Equal to an item in value-list</td>
<td>$\text{risk in ('high','medium','low')}$</td>
</tr>
<tr>
<td>NOT IN (value-list)</td>
<td>Not equal to an item in value-list</td>
<td>$\text{offerPercent not in (10,20,30)}$</td>
</tr>
<tr>
<td>LIKE 'pattern'</td>
<td>If the variable's value matches the expression pattern in pattern, the result is true.</td>
<td>$\text{like 'HS%PP'}$</td>
</tr>
<tr>
<td>expression AND expression</td>
<td>If both expressions are true, the result is true.</td>
<td>$\text{dateExpired} \geq '01AUG2015'd \text{ AND } \text{dateExpired} \leq '31AUG2015'd$</td>
</tr>
<tr>
<td>expression OR expression</td>
<td>If either expression is true, the result is true.</td>
<td>$\text{dateEnrolled} \geq '01JAN2015' \text{ OR } \text{member = True}$</td>
</tr>
</tbody>
</table>

### Using the LIKE Operator

The LIKE operator determines whether the value of a variable matches a pattern-matching expression. An expression that uses the LIKE operator has the following syntax:

LIKE 'pattern-matching-expression'
If a variable’s value matches the pattern that is specified by \textit{pattern-matching-expression}, the expression evaluates to true (1). Otherwise, the expression evaluates to false (0).

There are three classes of pattern-matching characters.

\textbf{Table 2.3} Pattern-Matching Characters

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>underscore (_)</td>
<td>Matches any single character</td>
</tr>
<tr>
<td>percent sign (%)</td>
<td>Matches any sequence of zero or more characters</td>
</tr>
<tr>
<td>Note: Be aware of the effect of trailing blanks. To match values, you might have to use the TRIM function to remove trailing blanks.</td>
<td></td>
</tr>
<tr>
<td>any other character</td>
<td>Matches that character</td>
</tr>
</tbody>
</table>

The LIKE expression is case sensitive. To search for mixed-case strings, use the \textsc{UPCASE} function to create an uppercase version of the variable that you want to search. You can use a temporary variable to store the results of the \textsc{UPCASE} function. Use the LIKE operator to search the uppercase version of the variable. For example, you can search the variable Part\_Number for mixed-case strings that begin with HS and end with PP by using the two rules shown in the following figure.

![Assign temp \textsc{UPCASE}(Part\_Number)](image_url)

The following table shows examples of the matches that result if you search a variable that could have these values: Smith, Smooth, Smothers, Smart, Smuggle.

\textbf{Table 2.4} Examples of LIKE Expressions

<table>
<thead>
<tr>
<th>LIKE Expression Example</th>
<th>Matching Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>like 'Sm%'</td>
<td>Smith, Smooth, Smothers, Smart, Smuggle</td>
</tr>
<tr>
<td>like '%th'</td>
<td>Smith, Smooth</td>
</tr>
<tr>
<td>like 'S__gg%'</td>
<td>Smuggle</td>
</tr>
<tr>
<td>like 'S_o'</td>
<td>(no matches)</td>
</tr>
<tr>
<td>like 'S_o%'</td>
<td>Smooth, Smothers</td>
</tr>
<tr>
<td>like 'S%th'</td>
<td>Smith, Smooth</td>
</tr>
</tbody>
</table>
Using Functions in Expressions

SAS Decision Manager supports the following functions in expressions:

- LOOKUP and LOOKUPVALUE functions. Condition expressions can contain the LOOKUP function, and action expressions can contain the LOOKUPVALUE function. However, if the expression contains the LOOKUP or LOOKUPVALUE function, then the expression cannot contain anything else. See “LOOKUP Function” on page 60 and “LOOKUPVALUE Function” on page 61 for more information.

- SAS DS2 functions. Syntax information for the most commonly used functions is available by clicking on a function name in the Expression Editor. For additional information about these functions and additional DS2 functions, see SAS DS2 Language Reference.

- Data grid functions. Syntax information for these functions is available by clicking on a function name in the Expression Editor. For more information about these functions, see “Data Grid Functions” in SAS Decision Manager: Using Data Grids.

Working with Missing Values

You can use the MISSING function to check for missing values. This function returns 0 (false) or 1 (true). Missing values have a value of false when you use them with logical operators such as AND or OR. You can use the MISSING function to eliminate errors, notes, and warnings in the SAS log that are caused by missing values.

In expressions, you can use the period (.) to denote missing numeric values, and two single quotation marks with no space (the empty string ‘ ’) to denote missing character values.

For information about how DS2 processes nulls and SAS missing values, see SAS DS2 Programmer’s Guide.

Delete Condition or Action Expressions

To delete a condition or action expression, click for that expression.

Managing Rules

Duplicate a Rule

1 Click for the rule, and select Duplicate rule. The Duplicate Rule window appears.

2 Enter a name for the rule if you do not want to use the default name, and click Duplicate.

Delete a Rule

To delete a rule, click for the rule, and select Delete rule.

Rename a Rule

To rename the IF clause of a rule:

1 Click for the rule, and select Rename rule. The Rename Rule window appears.
2 Enter the new name and click Rename.

To rename the ELSE clause of a rule:

1 Right-click on the Else operator and select Rename rule.

TIP Rule names for ELSE clauses do not appear in the rule set editor.

Reorder Rules

To move a rule up or down within an IF or ELSE clause, select the rule, and click ↑ or ↓.

Copy a Rule Set URL

To create a link for external documentation that automatically opens a rule set in SAS Decision Manager, complete these steps:

1 Open the rule set.

2 Click , and select Copy object URL. The Copy Rule Set URL window appears.

3 Click Copy, and then click Close.

Paste the link into your documentation.
Managing Rule Sets

Duplicate Rule Sets

Note: You cannot duplicate a rule set if it is open.

To duplicate a single rule set:

1. In the Rule Sets view, select the rule set that you want to duplicate.
2. Click ⬅️ and select Duplicate. The Duplicate Rule Set window appears.
3. Enter a new name for the duplicate rule set.
4. (Optional) Enter a description for the rule set.
5. Click Duplicate.

To duplicate multiple rule sets:

1. In the Rule Sets view, select the rule sets that you want to duplicate.
2. Click ⬅️ and select Duplicate. SAS Decision Manager duplicates the rule sets and appends _Copy to the names of the duplicate copies. If needed, a number is also appended to the names of the duplicate copies.

Delete Rule Sets

Note: You cannot delete a rule set if it is open.

In the Rule Sets view, select the rule sets that you want to delete, click ⬇️, and select Delete.

Rename Rule Sets

Note: You cannot rename a rule set if it is open.

1. In the Rule Sets view, select the rule set that you want to rename.
2. Click ⬅️ and select Rename. The Rename window appears.
3. Enter a new name for the rule set, and click Rename.

Move Rule Sets to a Different Folder

1. In the Rule Sets view, select the rule sets that you want to move.
2. Click ⬅️ and select Move. The Choose a Location window appears.
3. Select the location to which you want to move the rule sets, and click OK.
Managing Versions of Rule Sets

To change the version of a rule set that is specified in a decision node, edit the properties of the node. For more information, see “Edit the Properties of a Decision Node” on page 41.

Set the Displayed Version

The displayed version is the version whose information is displayed on the other tabs, such as the Properties and Rule set tabs. On the Versions tab, a ✓ indicates the displayed version. To change the displayed version, select the version that you want to view, and click Set Version.

Create a New Version

Note: The current version of an object is the version with the highest version number. When you create a new version, SAS Decision Manager locks the current version before it creates the new version.

Note: You cannot save changes to a version that is locked. If you modify a version that is locked and click 📅, SAS Decision Manager asks you if you want to replace the current unlocked version with your edited version.

Note: You cannot unlock a locked version.

To create a new version:

2. Select the version type: Minor or Major. Version numbers follow the format Major.Minor. If you select Major, the number to the left of the period is incremented. If you select Minor, the number to the right of the period is incremented.
3. (Optional) Enter information about the new version in the Notes field.

