Using IBM Operational Decision Manager
IMS COBOL BMP, COBOL DLIBATCH, and COBOL MPP

Provides a step-by-step guide for calling ODM from IMS MPP, BMP, and DL/I applications

Discusses IMS applications' usage of ODM as a Rules System

Considers the configuration changes required in IMS

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This edition applies to IBM Operational Decision Manager (ODM) Version 8.0.
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Preface

IBM® Operational Decision Manager (ODM) is an implementation of a Business Rule Management System (BRMS). It enables you to create, manage, test, and govern business rules and events. You can store these in a central repository where multiple individuals and software products can access them.

IBM ODM Version 8.0 provides support for IBM IMS™ COBOL programs. This IBM Redpaper™ publication walks you through a step-by-step approach for using IBM ODM for rules management from an IMS COBOL MPP, BMP, or DL/IBATCH program.

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Using IBM Operational Decision Manager for COBOL Programs
IBM Operational Decision Manager (ODM) 8.0 provides support for rules management for IMS COBOL message processing program (MPP), batch message processing program (BMP), and DLIBATCH programs. This IBM Redpaper publication provides a step-by-step approach for using ODM for rules management for each of these types of programs.

In the current environment, it is necessary for systems to change quickly and effectively to keep up-to-date with constant change. The uncertainty of the current economic climate and the complexity of the business environment mean that business policies are changed more often than ever before. But keeping the software up-to-date with these changes is difficult. In many cases, the decision making is buried deep within the code, and only a long product change lifecycle can change them.

If you use a business rules and events engine, you can separate the policies from the software itself. By keeping the decision-making details separate, you can change them more conveniently, without modifying the software itself. This way, many different software modules can access the same rules, so there is less risk of contradicting policies. It is no wonder that such Business Rule Management Systems (BRMS) have become popular.

IBM ODM for z/OS V8.0 provides a rules engine that can be accessed directly from IMS MPP, BMP, and DLIBATCH programs, so when you use IMS you benefit directly from the advantages of using such a system.

The use of business terms in the definition of rules in ODM means that business analysts can change the rules directly without having to go to IT for the changes, further speeding up the process of changing rules. Decision tables enable you to implement more complex rules, still outside the main application.

You can run ODM either stand-alone on z/OS or within a WebSphere Application Server environment, in which case it is accessed via WebSphere z/OS Optimized Local Adapters (WOLA).
Figure 1-1 shows how IMS and ODM run on the same logical partition (LPAR).

This paper explains how an IMS application can use ODM as a rules system to separate the business policies from the main application.
Setting up rules in ODM

Begin by considering exactly how to translate a business policy into a set of rules that can be stored inside IBM Operational Decision Manager (ODM).

You create all rules in the Rules Designer GUI, which is shipped as part of ODM. The Rules Designer works on an Eclipse platform, and you employ it to create rules that your application uses. You then deploy these rules to the Rules Server.

In this chapter, you learn how to create simple rules in the Rules Designer.

You need to understand these two concepts before learning more about rules:

- **Business Object Model (BOM)**
  The BOM represents a model of the core concepts of a business, such as a loan or a borrower, and their logical connections. You explain this in business terms, and it represents the objects to the business user for use in rule authoring.

- **Execution Object Model (XOM)**
  The XOM represents a model that the runtime implementation uses to execute the rules. It references the application objects and data, and is the runtime implementation of the BOM.

In the following example, you create an XOM from a COBOL copybook, and from this you create a BOM to represent the content of this copybook in business-oriented language. This helps you create a rule. This section presents an overview of the scenario for this chapter.

This section discusses rules and the example scenario:

- **Rules**
  There are many ways of defining rules. They can be as simple as:
  ```java
  if balance < 0 then account_status = overdrawn
  ```
  Rules can also be much more complicated, involving multiple factors and multiple statuses. For example, consider a choice of interest amounts, depending on the type and balance of an account, as shown in Table 2-1 on page 4.
Table 2-1 Complex rule example

<table>
<thead>
<tr>
<th>Age of borrower</th>
<th>Loan &lt; annual income</th>
<th>Annual income &lt; loan &lt;= 3x annual income</th>
<th>3x annual income &lt; loan</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=21</td>
<td>Approved</td>
<td>Rejected</td>
<td>Rejected</td>
</tr>
<tr>
<td>21-60</td>
<td>Approved</td>
<td>Approved</td>
<td>Approved</td>
</tr>
<tr>
<td>60+</td>
<td>Approved</td>
<td>Approved</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

This kind of rule might be better developed as a decision table or a decision tree. The construction of such a rule is slightly more complicated. Appendix E, “Further rules definitions” on page 61 contains an example of these constructions.

Example scenario

A borrower wants to take out a loan. Whether the loan is approved is based on various factors:

- The company refuses to lend more than $1 million to any customer.
- The customer must be 65 years of age or younger.
- The loan repayment must be less than or equal to 30% of the annual income of the borrower.
- The income of the borrower after tax must be $24,000 or greater.

This example demonstrates how you create a project containing these rules ready for use by ODM.
2.1 Creating a rule project

To create a rule project, follow these steps:

1. In the Rule Designer, click **New** → **Rule Project**. Then, select **Standard Rule Project** and click **Next**.
2. In the Project name field, type `loan-decision-rules`, as shown in Figure 2-1.

![Create a rule project](image)

*Figure 2-1  Create a rule project*

3. Click **Finish** to create the rule project in the Rule Designer.
4. Examine the Rule Explorer window. It currently only contains empty folders, as shown in Figure 2-2.