   **TIP** You can edit these notes at any time on the Versions tab.

4. Click Save.

Testing a Rule Set

Create and Run a New Test

Testing a rule set is optional, but doing so is a best practice. Testing enables you to discover any problems before the rule set is published and incorporated into a production system.

1. On the Scoring tab, click the Tests tab.
3. Enter a name for the test if you do not want to use the default name.
4. (Optional) Enter a description for the test. Descriptions are limited to 1000 characters.
5. Click 📅, select the input table for the test, and click OK.
Map variables.

SAS Decision Manager automatically maps the input variables in the rule set to columns in the input table when the names and data types of the variables match those of the table columns. If any input variables cannot be mapped automatically, an error message is displayed.

Data source: *

HMEQ_TEST

Variables

Input variables must be mapped to table columns. X

You can change the automatic variable mappings in the Variable Mappings window.

To change variable mappings:

a Click Variables. The Variable Mappings window appears.

b For each input variable, select the table column to which the variable should be mapped. Alternatively, for Decimal, Integer, and Character variables, you can select Use value for the table column, and specify a literal value in the Value column.

Note: Do not enclose character strings in quotation marks.

TIP To specify a missing value for character variables, select Use value and leave the Value column empty. When SAS Decision Manager generates code, it will generate an empty string (""). For numeric values, enter a period (.).

c Click OK to close the Variable Mappings window.

7 (Optional) Click Advanced to display the advanced options.

8 (Optional) Click and select the library where you want to write the output of the test.

9 (Optional) Select the version of the rule set that you want to test.

10 (Optional) Select Preserve unmapped columns in the output table if you want columns that are not mapped to an output variable to be written to the output table.

11 Click Run to run the test. Alternatively, click Save to save the test definition without running it.

The status of the test is indicated by the icon in the Status column.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>The test is not ready to run. The test definition is not complete, or it might contain errors.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test is defined correctly and is ready to run.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test is running.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test completed successfully.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test completed, but warnings were issued in the SAS log. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test did not run successfully. Check the SAS log for information. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
</tbody>
</table>
12 Click in the **Results** column to view the results of the test.

13 On the Test Results page, click **Test Results** in the navigation pane to display the URIs and other information for the test. Click **Output**, **Code**, or **Log** to display the output data set, the code that was generated by SAS Decision Manager, or the SAS log that was generated when the code was run.

### Run a Rule-Fired Analysis

If a rule's conditions evaluate to True, then the rule is said to have fired. Rule-fired data includes summary information about how many times each rule fired and detailed information for each time that a rule evaluates to True. See “How Rules Are Evaluated and When Rule-Fired Records Are Generated” on page 13 for more information.

1. On the Test Results page, click **Rule-Fired Analysis** in the navigation pane.
2. Click **Run Rule-Fired Analysis**. SAS Decision Manager analyzes the test results to determine which rules fired for each row in the input table, and displays the Analysis page.

   The Analysis page displays the number of runs that fired for each output record that was generated by the decision. The number in the **Rules Fired Count** column is a link to more information. You can click on this link to display the rules that fired for that output row.

   For example, the following displays shows the rule-fired analysis for the low_ratio rule set.

   ![Rule-Fired Analysis](image_url)

   3. Click on a number in the **Rule Fired Count** column. SAS Decision Manager displays the Rule Fired Count window. This window shows which rules produced the selected output record.
Click **Close** to close the Rule Fired Count window.

Click **Plot** in the navigation pane. SAS Decision Manager displays a bar chart that shows how many times each rule fired. Position your cursor over a bar to display the name of the rule and the number of times that the rule fired.
6  Click **Rule-Fired Analysis** in the navigation pane to display the URIs and other information for the rule-fired test.

7  Click **Close** to close the rule set.

### Working with Test Output Data

After you run a test, you can work with the output table in other SAS applications to analyze the data, create and compare models, discover relationships hidden in the data, and generate reports based on the data.

**Note:** The actions available to you depend on the applications that are available at your site.

On the Test Results page, select the **Output** table in the navigation pane, click **Actions**, and select one of the following options:

- **Explore Lineage**
  opens SAS Lineage Viewer. SAS Lineage Viewer enables you to better understand the relationships between objects in your SAS Viya applications. These objects include data, transformation processes, reports, and visualizations. For more information, see *SAS Lineage Viewer: User’s Guide*.

- **Explore and Visualize Data**
  opens the output table in SAS Visual Analytics. SAS Visual Analytics enables you to create, test, and compare models based on the patterns discovered during exploration of the data. You can export the model before or after performing model comparison for use with other SAS products or to put the model into production. SAS Visual Analytics supports a range of visualization, discovery, and reporting features. For more information, see *SAS Visual Analytics: Overview*. 
Prepare Data
opens the output table in SAS Data Studio. SAS Data Studio enables you to perform data transforms such as joining tables, appending data to a table, transposing columns, creating calculated columns, and so on. For more information, see *SAS Data Studio: User’s Guide*.

Manage Data
opens SAS Data Explorer. SAS Data Explorer enables you to import data, connect to databases, and load tables into memory. For more information, see *SAS Data Explorer: User’s Guide*.

---

**Publishing and Validating a Rule Set**

**Publish a Rule Set**

Publishing content makes it available to other applications. Publishing a rule set creates an entity that can be managed and run in another environment. For example, if you publish content to the SAS Micro Analytic Service destination, SAS Decision Manager creates a DS2 package that can be managed and run through the SAS Micro Analytic Service interface.

*Note:* The publishing destinations that are available are determined by your system administrator. See *SAS Viya Administration: Publishing Destinations* for more information.

You can publish a single rule set, or you can publish multiple rule sets at the same time. If you publish a single rule set, you have the opportunity to select a specific version to publish. If you publish multiple rule sets at the same time, SAS Decision Manager publishes the latest version of each one.

To publish a rule set:

1. On the Rule Sets page, select one or more check boxes for the rule sets that you want to publish. The version that is published is the latest version.
   Alternatively, open a single rule set. You can select the version that is published on the Versions tab.

2. (Optional) If you are publishing only one rule set, change the displayed version:
   a. Click the Versions tab.
   b. Select the version that you want to publish, and click Set Version.

3. Click ![](Publish.png) and select Publish. Alternatively, if you are publishing only one rule set, click Publish. The Publish Rule Sets window appears.

4. Select the destination to which you want to publish.
   *Note:* The publishing destinations that are available to you depend on what is configured at your site. See *SAS Viya Administration: Publishing Destinations* for more information.

5. (Optional) Expand the Items to Publish section.

6. (Optional) Edit the Published Name if you do not want to use the default published name. The maximum length and character restrictions differ depending on your destination. See Table 2.5.

*Table 2.5 Requirements and Restrictions for Published Names*

<table>
<thead>
<tr>
<th>Destination</th>
<th>Maximum Length</th>
<th>Requirements And Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAS Micro Analytic Service</td>
<td>32</td>
<td>The published name must start with a letter or underscore. It cannot contain spaces, special characters, or multi-byte characters.</td>
</tr>
<tr>
<td>Destination</td>
<td>Maximum Length</td>
<td>Requirements And Restrictions</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Teradata</td>
<td>128</td>
<td>The published name must start with a letter or an underscore. It cannot contain spaces, special characters, or multi-byte characters.</td>
</tr>
<tr>
<td>SAS Cloud Analytic Services (CAS)</td>
<td>128</td>
<td>The published name cannot contain single or double quotation marks.</td>
</tr>
<tr>
<td>Apache Hadoop</td>
<td>128</td>
<td>The published name cannot contain colons (:) or double quotation marks.</td>
</tr>
</tbody>
</table>

7. (Optional) If you have previously published the rule set, select the check box in the Replace column in order to replace the previously published item of the same name in the same destination.

8. (Optional) Select the Rule Fired Tracking check box if you want the published rule set to generate rule-fired data.

Note: You cannot select this option if you are publishing content to SAS Micro Analytic Service.