![Rule Explorer overview](image)

*Figure 2-2  Rule Explorer overview*
2.2 Create COBOL XOM from a COBOL Copybook

Before you create a BOM, you must create a COBOL Executable Object Model (XOM). Follow these steps:

1. In the Design part of the Rule Project Map tab, click **Import XOM**, as shown in Figure 2-3.

![Figure 2-3 Locate the Import XOM task](image)

2. On the Import XOM page, choose **COBOL Execution Object Model**, as shown in Figure 2-4. Click **OK**.

![Figure 2-4 Import XOM](image)
3. On the Properties for loan-decision-rules page, select **COBOL Execution Object**, and click **Add**, as shown in Figure 2-5.

![Properties for loan-decision-rules](image)

*Figure 2-5  Properties for the loan-decision-rules*
4. In the Import COBOL XOM dialog, click **Add**, as shown in Figure 2-6.

![Add a copybook](image)

*Figure 2-6   Add a copybook*

5. Select **File system** and click **Browse**. Navigate to the copybook that you want to import. Replace the Package name it selects with `requestDetails`, as shown in Figure 2-7. Click **OK**.

![Select the copybook file](image)

*Figure 2-7   Select the copybook file*
6. In the Import COBOL XOM panel, enter `requestDetails` for the Execution Object Model name, as shown in Figure 2-8. Click Next.

```
Figure 2-8   Provide a name for the COBOL XOM
```

7. Figure 2-9 shows a summary of the default Java types and business object model (BOM) attributes that are derived from each COBOL item in the copybook.

```
Figure 2-9   Summary panel
```
8. Click **Finish** to create the COBOL XOM. This takes you back to the Properties dialog shown in Figure 2-10.

![Figure 2-10 Properties for loan-decision-rules with the new COBOL XOM](image)

9. Click **OK** to close the Properties for loan-decision-rules window.

The following artifacts are created:

- The `requestDetails-marshaller.jar` marshaller jar
- The `CobolXomConfig.xml` COBOL XOM configuration file
- The `requestDetails` project containing the defined structures in Java format, as shown in Figure 2-11 on page 11.
2.3 Creating a business object model from the JAVA XOM

To create a business object model from the JAVA XOM, follow these steps:

1. In the Design part of the Rule Project Map tab, click **Create BOM**, as shown in Figure 2-12.

Figure 2-11  Java artifacts for the project

Figure 2-12  Locate the Create BOM task
2. In the New BOM Entry wizard, in the Name field, accept the default name `model` for the BOM entry. Ensure that the **Create a BOM entry from a XOM** option is selected, as shown in Figure 2-13. Click **Next** to continue.

![Figure 2-13 Begin the New BOM Entry wizard](image)

3. On the Browse XOM page, in the Choose a XOM Element list, select `platform:/requestDetails`, as shown in Figure 2-14.

![Figure 2-14 Choose a XOM Element](image)
4. In the Select classes list of the New BOM Entry window shown in Figure 2-15, select the `requestDetails` package. When you select the package, you automatically select all of the classes that it contains.

![Figure 2-15 Select classes](image)

5. Now, click **Finish**. In the Rule Explorer view, the bom folder contains a new BOM entry model, as shown in Figure 2-16.

![Figure 2-16 New BOM entry](image)

6. Examine the generated BOM and its verbalization:
   a. In the Rule Explorer view shown in Figure 2-17 on page 14, double-click `bom → model` to open the BOM editor.
b. In the BOM editor, expand the `requestDetails` package to view the generated BOM, as shown in Figure 2-18.

![Figure 2-18 Expanded requestDetails view](image)

**Figure 2-18** Expanded requestDetails view

c. Double-click the **Borrower** class to view the default class verbalization, which is shown in Figure 2-19.

![Figure 2-19 Class verbalization for borrower](image)

**Figure 2-19** Class verbalization for borrower
### 2.4 Declaring ruleset parameters

*Ruleset parameters* provide the means to exchange data between a COBOL application and the rule application. You define ruleset parameters by name, type, and direction.

In this sample, you create ruleset parameters for the borrower and loan classes. The IN direction is used for the borrower, and the IN_OUT direction is used for the loan because it contains both input and output parameters. The output parameters are populated by the rule.

You cannot use the OUT parameter direction with the Rule Execution Server for z/OS because COBOL programs do not support memory allocation dynamically.

Follow these steps:

1. In the Design part of the Rule Project Map tab, click **Define parameters**, as shown in Figure 2-20.

   ![Figure 2-20 Locate the Define parameters task](image)

2. On the Ruleset Parameters page, ensure that **Enable type check for COBOL XOM** is selected.

3. To define a request parameter, click **Add**. Then, change the following default values:
   
   a. In the Name column, type *borrower*.
   
   b. In the Type column, click the ellipsis (…) button on the right of the cell and choose *borrower*. The requestDetails.borrower entry is entered in the cell automatically.
   
   c. In the Direction column, choose the **IN** direction.
   
   d. In the Verbalization column, type *the borrower*.

4. To define the response parameters, click **Add**. Then, change the following default values, as shown in Figure 2-21 on page 16:

   a. In the Name column, type *loan*.
   
   b. In the Type column, choose *loan*. The requestDetails.loan entry is added to the cell automatically.
   
   c. In the Direction column, choose the **IN_OUT** direction.
   
   d. In the Verbalization column, type *the loan*. 

---

*Chapter 2. Setting up rules in ODM 15*
5. Click **OK** to close the Properties for loan-decision-rules dialog box.

### 2.5 Adding BOM methods and map them to the XOM

The BOM methods are used to specify conditions and actions in your rules. You create methods in the Rule Designer. When you add methods to the BOM, you use BOM-to-XOM mapping in the BOM editor to implement the method.

You cannot map the BOM method to a Java XOM method because you must not change the XOM.

In this example, you create a method to reject a loan request for a configurable reason.

#### 2.5.1 Adding the reject methods

Follow these steps to add the reject methods:

1. In the Rules Explorer view, expand the model package, and then double-click the **Loan** class, as shown in Figure 2-22.

![Figure 2-22 Navigate to the Class Loan page](image)
2. On the Class Loan page of the BOM editor, to the right of the Members section, click **New**, as shown in Figure 2-23.

![Figure 2-23  Editing the Class Loan](image)

3. In the New Member window, provide the following information:
   - For Type, select **Method**.
   - For Name, type **reject**.
   - For Type, type **void**.
Click **Add** when finished, as shown in Figure 2-24.

**Figure 2-24   New Member**

4. In the Method Argument window, enter the following information:
   - For Name, enter *Message*.
   - For Type, enter *java.lang.String*.

   When complete, click **OK**, as shown in Figure 2-25. Back in the New Member window, click **Finish** to create the method.

**Figure 2-25   Method Argument**
5. On the Class page of the BOM editor, the Members list now includes the reject(String) method. Double-click this method, as shown in Figure 2-26.

![Figure 2-26 Double-click reject(String)](image)

6. In the Members Verbalization section of the BOM editor, click Create to view the default verbalization, as shown in Figure 2-27.

![Figure 2-27 Member Verbalization](image)

7. The default verbalization of the reject class now displays. Enter the following verbalization into the Template field, as shown in Figure 2-28:

   reject {this}, reason: ([0])

![Figure 2-28 Adding an Action Template](image)

8. Scroll down to the BOM to XOM Mapping section of the BOM editor, and then expand BOM to XOM Mapping to activate the BOM to XOM Mapping editor, as shown in Figure 2-29.

![Figure 2-29 BOM to XOM Mapping editor](image)
1. Type the following Java code, shown in Figure 2-30.

![Java code entered for the reject method](image1)

**Figure 2-30** Java code entered for the reject method

2. Finalize these steps by saving the method.

### 2.6 Orchestrating the ruleflow

You need to control the order in which rules are executed by using ruleflows. When defining the flow of execution, you organize rules into packages that contain related rules. This section explains how you can create a package that relates to validation rules.

Follow these steps:

1. In the Rule Designer, in the IBM Orchestrate® part of the Rule Project Map, click Add rule package, as shown in Figure 2-31.

![Add a rule package](image2)

**Figure 2-31** Add a rule package
2. In the New Rule Package wizard, type decideOnLoan into the Package field, and then click Finish, as shown in Figure 2-32.

![Create rule package](image)

Figure 2-32  Create rule package

3. This creates the rule package, which now displays in the Rule Explorer, as shown in Figure 2-33.

![New rule package in Rule Explorer](image)

Figure 2-33  New rule package in Rule Explorer

4. To create the ruleflow, in the Orchestrate part of the Rule Project Map, click Add ruleflow, as shown in Figure 2-34.

![Add ruleflow](image)

Figure 2-34  Add ruleflow
5. In the New Ruleflow dialog box, type mainflow into the Name field, and then click Finish, as shown in Figure 2-35.

![New Ruleflow dialog box](image)

*Figure 2-35  Create a ruleflow*

6. A blank Ruleflow diagram is created. Follow these steps:

a. Drag a Start Node onto the page.

![Start Node](image)

b. Drag an End Node onto the page.

![End Node](image)

c. Drag the task for the decideOnLoan rule package onto the page, as shown in Figure 2-36.

![Rule Explorer](image)

*Figure 2-36  Drag the decideOnLoan rule package*

d. Select the Arrow icon.

![Arrow](image)

e. With the arrow icon selected, click your start node to begin the arrow and click the calculation rule package box to complete the arrow. Click the rule package box to start another arrow and click your end node to finish the second arrow.
f. Refine the diagram by clicking the **Refine** icon.

![Refine icon](image)

g. The diagram now has the Start Node at the top, an arrow from that to the `decideOnLoan` rule package, and an arrow from that to the End Node, as shown in Figure 2-37.

![Finished ruleflow diagram](image)

h. Save the diagram.

### 2.7 Authoring the rules

Next, you need to create a number of rules to fit into the calculation area:

- The `belowMaximumAmount` rule ensures that the amount of the loan does not exceed $1,000,000.
- The `belowMaximumAge` rule ensures that the borrower is 65 years of age or younger.
- The `repaymentLessThanMaximum` rule ensures that the loan repayment is less than or equal to 30% of the annual income of the borrower.
- The `aboveMinimumIncome` rule ensures that the yearly income of the borrower is $24,000 or greater.

To demonstrate a system like this, it is not necessary to create every rule: only those rules that are created are followed. In fact, the full sample program, on which this example is based,
2.7.1 Creating the exceedsMaximumAmount rule

To create the exceedsMaximumAmount rule, follow these steps:

1. In the rules project, right-click decideOnLoan, and then click New → Action Rule, as shown in Figure 2-38.

Figure 2-38  Create an Action Rule
2. In the Name field, enter exceedsMaximumAmount, as shown in Figure 2-39. Click Finish to continue.