9. Publish the rule sets.

   - To publish content to a SAS Cloud Analytic Services (CAS) destination, you must reload the CAS destination table in order to make the newly published item available to other applications. Select one of the following options to publish the decision:
     
     **Publish**
     
     publishes the rule sets and automatically reloads the CAS destination table. If another user is executing the code for an item that was previously published to CAS while the destination table is being reloaded, reloading the table might cause temporary problems with accessing the table content. After the table is reloaded, all authorized users can access all items in the table.

     **Publish without reloading**
     
     publishes the rule sets but does not reload the CAS destination table. You must manually reload the table in order for the newly published items to be accessible.

   - To publish the rule set to a Teradata, Apache Hadoop, or SAS Micro Analytic Service destination, click Publish. You do not need to reload the destination table when you publish to these destinations.

   The Publishing Results window appears. It displays the name of the published rule set, its status, and information about any issues that were encountered while publishing the rule set.

10. After the status changes to Published successfully, click Close to close the Publishing Results window.

11. Click Close to close the rule set.

12. To view the publishing history for the rule set, click the History tab.

**Validate a Published Rule Set**

You can test the published rule set in the target publishing destination. When you publish the rule set, a validation test is automatically defined for that rule set in that destination. To run the publishing validation test:

1. On the Scoring tab, click the Publishing Validation tab. The 🔄 icon in the Status column indicates that the test has been defined.

2. Click on the test name. The Edit Publishing Validation Test window appears.

   Note: To generate the name of the publishing validation test, SAS Decision Manager appends a timestamp to the rule set name. The timestamp indicates when the rule set was published.
3 Click , and select the input table for the test.

Note: If you are validating content that was published to SAS Micro Analytic Service, the time required to run the test depends on the number of worker threads on your system, the number of threads in the middle tier, and the network latency between CAS and the middle tier server. It is recommended that you select an input table with as few input records as needed to accurately test the published content. See SAS Micro Analytic Service: Programming and Administration Guide for more information.

Note: If the input table contains a character column, and that column contains control characters in any row, do not use the table an input for publishing validation tests.

4 (Optional) Expand the Advanced section, click , and select a different library to store the validation test output data.

5 Click Run to run the test. Alternatively, click Save to save the test definition without running it.

The status of the test is indicated by the icon in the Status column.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The test is not ready to run. You must edit the test and select an input data source.</td>
</tr>
<tr>
<td>✔</td>
<td>The test is defined correctly and is ready to run.</td>
</tr>
<tr>
<td>✔</td>
<td>The test is running.</td>
</tr>
<tr>
<td>✔</td>
<td>The test completed successfully.</td>
</tr>
<tr>
<td>🚨</td>
<td>The test completed, but warnings were issued in the SAS log. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
<tr>
<td>✗</td>
<td>The test did not run successfully. Check the SAS log for information. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
</tbody>
</table>

6 Click in the Results column to view the test results.

7 On the Test Results page, click Test Results in the navigation pane to display the URIs and other information for the test. Click Output, Code, or Log to display the output data set, the code that was generated by SAS Decision Manager, or the SAS log that was generated when the code was run.

8 Click Close to close the rule set.
Working with Decisions

About Decisions ................................................................. 32
Create a Decision ................................................................. 32
Views for Editing a Decision .................................................. 32
  The Decision Flow Tab versus the Decision Tab ......................... 32
  Condition Nodes in Each Tab ................................................. 33
  Controlling the Tab Display ................................................. 33
Managing the Variables in a Decision ....................................... 34
  About Variables and Mapping ............................................... 34
  Import Variables from a Data Source ....................................... 35
  Import Variables from a Rule Set or Decision ............................ 35
  Create Custom Variables ..................................................... 35
  Delete Variables ................................................................... 36
  Edit Variable Properties ....................................................... 37
Using Custom Code Files ......................................................... 37
Adding Objects to a Decision ................................................... 38
  Add a Rule Set or Model ....................................................... 38
  Add an Existing Code File ..................................................... 38
  Add a New Code File ........................................................... 39
  Add a Condition .................................................................. 39
  Add an Object to a Condition Path ......................................... 40
Mapping Variables within a Decision ........................................ 40
Edit the Properties of a Decision Node ....................................... 41
Reorder Objects in a Decision .................................................. 42
Delete an Object from a Decision ............................................. 42
Open an Object from within a Decision ...................................... 42
Copy a Decision URL ............................................................. 42
Managing Decisions ............................................................... 43
  Duplicate Decisions ............................................................. 43
  Delete Decisions .................................................................. 43
  Rename a Decision ............................................................. 43
  Move Decisions to a Different Folder ....................................... 43
Managing Versions of Decisions ................................................. 44
  Set the Displayed Version ..................................................... 44
  Create a New Version .......................................................... 44
Testing a Decision ................................................................. 44
  Create and Run a New Test ................................................... 44
About Decisions

A decision enables you to combine rule sets, analytical models, and conditional logic into a single process. Explicitly defining a decision makes your organization’s decision-making process transparent, and enables you to monitor the process for accuracy.

Create a Decision

1. Click \( \text{new decision} \) on the navigation bar.
2. Click New Decision. The New Decision window appears.
3. Enter a name for the decision if you do not want to use the default name. Decision names are limited to 100 characters and must be unique within a folder.
4. (Optional) Enter a description for the new decision. Descriptions are limited to 1000 characters.
   
   **TIP** You can edit the description at any time on the Properties tab.

5. Click the new decision, and select the folder where you want to save the decision.
6. Click Save. SAS Decision Manager opens the new decision and displays the Decision Flow tab.

Views for Editing a Decision

The Decision Flow Tab versus the Decision Tab

There are two tabs on which you can view and edit decisions.

- The Decision Flow tab enables you to edit a decision by using a graphical editor. You add and rearrange nodes in the decision diagram by dragging them. You can add objects to a decision by clicking \( \text{add node} \) or by right-clicking on a node to display a pop-up menu.

- The Decision tab enables you to edit the decision by using a tabular view similar to the rule set editor. You add and rearrange objects in the decision by using menu options and clicking icons.

You can switch between the tabs according to your personal preference. Save your work before switching tabs. Click \( \text{Refresh} \) to refresh the view in a tab.
Condition Nodes in Each Tab


For example, suppose you have the following nodes on the Decision Flow tab:

The same nodes appear on the Decision tab as an IF-THEN-ELSE statement:

Controlling the Tab Display

On the Decision Flow tab:

- Click « to hide the properties pane.
- Click ☐ to open the diagram overview. The diagram overview is a scaled-down version of the entire diagram. The section that is currently visible on the screen is outlined. The overview is useful when a decision diagram is too large to display all of the nodes on one screen.
- Click ☐ to display the list of objects that you can add to a decision.
- Click ⬇️ and ⬆️ to enlarge or shrink the diagram.
- Click ☐ to resize the diagram to fill the display.

On the Decision tab:

- Click ◀ or ▶ to collapse or expand a single node in the decision.
- Click ▼ or ▲ to collapse or expand all of the nodes in the decision.
Managing the Variables in a Decision

To use a variable in an expression, you must either import the variable from another source or you must create it as a custom variable. You can import variables from data sources, rule sets, and decisions.