![New Action Rule dialog](image)

Figure 2-39  New Action Rule dialog

3. The new action rule displays in the Rule Explorer view, and the Intellirule Editor opens.

4. Type the code for the exceedsMaximumAmount rule, as shown in Example 2-1.

   **Example 2-1  exceedsMaximumAmount rule coding**
   
   ```
   Definitions
   set maximumAmount to 1000000;
   if
   the amount of 'the loan' is more than maximumAmount
   then
   reject 'the loan',
   reason: ("The loan amount is greater than the maximum of " + maximumAmount);
   ```

5. Save the code.

### 2.7.2 Creating the belowMaximumAge rule

To create the belowMaximumAge rule, follow these steps:

1. In the rules project, right-click decideOnLoan, and then click New → Action Rule.
2. In the Name field, enter belowMaximumAge. Then, click Finish.
3. The new action rule displays in the Rule Explorer view, and the Intellirule Editor opens.
4. Type the code for the belowMaximumAge rule, as shown in Example 2-2.

**Example 2-2 belowMaximumAge rule coding**

<table>
<thead>
<tr>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>set maximumAge to 65;</td>
</tr>
<tr>
<td>if the age of 'the borrower' is more than maximumAge then</td>
</tr>
<tr>
<td>reject 'the loan',</td>
</tr>
<tr>
<td>reason: (&quot;The borrower is older than the maximum age of &quot; + maximumAge );</td>
</tr>
</tbody>
</table>

5. Save the code.

### 2.7.3 Creating the repaymentLessThanMaximum rule

To create the repaymentLessThanMaximum rule, follow these steps:

1. In the rules project, right-click decideOnLoan, and then click New → Action Rule.
2. In the Name field, enter repaymentLessThanMaximum. Then, click Finish.
3. The new action rule displays in the Rule Explorer view, and the Intellirule Editor opens.
4. Type the code for the repaymentLessThanMaximum rule, as shown in Example 2-3.

**Example 2-3 repaymentLessThanMaximum rule coding**

<table>
<thead>
<tr>
<th>if</th>
</tr>
</thead>
<tbody>
<tr>
<td>the yearly repayment of 'the loan' is more than (0.3 * the yearly income of 'the borrower') then</td>
</tr>
<tr>
<td>reject 'the loan',</td>
</tr>
<tr>
<td>reason: (&quot;The yearly repayment would be more than 30% of the income of the borrower&quot; );</td>
</tr>
</tbody>
</table>

5. Save the code.

### 2.7.4 Creating the aboveMinimumIncome rule

To create the aboveMinimumIncome rule, follow these steps:

1. In the rules project, right-click decideOnLoan, and then click New → Action Rule.
2. In the Name field, enter aboveMinimumIncome. Then, click Finish.
3. The new action rule displays in the Rule Explorer view, and the Intellirule Editor opens.
4. Type the code for the aboveMinimumIncome rule, as shown in Example 2-4.

**Example 2-4 aboveMinimumIncome rule coding**

<table>
<thead>
<tr>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>set minimumIncome to 24000;</td>
</tr>
<tr>
<td>if the yearly income of 'the borrower' is less than minimumIncome then</td>
</tr>
<tr>
<td>reject 'the loan',</td>
</tr>
<tr>
<td>reason: (&quot;The annual income of the borrower is less than the minumum of &quot; + minimumIncome );</td>
</tr>
</tbody>
</table>

5. Save the code.
2.8 Preparing for rule execution

You now need to deploy the rules to the execution server on z/OS.

2.8.1 Creating a RuleApp project

First, create a RuleApp project to contain the rulesets that you want to execute:

1. In the Rule Designer, in the Rule Project Map, in the Deploy and Integrate section, click Create RuleApp Project, as shown in Figure 2-40.

![Create RuleApp project](image1.png)

Figure 2-40 Create RuleApp project

2. In the New RuleApp Project wizard, enter loanRequest in the Project name field, and ensure that the Use default location option is selected, as shown in Figure 2-41. Click Next.

![Enter a project name](image2.png)

Figure 2-41 Enter a project name
3. The Rule project is listed in the Rule Projects tab, as shown in Figure 2-42.

![Add Ruleset Archives](image)

*Figure 2-42 Add Ruleset Archives*

4. Click **Finish** to create the RuleApp project. It is displayed in the Rule Explorer view, as shown in Figure 2-43.

![Showing the loanRequest RuleApp project](image)

*Figure 2-43 Showing the loanRequest RuleApp project*
2.8.2 Deploying the RuleApp to the Rule Execution Server for z/OS

In the next step, you have to deploy the Java XOM, the marshaller XOM, and your RuleApp to the Rule Execution Server to be able to execute it:

1. Right-click the RuleApp project loanRequest and select **Deploy**, as shown in Figure 2-44.

![Figure 2-44  Deploy your RuleApp](image)
2. Accept the default option of **Increment RuleApp major version** for the deployment type and click **Next**, as shown in Figure 2-45.

![Deploy RuleApp Archive](image)

*Figure 2-45  Select a deployment type*

3. Select **Create a temporary Rule Execution Server configuration** and enter the following details, as shown in Figure 2-46 on page 31:

- **URL**: http://<yourserveraddress>:<port>/res
- **Login**: resAdmin
- **Password**: resAdmin
4. Click **Finish** to deploy the artifacts to the Rule Execution Server. This deploys the application.

### 2.8.3 Viewing the deployed rule artifacts in the Rule Execution Server Console

Log in to the Rule Execution Server Console to see the RuleApp and XOM that you have deployed:

1. In a web browser, open the web console for the Rule Execution Server for z/OS by using the URL:

   http://<yourserveraddress>:<PORT>/res
2. At the login prompt, enter the User Name `resAdmin` and Password `resAdmin`, as shown in Figure 2-47.

![Figure 2-47](image)  
*Figure 2-47  Sign in to the Rule Execution Server Console*

3. Click **Sign In**, and then select the Explorer tab, as shown in Figure 2-48.

![Figure 2-48](image)  
*Figure 2-48  Rule Execution Server Console*
4. In the Explorer panel, expand **RuleApps** and **Resources** to view the deployed RuleApp and the required resources (Figure 2-49).

![Navigator](image-url)

*Figure 2-49  Locate your RuleApps and Resources*

The rules are now ready to be used.
Coding IMS programs to use IBM Operational Decision Manager for rules management

To enable IMS programs to use the Rule Execution Server for z/OS (Rule Execution Server) for rules management, you first need to establish a connection between the program and the server. After that, the program can invoke the Rule Execution Server for rules checking as many times as it needs to. Finally, before the program ends, you need to disconnect it from the server.

This chapter contains details about each of these steps (connection, invocation, and disconnection). First, however, it discusses the COBOL copybooks that are used by the applications program.
3.1 Including copybooks

During each of the steps (connection, invocation, and disconnection), parameters are passed between the program and the Rule Execution Server. This parameter area is defined in Example 3-1.

Example 3-1  HBRA-CONN-AREA definition

```
01 HBRA-CONN-AREA.
   10 HBRA-CONN-EYE PIC X(4) VALUE 'HBRC'.
   10 HBRA-CONN-LENGTH PIC S9(8) COMP VALUE +3536.
   10 HBRA-CONN-LENTH REDEFINES HBRA-CONN-LENGTH PIC S9(8) COMP.
   10 HBRA-CONN-VERSION PIC S9(8) COMP VALUE +2.
   10 HBRA-CONN-RETURN-CODES.
      15 HBRA-CONN-COMPLETION-CODE PIC S9(8) COMP VALUE -1.
      15 HBRA-CONN-REASON-CODE PIC S9(8) COMP VALUE -1.
   10 HBRA-CONN-FLAGS PIC S9(8) COMP VALUE +1.
   10 HBRA-CONN-INSTANCE.
      15 HBRA-CONN-PRODCODE PIC X(4) VALUE SPACES.
      15 HBRA-CONN-INSTCODE PIC X(12) VALUE SPACES.
      15 HBRA-CONN-SSID PIC X(4) VALUE SPACES.
      15 HBRA-CONN-RESERVED PIC X(4) VALUE SPACES.
   10 HBRA-RESERVED01 PIC S9(8) COMP VALUE 0.
   10 HBRA-RESERVED02 PIC S9(8) COMP VALUE 0.
   10 HBRA-RESERVED03 PIC S9(8) COMP VALUE 0.
   10 HBRA-CONN-RULE-CCSID PIC S9(8) COMP VALUE 0.
   10 HBRA-CONN-RULEAPP-PATH PIC X(256) VALUE SPACES.
   10 HBRA-RESPONSE-AREA VALUE SPACES.
      15 HBRA-RESPONSE-MESSAGE PIC X(1024).
   10 HBRA-RA-INIT VALUE LOW-VALUES.
      15 HBRA-RESERVED04 PIC X(1792).
   10 HBRA-RA-PARMETERS REDEFINES HBRA-RA-INIT.
      15 HBRA-RA-PARMS OCCURS 32.
         20 HBRA-RA-PARAMETER-NAME PIC X(48).
         20 HBRA-RA-DATA-ADDRESS USAGE POINTER.
         20 HBRA-RA-DATA-LENGTH PIC 9(8) BINARY.
   10 HBRA-RESERVED.
      15 HBRA-RESERVED05 PIC X(12).
      15 HBRA-RESERVED06 PIC X(64).
      15 HBRA-RESERVED07 PIC X(64).
      15 HBRA-RESERVED08 PIC X(128).
      15 HBRA-RESERVED09 PIC X(132).
```

This HBRA-CONN-AREA is provided as a copybook in <HBRHLQ>.SHBRCOBS(HBRWS)

After each call (connection, invocation, and disconnection), the success or failure of the call is returned in HBRA-CONN-COMPLETION-CODE.

These are the possible values for HBRA-CONN-COMPLETION-CODE:

```
10 HBR-CC-OK      PIC S9(9) BINARY VALUE 0.
10 HBR-CC-WARNING PIC S9(9) BINARY VALUE 4.
10 HBR-CC-ERROR   PIC S9(9) BINARY VALUE 8.
10 HBR-CC-SEVERE  PIC S9(9) BINARY VALUE 12.
```
If HBRA-CONN-COMPLETION-CODE = HBR-CC-OK, the call was successful.

Otherwise, HBRA-CONN-REASON-CODE and HBRA-RESPONSE-MESSAGE can provide additional information as to why the call was not successful.

Both the completion codes and reason codes are provided as a copybook in <HBRHLQ>.SHBRCOBS(HBRC).

Both the HBRWS and HBRC copybooks have been provided in Appendix A, “COBOL copybooks” on page 45.