About Variables and Mapping

The Properties of a Variable

Table 3.1 describes the properties of a variable.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Variable names must start with a letter or an underscore (_), and they can contain only alphanumeric characters and the underscore. They can be up to 32 characters long and must be unique within a rule set. <strong>Note:</strong> Do not use any of these operators or keywords as variable names: AND, OR, IN, NOT, LIKE, TRUE, or FALSE. Do not use <em>N</em> or any DS2 reserved word as a variable name. See <em>SAS DS2 Programmer’s Guide</em> for information about reserved words in the DS2 language.</td>
</tr>
<tr>
<td>Data type</td>
<td>SAS Decision Manager supports the following data types: Boolean, character, data grid, date, datetime, decimal, and integer. For Boolean values, enter True and False. When SAS Decision Manager generates code, it represents Boolean values using the numbers one and zero. <strong>Note:</strong> For information about data grid variables, see “Using Data Grids in SAS Decision Manager” in SAS Decision Manager: Using Data Grids.</td>
</tr>
<tr>
<td>Input and Output</td>
<td>A variable can be an input variable, an output variable, both, or neither (a temporary variable). See “Input Variables, Output Variables, and Temporary Variables” on page 34 for more information.</td>
</tr>
<tr>
<td>Length</td>
<td>For character variables that are input-only variables or both input and output variables, the length is derived from the length of the column to which the variable is mapped when the decision is run. The maximum length for character variables is 32767. The length for Boolean and numeric variable types is set automatically.</td>
</tr>
<tr>
<td>Description</td>
<td>Descriptions are limited to 256 characters.</td>
</tr>
</tbody>
</table>

Input Variables, Output Variables, and Temporary Variables

For each variable used in a decision, you must specify whether the variable is an input variable, an output variable, both an input and an output variable, or a temporary variable.

- Input variables are variables that are present in the input table for a decision. When a decision is deployed in a production system, all input variables must be mapped to table columns in input data. When you test a decision in SAS Decision Manager, for each input variable, you must either map it to a table column or specify a constant as its input value. When you create or edit a variable, clear the Input check box for any variable that you do not want to be mapped to a column in an input table or for which you do not want to specify a value.
Output variables are variables that are written to the output table that is created when a decision is run. When you create or edit a variable, clear the **Output** check box for any variable that you want to exclude from the output data.

Temporary variables are variables that are not present in the input data and they are not written to the output table. To create a temporary variable for use only while a decision is executing, clear both the **Input** and **Output** check boxes.

When you create a new variable, it is created as both an input and output variable by default.

**Import Variables from a Data Source**

1. On the **Variables** tab, click **Add from Data Source**, or click **Add Variable** and select **Data Source**. The **Choose a Data Source** window appears.

2. Select the table from which you want to import variables, and click **OK**. The **Add Variables** window appears.

3. Select the variables that you want to import and click ➔. To import all of the variables in the table, click ➔.

4. Click **OK**.

5. On the **Variables** tab, select or clear the **Input** and **Output** check boxes as necessary. See “Input Variables, Output Variables, and Temporary Variables” on page 34 for more information.

**Import Variables from a Rule Set or Decision**

1. To enable the ability to import variables from a rule set or decision, you must first create a custom variable or import variables from a data source. For more information, see “Import Variables from a Data Source” on page 35 and “Create Custom Variables” on page 35.

2. On the **Variables** tab, click **Add Variable**, and select **Rule set** or **Decision**. The **Add Variables** window appears.

3. Select the rule set or decision from which you want to import variables.

4. Select the variables that you want to import and click ➔. To import all of the variables in the table, click ➔.

5. Click **OK**.

6. On the **Variables** tab, select or clear the **Input** and **Output** check boxes as necessary. See “Input Variables, Output Variables, and Temporary Variables” on page 34 for more information.

**Create Custom Variables**

**Create a Decimal Variable Dynamically**

On the **Decision Flow** tab, you can enter the new variable by entering the variable name in the **Variable** or **Variable or Value** property fields of a condition node. SAS Decision Manager creates a variable of type Decimal that is both an input variable and an output variable. For example, you can enter a Decimal variable named `daysLate` by entering it in the **Variable** field:
Create Custom Variables on the Variables Tab

Note: For information about data grid variables, see “Defining Data Grid Variables” in SAS Decision Manager: Using Data Grids.

To create custom variables on the Variables tab:

1. Click Add Custom Variables, or click Add Variable and select Custom variable. The Add Variables window appears.

2. Complete these steps for each variable that you want to add:
   a. Enter the name of the new variable, and select the data type of the variable. See Table 3.1 on page 34 for additional information.
   b. (Optional) Click ▶ to display the Length and Description fields.
   c. (Optional) Enter a length and description for the new variable. See Table 3.1 on page 34 for additional information.
   d. Click Add. SAS Decision Manager adds the new variable to the table of variables. By default, variables are added to the table as both input and output variables.
   e. (Optional) Clear the check boxes in the Input or Output columns.
      - Clear the Input check box for any variable that you do not want to be mapped to a column in an input table or for which you do not want to specify a value.
      - Clear the Output check box for any variable that you want to exclude from the output data.
      - Clear both the Input and Output check boxes to create a temporary variable.
      See Table 3.1 on page 34 for additional information.

3. Click OK to add the variables and close the Add Variables window.

Delete Variables

On the Variables tab, select the check box for the variables that you want to delete, click ⏐ and select Delete.

Note: You cannot delete a variable if it is used in a rule set or decision.
Edit Variable Properties

On the Variables tab, click on the variable name of the variable that you want to edit. The Edit Variable window appears. Edit the properties as needed, and then click Save. See Table 3.1 on page 34 for additional information.

Using Custom Code Files

You can define a custom DS2 package, and then add this package to decisions by using code file nodes. You can use code files to do many things that are not possible in rules or models, such as iterate through a data grid or make HTTP calls to REST APIs.

When you are developing your DS2 package, follow these rules:

- Do not change the package name in the PACKAGE statement:

  ```
  package "${PACKAGE_NAME}" /inline;
  ```

  This variable is replaced with a package name that SAS Decision Manager uses to maintain the relationship between the code file and the decisions that use it.

- Do not specify any DS2 options (DS2_OPTIONS statement) in your package code.

- Custom code files in SAS Decision Manager support only three data types: double, varchar, and dcm_datagrid. These data type names are case sensitive. For example, the following lines define the variables LOAN, REASON, and ASSETS.

  ```
  double "loan"
  IN_OUT varchar "reason"
  package dcm_datagrid "assets"
  ```

- Your package must define an EXECUTE method.

For example, the following DS2 package sends a request to the external API http://helloacm.com/api/fortune. This API returns a character string that contains escaped characters. The GETFORTUNE method uses the DS2 function TRANSTRN to modify these characters.

```
For information about developing DS2 packages, processing data grids, and the SAS APIs, see the following:

- SAS DS2 Programmer’s Guide
- SAS DS2 Language Reference
- SAS Decision Manager: Using Data Grids
- http://developer.sas.com

Important: Any changes that you make to a code file affect all decisions that use that code file.

### Adding Objects to a Decision

By default, new objects are added immediately after the currently selected object. If no object is currently selected, the decision editor adds the new object at the beginning of the decision. If the currently selected object is a condition and the condition is expanded, the decision editor adds the new object to the THEN clause. See “Reorder Objects in a Decision” on page 42 for information about reordering the objects in a decision.

**Note:** On the Decision tab, you cannot add a new object to a decision when the selected object is a condition and the condition is collapsed.

#### Add a Rule Set or Model

1. On the Decision Flow tab, drag the Rule Set or Model object from the list of objects onto the diagram where you want to add it. The Select a Rule Set or Select a Model window appears.

   Alternatively, on the Decision tab, click Add and select Add rule set or Add model. The Select a Rule Set or Select a Model window appears.

2. Select the rule set or model that you want to add, and click OK. By default, the current unlocked version of the rule set or model is added to the decision.

   **Note:** If a new version of a model is created and the decision is not locked, the decision is updated to use the new version of the model.

3. (Optional) Select a different version of the rule set. Edit the properties of the node and change the version. See “Edit the Properties of a Decision Node” on page 41 for more information.

   **Note:** You cannot change the version of a model that is in a decision.

#### Add an Existing Code File

1. On the Decision Flow tab, drag the Code File object from the list of objects onto the diagram where you want to add it. Alternatively, on the Decision tab, click Add and select Add code file. The Select a Code File window appears.

2. Select the code that you want to add, and click OK.
**Add a New Code File**

1. On the **Decision Flow** tab, drag the **Code File** object from the list of objects onto the diagram where you want to add it. Alternatively, on the **Decision** tab, click **Add** and select **Add code file**. The Select a Code File window appears.


3. Enter a name for the code file if you do not want to use the default name. Code file names are limited to 255 characters and must be unique within a folder.

4. (Optional) Enter a description for the new code file. Descriptions are limited to 1000 characters.

   **TIP** You can edit the description at any time on the **Properties** tab.

5. Click ☐, and select the folder where you want to save the code file.

6. Click **Save**. SAS Decision Manager creates a new code file and adds it to the decision.

7. Right-click the code file and select **Open**. The code file opens in the code editor. SAS Decision Manager adds a basic DS2 package template to the file:

   ```
   package "$\{PACKAGE_NAME}\" /inline;
   method execute();
   end;
   endpackage;
   ```

8. Add your custom DS2 code to the file. For information, see “Using Custom Code Files” on page 37.

9. Click ☐ and **Close** to save and close the code file.

**Add a Condition**

Note: When you add a condition, any objects that follow the currently selected object become part of the ELSE clause in the condition.

1. On the **Decision Flow** tab, drag the **Condition** object from the list of objects onto the diagram where you want to add it. The condition is added to the decision flow, and the **Properties** pane for the condition opens.

   Alternatively, on the **Decision** tab, click **Add** and select **Add condition**. SAS Decision Manager adds an IF-THEN-ELSE statement to the decision.

2. On the **Decision Flow** tab, in the **Variable** field on the **Properties** pane, select the first variable in the condition expression.

   Alternatively, on the **Decision** tab, in the first field of the IF condition, select the first variable in the condition expression.

3. Select the expression operator.

4. Select **Value** or **Variable** for the comparison mode.

   **Value**
   - compares the first variable to a literal value. The condition becomes *first-variable operator value*.

   **Variable**
   - compares the first variable to the value of a second variable. The condition becomes *first-variable operator second-variable*.
5 Select a variable or enter a literal value in the **Variable or Value** field, depending on which choice you made in **Step 4**.

For example, the condition expression \( \text{DEBTINC} > 35.5 \) appears on the **Decision** tab as follows:

```
If DEBTINC > Value 35.5 Then
```

The following figure shows the same condition as it appears on the **Properties** pane on the **Decision Flow** tab:

**Properties**

- **Variable**: DEBTINC
- **Operator**: >
- **Comparison mode**: Value
- **Variable or Value**: 35.5

---

**Add an Object to a Condition Path**

On the **Decision Flow** tab, right-click on the condition node, and select one of the following options:

**Add to yes path**

- opens the selection window for the selected object type type. After you select the object that you want to add to the decision, SAS Decision Manager adds it to the Yes path in the decision. This path is executed if the condition expression on the condition node evaluates to True.

**Add to no path**

- opens the selection window for the selected object type type. After you select the object that you want to add to the decision, SAS Decision Manager adds it to the No path in the decision. This path is executed if the condition expression on the condition node evaluates to False.

On the **Decision** tab, the condition paths are THEN and ELSE clauses. See “**Condition Nodes in Each Tab**” on page 33 for more information. For more information about adding objects to THEN and ELSE clauses, see “**Add a Rule Set or Model**” on page 38 and “**Add a Condition**” on page 39.

---

**Mapping Variables within a Decision**

Rule sets, models, and code files each define their own variables. When you add a rule set, model, or code file to a decision, SAS Decision Manager automatically defines decision variables that have the same name and data type as the object’s variables. The rule set, model, and code file variables must be mapped to decision variables. SAS Decision Manager automatically maps the rule set, model, and code file variables to the decision variables that have the same name and data type.
You can create decision variables with different names, and change the decision variable mappings on the **Input Variables** and **Output Variables** property panes for objects in the decision.

For example, suppose you have a decision named Credit Approval, and this decision contains a model named Loan Default and a rule set named Evaluate Credit. The model has an output variable named `em_prob`. The value of this variable must be passed as input to the Evaluate Credit rule set, but the rule set is expecting a variable named `probability`. In order for the value to be passed to the rule set, you must map the output variable of the model, `em_prob`, to the decision variable `em_prob`, and you must map the input variable of the rule, `probability`, to the decision variable `em_prob`.

![Diagram of Credit Approval Decision Variables](image)

**Important:** When the decision is published and run in a production environment, the decision expects the input data to contain variables that have the same name and data type as the decision’s input variables.

---

**Edit the Properties of a Decision Node**

On the **Decision Flow** tab:

1. Select the node and click ⌁. The **Properties** pane appears.
2. (Optional) Select a different model, rule set, or rule set version for the selected node.
3. (Optional) Click ⌁. The **Input Variables** pane appears.
4. (Optional) Modify the input variable mappings for the selected node.
5. (Optional) Click ⌁. The **Output Variables** pane appears.
6. (Optional) Modify the output variable mappings for the selected node.

On the **Decision** tab:
1 Click 📐 for the node. The properties window for the node appears.

2 (Optional) On the Variables tab, modify the variable mappings.

3 (Optional) On the Properties tab, select a different model, rule set, or rule set version.

4 Click Close to save your changes and close the properties window.

---

**Reorder Objects in a Decision**

On the Decision Flow tab, you can drag rule sets, models, and code files from one position to another. To move a condition, you must delete and re-add the condition in the new location.

On the Decision tab, to move an object up or down, including into and out of conditions, select the object and click ↑ or ↓. You can also move the selected object by using Shift + ↑ and Shift + ↓.

---

**Delete an Object from a Decision**

On the Decision Flow tab, click 🗑️ on the object that you want to delete, and select Delete.

On the Decision tab, click 🗑️ on the object that you want to delete.

---

**Open an Object from within a Decision**

On a node in the Decision Flow diagram, click 📐 for the object that you want to open, and select Open.

Rule sets open in the rule set editor. Code files open in the code editor. Models open in SAS Model Manager if you have access to that application. For condition nodes, SAS Decision Manager displays the property pane for the node.

---

**Copy a Decision URL**

To create a link for external documentation that automatically opens a decision in SAS Decision Manager, complete these steps:

1 Open the decision.

2 Click 📐, and select Copy object URL. The Copy Decision URL window appears.

3 Click Copy, and then click Close.

   Paste the link into your documentation.
Managing Decisions

Duplicate Decisions

Note: You cannot duplicate a decision if it is open.

To duplicate a single decision:

1. In the Decisions view, select the decision that you want to duplicate.
2. Click ☰ and select Duplicate. The Duplicate Decision window appears.
3. Enter a new name for the duplicate decision.
4. (Optional) Enter a description for the decision.
5. Click Duplicate.

To duplicate multiple decisions:

1. In the Decisions view, select the decisions that you want to duplicate.
2. Click ☰ and select Duplicate. SAS Decision Manager duplicates the decisions and appends _Copy to the names of the duplicate copies. If needed, a number is also appended to the names of the duplicate copies.

Delete Decisions

Note: You cannot delete a decision if it is open.

In the Decisions category view, select the decisions that you want to delete, click ☰, and select Delete.

Rename a Decision

Note: You cannot rename a decision if it is open.

1. In the Decisions category view, select the decision that you want to rename.
2. Click ☰ and select Rename. The Rename window appears.
3. Enter a new name for the decision, and click Rename.

Move Decisions to a Different Folder

1. In the Decisions category view, select the decisions that you want to move.
2. Click ☰ and select Move. The Choose a Location window appears.
3. Select the location to which you want to move the decisions, and click OK.
Managing Versions of Decisions

Set the Displayed Version

The displayed version is the version whose information is displayed on the other tabs, such as the Properties and Decision tabs. On the Versions tab, a ✓ indicates the displayed version. To change the displayed version, select the version that you want to view, and click Set Version.

Create a New Version

Note: The current version of an object is the version with the highest version number. When you create a new version, SAS Decision Manager locks the current version before it creates the new version.

Note: You cannot save changes to a version that is locked. If you modify a version that is locked and click , SAS Decision Manager asks you if you want to replace the current unlocked version with your edited version.

Note: You cannot unlock a locked version.

To create a new version:


2 Select the version type: Minor or Major. Version numbers follow the format Major.Minor. If you select Major, the number to the left of the period is incremented. If you select Minor, the number to the right of the period is incremented.

3 (Optional) Enter information about the new version in the Notes field.

   TIP You can edit these notes at any time on the Versions tab.

4 Click Save.

Testing a Decision

Create and Run a New Test

Testing a decision is optional, but doing so is a best practice. Testing enables you to discover any problems before the decision is published and incorporated into a production system.

1 On the Scoring tab, click the Tests tab.

2 Click New Test. The New Test window appears.

3 Enter a name for the test if you do not want to use the default name.

4 (Optional) Enter a description for the test. Descriptions are limited to 1000 characters.

5 Click , select the input table for the test, and click OK.

6 Map variables.
SAS Decision Manager automatically maps the input variables in the decision to columns in the input table when the names and data types of the variables match those of the table columns. If any input variables cannot be mapped automatically, an error message is displayed.

You can change the automatic variable mappings in the Variable Mappings window.

To change variable mappings:

a. Click Variables. The Variable Mappings window appears.

b. For each input variable, select the table column to which the variable should be mapped. Alternatively, for Decimal, Integer, and Character variables, you can select Use value for the table column, and specify a literal value in the Value column.

Note: Do not enclose character strings in quotation marks.

TIP To specify a missing value for character variables, select Use value and leave the Value column empty. When SAS Decision Manager generates code, it will generate an empty string (" "). For numeric values, enter a period (.)

c. Click OK to close the Variable Mappings window.

7 (Optional) Click Advanced to display the advanced options.

8 (Optional) Click and select the library where you want to write the output of the test.

9 (Optional) Select the version of the decision that you want test.

10 (Optional) Select Preserve unmapped columns in the output table if you want columns that are not mapped to an output variable to be written to the output table.

11 Click Run to run the test. Alternatively, click Save to save the test definition without running it.

The status of the test is indicated by the icon in the Status column.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>The test is not ready to run. The test definition is not complete, or it might contain errors.</td>
</tr>
<tr>
<td>⚫</td>
<td>The test is defined correctly and is ready to run.</td>
</tr>
<tr>
<td>🌴</td>
<td>The test is running.</td>
</tr>
<tr>
<td>✔</td>
<td>The test completed successfully.</td>
</tr>
<tr>
<td>🍀</td>
<td>The test completed, but warnings were issued in the SAS log. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
<tr>
<td>⚠</td>
<td>The test did not run successfully. Check the SAS log for information. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
</tbody>
</table>

12 Click in the Results column to view the results of the test.
On the Test Results page, click Test Results in the navigation pane to display the URIs and other information for the test. Click Output, Code, or Log to display the output data set, the code that was generated by SAS Decision Manager, or the SAS log that was generated when the code was run.

**Run a Rule-Fired Analysis**

If a rule’s conditions evaluate to True, then the rule is said to have fired. Rule-fired data includes summary information about how many times each rule fired and detailed information for each time that a rule evaluates to True. See “How Rules Are Evaluated and When Rule-Fired Records Are Generated” on page 13 for more information.

1. On the Test Results page, click Rule-Fired Analysis in the navigation pane.

2. Click Run Rule-Fired Analysis. SAS Decision Manager analyzes the test results to determine which rules fired for each row in the input table, and displays the Analysis page.

   The Analysis page displays the number of runs that fired for each output record that was generated by the decision. The number in the Rules Fired Count column is a link to more information. You can click on this link to display the rules that fired for that output row.

   For example, in the following display there is one output record for which two rules fired.

3. Click on a number in the Rule Fired Count column. SAS Decision Manager displays the Rule Fired Count window. This window shows which rules produced the selected output record.

   **Note:** If a decision contains only models, the rule-fired analysis tables are not generated.
4 Click **Close** to close the Rule Fired Count window.

5 Click **Plot** in the navigation pane. SAS Decision Manager displays a bar chart that shows how many times each rule fired. Position your cursor over a bar to display the name of the rule and the number of times that the rule fired.

**Note:** If a decision contains only models, the rule-fired plot is not generated.
6 Click **Rule-Fired Analysis** in the navigation pane to display the URIs and other information for the rule-fired test.

7 Click **Close** to close the decision.

**Run a Path Tracking Analysis**

Decision path tracking shows you the route that input records take through the rule sets, models, and conditions in your decision.

1 Click **Decision Path Tracking** in the navigation pane.

2 Click **Run Path Tracking** to run a decision path analysis.

3 Click **Analysis and Plot** to display a Sankey diagram that shows the flow of the input records through the rule sets, models, code files, and conditions in the decision. The numbers in the diagram are the number of rows in the input table that followed each path.
Note: Nodes that are not executed are shown to the right of the Sankey diagram.

4 Click **Node Count** in the navigation pane to display a table showing the number of input records evaluated at each rule set, code file, and model node in the decision.

5 Click **Close** to close the Test Results window.

**Working with Test Output Data**

After you run a test, you can work with the output table in other SAS applications to analyze the data, create and compare models, discover relationships hidden in the data, and generate reports based on the data.

Note: The actions available to you depend on the applications that are available at your site.

On the Test Results page, select the **Output** table in the navigation pane, click **Actions**, and select one of the following options:

**Explore Lineage**

opens SAS Lineage Viewer. SAS Lineage Viewer enables you to better understand the relationships between objects in your SAS Viya applications. These objects include data, transformation processes, reports, and visualizations. For more information, see *SAS Lineage Viewer: User’s Guide*. 
Explore and Visualize Data
opens the output table in SAS Visual Analytics. SAS Visual Analytics enables you to create, test, and compare models based on the patterns discovered during exploration of the data. You can export the model before or after performing model comparison for use with other SAS products or to put the model into production. SAS Visual Analytics supports a range of visualization, discovery, and reporting features. For more information, see SAS Visual Analytics: Overview.

Prepare Data
opens the output table in SAS Data Studio. SAS Data Studio enables you to perform data transforms such as joining tables, appending data to a table, transposing columns, creating calculated columns, and so on. For more information, see SAS Data Studio: User’s Guide.

Manage Data
opens SAS Data Explorer. SAS Data Explorer enables you to import data, connect to databases, and load tables into memory. For more information, see SAS Data Explorer: User’s Guide.

Publishing and Validating a Decision

Publish a Decision
Publishing content makes it available to other applications. Publishing a decision creates an entity that can be managed and run in another environment. For example, if you publish content to the SAS Micro Analytic Service destination, SAS Decision Manager creates a DS2 package that can be managed and run through the SAS Micro Analytic Service interface.

Note: The publishing destinations that are available are determined by your system administrator. See SAS Viya Administration: Publishing Destinations for more information.

Important: If you are publishing a decision that includes an Analytic store model, the model’s analytic store (ASTORE) file must be in the /opt/sas/viya/config/data/modelsvr/astore directory on the CAS server for the destination to which you are publishing the decision. The ASTORE file is copied to that location when you do any of the following:

- run a decision test for the decision that uses the Analytic store model
- set the model as a project champion in SAS Model Manager
- publish the model to SAS Micro Analytic Service from SAS Model Manager

If you are publishing a decision that includes an Analytic store model and the model has not been set as a project champion or published from SAS Model Manager, you must test the decision before you publish it. For more information, see "Configuring Access to Analytic Store Models" in SAS Decision Manager: Administrator’s Guide and "Testing a Decision" on page 44.

You can publish a single decision, or you can publish multiple decisions at the same time. If you publish a single decision, you have the opportunity to select a specific version to publish. If you publish multiple decisions at the same time, SAS Decision Manager publishes the latest version of each one.

To publish a decision:

1. On the Decisions page, select one or more check boxes for the decisions that you want to publish. The version that is published is the latest version.
   Alternatively, open a single decision. You can select the version that is published on the Versions tab.

2. (Optional) If you are publishing only one decision, change the displayed version:
   a. Click the Versions tab.
b Select the version that you want to publish, and click **Set Version**.

3 Click and select **Publish**. Alternatively, if you are publishing only one decision, click **Publish**. The Publish Decisions window appears.

4 Select the destination to which you want to publish.
   
   **Note:** The publishing destinations that are available to you depend on what is configured at your site. See *SAS Viya Administration: Publishing Destinations* for more information.

5 (Optional) Expand the **Items to Publish** section.

6 (Optional) Edit the **Published Name** if you do not want to use the default published name. The maximum length and character restrictions differ depending on your destination. See Table 3.2.

   **Table 3.2 Requirements and Restrictions for Published Names**

<table>
<thead>
<tr>
<th>Destination</th>
<th>Maximum Length</th>
<th>Requirements And Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAS Micro Analytic Service</td>
<td>32</td>
<td>The published name must start with a letter or underscore. It cannot contain spaces, special characters, or multi-byte characters.</td>
</tr>
<tr>
<td>Teradata</td>
<td>128</td>
<td>The published name must start with a letter or an underscore. It cannot contain spaces, special characters, or multi-byte characters.</td>
</tr>
<tr>
<td>SAS Cloud Analytic Services (CAS)</td>
<td>128</td>
<td>The published name cannot contain single or double quotation marks.</td>
</tr>
<tr>
<td>Apache Hadoop</td>
<td>128</td>
<td>The published name cannot contain colons (:) or double quotation marks.</td>
</tr>
</tbody>
</table>

7 (Optional) If you have previously published the decision, select the check box in the **Replace** column in order to replace the previously published item of the same name in the same destination.

8 (Optional) Select the **Rule Fired Tracking** check box if you want the published decision to generate rule-fired data.
   
   **Note:** You cannot select this option if you are publishing content to SAS Micro Analytic Service.

9 (Optional) Select the **Path Tracking** check box if you want the published decision to generate path tracking results data.
   
   **Note:** You cannot select this option if you are publishing content to SAS Micro Analytic Service.

10 Publish the decisions.

   - To publish content to a SAS Cloud Analytic Services (CAS) destination, you must reload the CAS destination table in order to make the newly published item available to other applications. Select one of the following options to publish the decision:
     
     **Publish** publishes the decisions and automatically reloads the CAS destination table. If another user is executing the code for an item that was previously published to CAS while the destination table is being reloaded, reloading the table might cause temporary problems with accessing the table content. After the table is reloaded, all authorized users can access all items in the table.

     **Publish without reloading** publishes the decisions but does not reload the CAS destination table. You must manually reload the table in order for the newly published items to be accessible.
To publish the decision to a Teradata, Apache Hadoop, or SAS Micro Analytic Service destination, click **Publish**. You do not need to reload the destination table when you publish to these destinations.

The Publishing Results window appears. It displays the name of the published decision, its status, and information about any issues that were encountered while publishing the decision.

11 After the status changes to **Published successfully**, click **Close** to close the Publishing Results window.

12 Click **Close** to close the decision.

13 To view the publishing history for the decision, click the **History** tab.

### Validate a Published Decision

You can test the published decision in the publishing destination. When you publish the decision, a validation test is automatically defined for that decision in that destination. To run the publishing validation test:

1 On the **Scoring** tab, click the **Publishing Validation** tab. The icon in the **Status** column indicates that the test has been defined.

2 Click on the test name. The Edit Publishing Validation Test window appears.

   **Note:** To generate the name of the publishing validation test, SAS Decision Manager appends a timestamp to the decision name. The timestamp indicates when the decision was published.

3 Click **Run**, and select the input table for the test.