### 3.2 Connecting to the Rule Execution Server

This is the API to connect to the Rule Execution Server:

```cobol
call 'HBRCONN' using HBRA-CONN-AREA
```

It is not necessary to define any additional information in the HBRA-CONN-AREA before issuing the HBRCONN call.

You can configure Rule Execution Server instances as server groups to enable rule execution to be transferred to another server in case a server fails, or if there is a planned outage.

A server group can include 1 - 32 server instances. The list of Rule Execution Servers (HBRSSIDLIST) is specified in a data set pointed to by the HBRENVPR DD statement in your JCL. Appendix B, “HBRENVPR DD statement” on page 51 has more information about the HBRENVPR DD statement. When you issue the HBRCONN call, it establishes the connection with the first available server in the list.

If the HBRCONN was successful, HBR-CONN-INSTANCE contains the details of the Rule Execution Server instance that was selected from the server group defined by the HBRENVPR DD statement.

### 3.3 Invoking rules in the Rule Execution Server

This is the API to invoke the Rule Execution Server for rules checking:

```cobol
call 'HBRRULE' using HBRA-CONN-AREA
```

These are the steps to invoke rules in the Rule Execution Server:

1. Before issuing the HBRRULE call, you need to specify in the program which rules (or RuleApps) to check. The location of the rules is specified in the following path:

   ```cobol
   HBRA-CONN-RULEAPP-PATH
   ```

2. Specify the input and output parameters associated with the rules in HBRA-RA-PARMS of the HBRA-CONN-AREA, as shown in Example 3-2.

   ```cobol
   Example 3-2   HBRA-RA-PARMS of the HBR-CONN-AREA
   15 HBRA-RA-PARMS OCCURS 32.
   20 HBRA-RA-PARAMETER-NAME PIC X(48).
   20 HBRA-RA-DATA-ADDRESS USAGE POINTER.
   20 HBRA-RA-DATA-LENGTH PIC 9(8) BINARY
   ```
You can use up to 32 parameters for input or output. Define these parameters using the structure shown previously in Example 3-2 on page 37, giving the parameter name, its location in storage, and the length of the data that storage contains.

3. You can use the Rule Application to pass back error text or informational messages. This is done in HBRA-RESPONSE-MESSAGE.

### 3.4 Disconnecting from the Rule Execution Server

This is the API to disconnect from the Rule Execution server:

```plaintext
call 'HBRDISC' using HBRA-CONN-AREA
```

It is not necessary to define any additional information in the HBRA-CONN-AREA before issuing the HBRDISC call.

**Miniloan application program example**

Chapter 2, “Setting up rules in ODM” on page 3, described an example of authoring and deploying rules where a loan company is trying to establish whether a loan request is acceptable according to their business policy.

In this section, you walk through the steps involved in coding a COBOL program that invokes the Rules Execution Server to apply the previous rules.

Specifically, the COBOL program reads the following information pertaining to the borrower and their loan from a file:

- **Borrower:**
  - Name
  - Credit Score
  - Yearly Income
  - Age

- **Loan:**
  - Amount
  - Yearly Interest Rate
  - Yearly Repayment
  - Effective Date

The COBOL program then invokes the Rules Execution Server to determine whether the loan is approved.

Follow these steps to disconnect from the Rules Execution Server:

1. When you code COBOL programs that use the Rules Execution Server for rules validation, make sure to include the copybooks:

   ```plaintext
   01 WS-REASON-CODES
      COPY HBRC.
      COPY HBRWS.
   ```

2. Include the file record layout copybook, because the program will read (from a file) information about the borrower and their loan:

   ```plaintext
   Copy HBRLDAT1.
   ```

3. Establish a connection to the Rules Execution Server using the HBRCNN call, and then check the completion and reason codes to confirm that the operation completed successfully. Example 3-3 on page 39 shows that code.
Example 3-3  Check for successful completion and reason codes

DISPLAY WS-PROGRAM  '--Connecting to zRule Execution Server'
call 'HBRCONN' using HBRA-CONN-AREA
   IF HBRA-CONN-COMPLETION-CODE = HBR-CC-ERROR OR
      HBRA-CONN-COMPLETION-CODE = HBR-CC-SEVERE THEN
      move 'F' to ws-demo-outcome
      DISPLAY WS-PROGRAM  ' --'
         'HBRCONN FAILED'
         '   -CC->' HBRA-CONN-COMPLETION-CODE
         '   -RC->' HBRA-CONN-REASON-CODE
         '   -MSG->' HBRA-RESPONSE-MESSAGE
   ELSE
      IF HBRA-CONN-COMPLETION-CODE IS EQUAL TO HBR-CC-WARNING THEN
         DISPLAY WS-PROGRAM  ' --'
         'HBRCONN WARNING'
         '   -CC->' HBRA-CONN-COMPLETION-CODE
         '   -RC->' HBRA-CONN-REASON-CODE
         '   -MSG->' HBRA-RESPONSE-MESSAGE
      END-IF
   END-IF

4. The program reads the borrower and loan information from the input file, as shown in Example 3-4.

Example 3-4  Reading the input file

perform until WS-EOF IS EQUAL TO 'Y'
   READ SCENARIO-FILE AT END
   MOVE 'Y' TO WS-EOF
END-READ
   IF NOT-AT-EOF THEN
      add 1 to ws-customerNumber
      perform PROCESS-DATA
   END-IF
end-perform

5. For each input (borrower and their loan), you have to invoke the Rules Execution Server for rules checking. To do that, specify the rules location:

   MOVE "/MiniLoanDemoRuleApp/MiniLoanDemo" TO HBRA-CONN-RULEAPP-PATH

6. Initialize the parameters that are needed for the rules checking, as shown in Example 3-5.

Example 3-5  Initialize the parameters

   MOVE ALL SPACES TO Borrower Loan
   MOVE ALL LOW-VALUES TO HBRA-RA-PARMETERS
   move LENGTH OF Borrower to HBRA-RA-DATA-LENGTH(1)
   move "borrower" to HBRA-RA-PARAMETER-NAME(1)
   set HBRA-RA-DATA-ADDRESS(1) to address of Borrower
   move LENGTH OF Loan to HBRA-RA-DATA-LENGTH(2)
   multiply length of messages by 99 giving WS-maxMessageLen
   add WS-maxMessageLen to HBRA-RA-DATA-LENGTH(2)
   move "loan" to HBRA-RA-PARAMETER-NAME(2)
   set HBRA-RA-DATA-ADDRESS(2) to address of Loan

7. Populate the parameters with the borrower and loan information from the input record that was just read, as shown in Example 3-6 on page 40.
Example 3-6  Populate the parameters with the borrower and loan information

MOVE ALL LOW-VALUES TO WS-IN
UNSTRING SCENARIO-DATA DELIMITED BY ',' INTO
   WS-IN-data(1) WS-IN-data(2) WS-IN-data(3)
   WS-IN-data(4) WS-IN-data(5) WS-IN-data(6)
   WS-IN-data(7) WS-IN-data(8)
MOVE WS-IN-data(1) TO name
Compute creditScore = Function numval(WS-IN-data(2))
Compute yearlyIncome = Function numval(WS-IN-data(3))
Compute age = Function numval(WS-IN-data(4))
Compute amount = Function numval(WS-IN-data(5))
Compute yearlyInterestRate = Function numval(WS-IN-data(6))
Compute yearlyRepayment = Function numval(WS-IN-data(7))
MOVE WS-IN-data(8) TO effectDate
MOVE 'T' TO approved
MOVE 0 TO messageCount

Note: The approved parameter has been initialized to T and the messageCount to 0. These parameters will be updated by the reject method if it is called; otherwise, the parameters will not be updated and you can assume that the request is successful.

8. Invoke the Rules Execution Server by using the HBRRULE call, and then check the completion and reason codes, as shown in Example 3-7.

Example 3-7  Check the completion and reason codes

*  *
* Invoke the rule
*  *
DISPLAY WS-PROGRAM
   '--Invoking rules in zRule Execution Server'
call 'HBRRULE' using HBRA-CONN-AREA
*  *
* Display rule responses, or error code, as appropriate
*  *
IF HBRA-CONN-COMPLETION-CODE = HBR-CC-OK THEN
   DISPLAY WS-PROGRAM ' '--'
      ' Rule executed in->' HBRA-CONN-SSID
   DISPLAY WS-PROGRAM ' '-'
      '-name->' name
      '-loan amount->' amount
      '-approved->' approved
   move 1 to ws-msgcount
   display WS-PROGRAM ' '-'
      '-messages->'
   perform until ws-msgcount > messageCount
      display WS-PROGRAM '->' messages(ws-msgcount)
      add 1 to ws-msgcount
   end-perform
ELSE
   move 'F' to ws-demo-outcome
   DISPLAY WS-PROGRAM ' '-'
      '-CC->' HBRA-CONN-COMPLETION-CODE
      '-RC->' HBRA-CONN-REASON-CODE
   end-if
You can find the complete sample miniloan COBOL application program in Appendix C, “Sample miniloan application program” on page 55.

3.5 Connecting to Rule Execution Server with WebSphere z/OS Optimized Local Adapters and IMS

You can also connect to Rule Execution Server for WebSphere Application Server for z/OS by using WebSphere z/OS Optimized Local Adapters (WOLA). This requires that you set up both IMS and the Rule Execution Server to establish a connection with the correct WebSphere Application Server.

3.5.1 Setting up IMS

In order to connect IMS to WOLA, you need to follow these steps:

1. Create an external subsystem IMS PROCLIB member, or update your existing member to include the following entry:
   
   WOLA,BBOA,BBOAIEMT

2. Pass the SSM parameter into your IMS startup data.

3. Include the WOLA load library, created during the WOLA setup, in your IMS Control region startup in both the STEPLIB and the DFSESL DDs.

4. Restart IMS to pick up the changes.

3.5.2 Setting up Rule Execution Server for WebSphere Application Server for z/OS

Currently, this is only available for message processing programs (MPP) and batch message processing programs (BMP), and not for DL/I programs.

When connecting via WOLA, you need to specify to which WebSphere Application Server system the WOLA is used to connect. You define all of the necessary parameters in a member specified by the HBRENVPR DD statement. These consist of the following parameters:

- **HBRWOLALOADLIB**
  
  The load library that is created as part of the setting up of WOLA with IMS (see 3.5.1, “Setting up IMS” on page 41): for example, &HLQ.WAS.OLA.LOADLIB

- **HBRTARGETRES**
  
  This indicates that the connection is to WOLA rather than the Rule Execution Server for z/OS: enter the value WOLA

- **HBRWOLACELL**
  
  The cell name of the WebSphere Application Server for the connection: for example, CS03A1
Using IBM Operational Decision Manager for COBOL Programs

3.6 Using IMS APIs

The use of the Rule Execution Server for rules management does not limit the IMS program in any way. In addition to the API to communicate with the Rule Execution Server, the program can continue to use other APIs, for example, DL/I calls, SQL calls, message queue (MQ) calls, and so on.