   **Note:** If you are validating content that was published to SAS Micro Analytic Service, the time required to run the test depends on the number of worker threads on your system, the number of threads in the middle tier, and the network latency between CAS and the middle tier server. It is recommended that you select an input table with as few input records as needed to accurately test the published content. See *SAS Micro Analytic Service: Programming and Administration Guide* for more information.

   **Note:** If the input table contains a character column, and that column contains control characters in any row, do not use the table an input for publishing validation tests.

4 (Optional) Expand the **Advanced** section, click **Run**, and select a different library to store the validation test output data.

5 Click **Run** to run the test. Alternatively, click **Save** to save the test definition without running it.

The status of the test is indicated by the icon in the **Status** column.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>The test is not ready to run. You must edit the test and select an input data source.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test is defined correctly and is ready to run.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test is running.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test completed successfully.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test completed, but warnings were issued in the SAS log. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>The test did not run successfully. Check the SAS log for information. The URI to the log file is shown on the Test Results page. See Step 12.</td>
</tr>
</tbody>
</table>
6 Click in the Results column to view the test results.

7 On the Test Results page, click Test Results in the navigation pane to display the URIs and other information for the test. Click Output, Code, or Log to display the output data set, the code that was generated by SAS Decision Manager, or the SAS log that was generated when the code was run.

8 Click Close to close the decision.
Using Lookup Tables and Functions

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Lookup Tables and Functions</td>
<td>55</td>
</tr>
<tr>
<td>CSV File Imported Into SAS Decision Manager</td>
<td>56</td>
</tr>
<tr>
<td>Create a New Lookup Table</td>
<td>56</td>
</tr>
<tr>
<td>Import or Refresh Lookup Table Entries</td>
<td>56</td>
</tr>
<tr>
<td>Export a Lookup Table</td>
<td>57</td>
</tr>
<tr>
<td>Add Lookup Table Entries</td>
<td>57</td>
</tr>
<tr>
<td>Edit Lookup Table Entries</td>
<td>57</td>
</tr>
<tr>
<td>Delete Lookup Table Entries</td>
<td>57</td>
</tr>
<tr>
<td>Copy a Lookup Table URL</td>
<td>58</td>
</tr>
<tr>
<td>Managing Lookup Tables</td>
<td>58</td>
</tr>
<tr>
<td>Duplicate Lookup Tables</td>
<td>58</td>
</tr>
<tr>
<td>Delete Lookup Tables</td>
<td>58</td>
</tr>
<tr>
<td>Rename a Lookup Table</td>
<td>58</td>
</tr>
<tr>
<td>Move Lookup Tables</td>
<td>58</td>
</tr>
<tr>
<td>Managing Versions of Lookup Tables</td>
<td>59</td>
</tr>
<tr>
<td>Set the Displayed Version</td>
<td>59</td>
</tr>
<tr>
<td>Create a New Version</td>
<td>59</td>
</tr>
<tr>
<td>Activate a Lookup Table</td>
<td>59</td>
</tr>
<tr>
<td>LOOKUP Function</td>
<td>60</td>
</tr>
<tr>
<td>LOOKUPVALUE Function</td>
<td>61</td>
</tr>
</tbody>
</table>

**About Lookup Tables and Functions**

SAS Decision Manager provides the ability to import lookup tables and reference them from rules. Lookup tables are tables of key-value pairs. For example, you can use a lookup table to retrieve a part name based on the code number of the part or to retrieve the full name for a country based on its abbreviation.

You can import lookup data from comma-separated-values (CSV) files, such as those created by spreadsheet applications, into lookup tables in SAS Decision Manager. You can re-import updated CSV files as needed to refresh the lookup tables.

**Note:** SAS Decision Manager does not support CSV files that contain signature lines.
In a lookup table, each lookup key is associated with a lookup value. Lookup keys must be unique within each lookup table.

SAS Decision Manager provides two functions, LOOKUP and LOOKUPVALUE, that enable you to determine whether a lookup key exists in a lookup table and to retrieve a lookup value from a lookup table.

Create a New Lookup Table

1. Click on the navigation bar.
2. Click New Lookup Table. The New Lookup Table window appears.
3. Enter a name for the new lookup table. Lookup table names are limited to 250 characters. Lookup table names are case insensitive and must be unique within the database.
4. (Optional) Enter a description for the new lookup table. Descriptions are limited to 1000 characters.
   
   **TIP** To modify this description at any time, click next to the Description field on the Properties tab.
5. Click , select the folder where you want to create the new lookup table, and click Save. The application opens the new lookup table and displays the Lookup Table tab.
6. Add entries to the new table either by importing a CSV file or by adding entries manually. See “Import or Refresh Lookup Table Entries” on page 56 and “Add Lookup Table Entries” on page 57 for more information.

Import or Refresh Lookup Table Entries

**Note:** It is recommended that a single lookup table contains no more than 5000 entries.

You can import entries into an empty table, and you can refresh an existing lookup table by re-importing the same table.

1. Open the lookup table to which you want to import entries.
2. Click Import. The Import Lookup Table window appears.
3 Click 📄, and select the CSV file that contains the lookup table entries.

4 Select the encoding for the lookup table, and click **Import**.

---

**Export a Lookup Table**

To export a lookup table, open the lookup table and click **Export**. The table is exported into a CSV file, and a notification appears in the download bar at the bottom of the browser window.

---

**Add Lookup Table Entries**

**Note:** It is recommended that a single lookup table contains no more than 5000 entries.

![TIP](image)

**You cannot add new entries to a lookup table version that has been activated. In order to edit the table, you must create a new version.**

1 Open the lookup table to which you want to add entries.

2 Click **New Entries** if the lookup table is empty, or click 👉 if the lookup table already contains entries. The **Add Table Entries** window appears.

3 Enter the lookup key name and value for the new entry. Key names and lookup values are each limited to 100 characters. Key names must be unique within the same lookup table.

   To add additional entries, click **Add an entry**, and enter the new key name and value.

4 Click **Save** to save the new entries and close the **Add Table Entries** window.

---

**Edit Lookup Table Entries**

![TIP](image)

**You cannot edit entries in a lookup table version that has been activated. In order to edit the table, you must create a new version.**

1 Open the lookup table.

2 Select the entries that you want to edit, and click 👍. The **Edit Table Entries** window appears.

3 Edit the exiting entries, and click **Save**.

---

**Delete Lookup Table Entries**

1 Open the lookup table.

2 Select the entries that you want to delete and click 🗑️.
Copy a Lookup Table URL

To create a link for external documentation that automatically opens a lookup table in SAS Decision Manager, complete these steps:

1. Open the lookup table.
2. Click ☐, and select Copy object URL. The Copy Lookup URL window appears.
3. Click Copy, and then click Close.
   Paste the link into your documentation.

Managing Lookup Tables

Duplicate Lookup Tables

Note: If you duplicate a lookup table that has an active version, the duplicate table is automatically activated.

To duplicate a single lookup table:

1. Select the table that you want to duplicate, click ☐, and select Duplicate.
2. Enter a new name for the duplicate lookup table. Names are limited to 250 characters. Lookup table names are case insensitive and must be unique within the database.
3. (Optional) Enter a description for the duplicate table. Descriptions are limited to 1000 characters.
4. Click Duplicate.

To duplicate multiple lookup tables, select the tables that you want to duplicate, click ☐, and select Duplicate. SAS Decision Manager appends an -Copy and a number (if needed) to the duplicate table names.

Delete Lookup Tables

Select the tables that you want to delete, click ☐, and select Delete.

Rename a Lookup Table

1. Select the table that you want to rename, click ☐, and select Rename. The Rename window appears.
2. Enter a new name for the table, and click Rename.

Move Lookup Tables

1. Select the tables that you want to move, click ☐, and select Move. The Choose a Location window appears.
2. Select the folder where you want to move the tables, and click OK.
Managing Versions of Lookup Tables

Creating a new version of a lookup table does not lock the previous version. The only way to lock a lookup table is to activate it.

Set the Displayed Version

The displayed version is the version whose information is displayed on the Lookup Table tab. On the Versions tab, a ✓ indicates the displayed version. To change the displayed version, select the version that you want to view, and click Set Version.

Create a New Version

Note: The current version of an object is the version with the highest version number. When you create a new version, SAS Decision Manager locks the current version before it creates the new version.

Note: You cannot save changes to a version that is locked. If you modify a version that is locked and click ✓, SAS Decision Manager asks you if you want to replace the current unlocked version with your edited version.

Note: You cannot unlock a locked version.

To create a new version:


2. Select the version type: Minor or Major. Version numbers follow the format Major.Minor. If you select Major, the number to the left of the period is incremented. If you select Minor, the number to the right of the period is incremented.

3. (Optional) Enter information about the new version in the Notes field.

   **TIP** You can edit these notes at any time on the Versions tab.

4. Click Save.

Activate a Lookup Table

The active version of a lookup table is the version that is used when the lookup table is referenced by running processes.

Note: Activating a version of a lookup table locks that version. Locked tables cannot be unlocked. In order to edit the lookup entries, you must create a new version.

You must activate a lookup table before you can use it in a rule.

1. Open the lookup table that you want to activate.

2. On the Versions tab, select the version that you want to activate, and set it as the displayed version. See “Set the Displayed Version” on page 59 for more information.

   **TIP** You can also activate a lookup table on the Properties tab. The displayed version is activated.
3 Click **Activate**.

## LOOKUP Function

Determines whether a lookup key exists in a lookup table.

**Restrictions:**
- You can specify the LOOKUP function in condition expressions only.
- If an expression contains the LOOKUP function, then the expression cannot contain anything else.

**Returned data type:**
- Boolean

**Syntax**

```
LOOKUP ('lookup_table_name', variable)
```

**lookup_table_name**
- specifies the name of the lookup table that you want to search.

**variable**
- specifies the variable that contains a lookup key value.

**Example**

Suppose you have a Country_Codes lookup table that uses two-letter abbreviations for countries as the lookup key and country names as the lookup values.

<table>
<thead>
<tr>
<th>Key</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>Australia</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
</tr>
<tr>
<td>CA</td>
<td>Canada</td>
</tr>
<tr>
<td>CR</td>
<td>Costa Rica</td>
</tr>
</tbody>
</table>

To verify that the value of the variable Cntry_Key exists as a lookup key in the table Country_Codes, you can use the following expression:

```
LOOKUP ('Country_Codes', Cntry_Key)
```

If the value of Cntry_Key exists as a lookup key, the LOOKUP function returns the value **True**.

In the following rule, if the key specified by the variable Cntry_Key exists in the lookup table Country_Codes, then the value that is associated with that key is assigned to the variable Country_Name.
LOOKUPVALUE Function

Retrieves a lookup value from a lookup table.

Restrictions:
- You can specify the LOOKUPVALUE function only in action expressions.
- If an expression contains the LOOKUPVALUE function, then the expression cannot contain anything else.

Returned data type:
- Lookup tables are stored as character data. However, you can assign the results of the LOOKUPVALUE function to the following types of variables: Character, Integer, Decimal, Date, Datetime, or Boolean. The LOOKUPVALUE function converts the results to match the type of the variable.

Syntax

LOOKUP ('lookup_table_name', variable)

lookup_table_name
- specifies the name of the lookup table that you want to search.

variable
- specifies the lookup key for the value that you want to retrieve.

Example

Suppose you have a Country_Codes lookup table that uses two-letter abbreviations for countries as the lookup key and country names as the lookup values. The Country_Codes lookup table contains the lookup key CA, and the lookup value that corresponds to that key is Canada.

<table>
<thead>
<tr>
<th>Key</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>Australia</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
</tr>
<tr>
<td>CA</td>
<td>Canada</td>
</tr>
<tr>
<td>CR</td>
<td>Costa Rica</td>
</tr>
</tbody>
</table>

If the Cntry_Key variable in the current input record contains the value CA, you can use the following expression to retrieve the lookup value that is associated with that key from the table Country_Codes:

LOOKUPVALUE('Country_Codes', Cntry_Key)

In the following rule, if the key specified by the variable Cntry_Key exists in the lookup table Country_Codes, then the value that is associated with that key is assigned to the variable Country_Name.

If Lookup('Country_Codes', Cntry_Key)
Then Assign Country_Name LookupValue('Country_Codes', Cntry_Key)