3.7 Preparing the program

All IMS application programs need to be link-edited with the DL/I Language interface module (DFSLI000). To do so, follow these steps:

1. Ensure that the link-edit step has the following include:

   INCLUDE RESLIB (DFSLI000)

   This is standard procedure for IMS.

   In addition, to resolve the API calls (HBRCONN, HBRRULE & HBRDISC), the IMS program also needs to be link-edited with the HBRISTUB module.

2. Ensure that the link-edit step also has an INCLUDE for HBRISTUB:

   INCLUDE HBRLIB (HBRISTUB)

Figure 3-1 depicts how the call from the Cobol application goes to the stub module, and the stub module issues a PC call into the Rule Execution Server Address space.

![Figure 3-1 Call flow from a COBOL program to the Rules Execution Server](image_url)
3.8 Changing the execution Job Control Language

You need to make some changes to the execution Job Control Language (JCL). Follow these steps:

1. In the STEPLIB of the execution JCL, concatenate the SHBRLOAD library. The SHBRLOAD library contains the IBM Operational Decision Manager (ODM) Load modules.

2. Ensure that the JCL has an HBRENVPR DD statement that points to a data set that specifies which Rules Execution Server to use.

You can run ODM servers within WebSphere Application Server for z/OS, or you can run them stand-alone on z/OS (referred to as ODM on z/OS). These are some of the advantages and disadvantages for these setups:

- ODM for z/OS advantages:
  - Lightweight address space
  - Highest performing option
  - Less real storage consumption

- WebSphere Application Server advantage:
  Ability to run rules engine side-by-side with Java applications

- WebSphere Application Server disadvantages:
  - Not always a preferred solution on z/OS
  - Slower performance than stand-alone ODM on z/OS
  - Heavy architecture (real storage usage, admin costs) to support a rules engine

ODM servers running within WebSphere Application Server for z/OS communicate using WOLA, so the data set that the HBRENVPR DD statement points to must contain information about which WebSphere Application Server to connect to. These parameters for WOLA are described in 3.5.2, “Setting up Rule Execution Server for WebSphere Application Server for z/OS” on page 41, and also in “Rules Execution Server on WebSphere Application Server for z/OS” on page 53.

If you are using a stand-alone ODM on z/OS, the data set that the HBRENVPR DD statement points to can contain either one or a list of several ODM on z/OS servers.

The reason why you might want to specify a list is because ODM on z/OS Server for instances are configured as server groups to enable rule execution to be transferred to another server in case a server fails, or if there is a planned outage.

Appendix B, “HBRENVPR DD statement” on page 51 provides more information about specifying this list of ODM on z/OS Servers.

Aside from the SHBRLOAD library and the HBRENVPR DD statement, there are no other required JCL changes.

3.9 Setting up IMS definitions

In this chapter, you have learned about these changes:

- The link-edit step changes (3.7, “Preparing the program” on page 42)
- The execution JCL changes (3.8, “Changing the execution Job Control Language” on page 43)
Aside from these, you do not need to perform any other setup in IMS before you can use the Rules Execution Server from an IMS application program. There are no special definitions in the IMS System definition, or in the IMS startup parameters.

Everything else in IMS is standard. For example, if the COBOL program that uses the Rules Execution Server is a BMP, the definition in the IMS system definition for the BMP does not change. In addition, there are no changes in the program specification block (PSB) associated with the program.

### 3.10 Conclusion

As demonstrated in this Redpaper, you can use the functionality provided by IBM Operational Decision Manager from IMS COBOL MPP, BMP, and DLIBATCH applications. IBM ODM can provide such applications with a powerful decision engine, which you can use to change rules conveniently to support a quickly-moving business. The steps described in this Redpaper configure IMS to exploit this functionality.
COBOL copybooks

This appendix contains the following COBOL copybooks:

- HBRWS copybook
- HBRC copybook
HBRWS copybook

01 HBRA-CONN-AREA.
   10 HBRA-CONN-EYE PIC X(4) VALUE 'HBRC'.
   10 HBRA-CONN-LENGTH PIC S9(8) COMP VALUE +3536.
   10 HBRA-CONN-LENTH REDEFINES HBRA-CONN-LENGTH PIC S9(8) COMP.
   10 HBRA-CONN-VERSION PIC S9(8) COMP VALUE +2.
   10 HBRA-CONN-RETURN-CODES.
      15 HBRA-CONN-COMPLETION-CODE PIC S9(8) COMP VALUE -1.
      15 HBRA-CONN-REASON-CODE PIC S9(8) COMP VALUE -1.
   10 HBRA-CONN-FLAGS PIC S9(8) COMP VALUE +1.
   10 HBRA-CONN-INSTANCE.
      15 HBRA-CONN-PRODCODE PIC X(4) VALUE SPACES.
      15 HBRA-CONN-INSTCODE PIC X(12) VALUE SPACES.
      15 HBRA-CONN-SSID PIC X(4) VALUE SPACES.
      15 HBRA-CONN-RESERVED PIC X(4) VALUE SPACES.
   10 HBRA-RESERVED01 PIC S9(8) COMP VALUE 0.
   10 HBRA-RESERVED02 PIC S9(8) COMP VALUE 0.
   10 HBRA-RESERVED03 PIC S9(8) COMP VALUE 0.
   10 HBRA-CONN-RULE-CCSID PIC S9(8) COMP VALUE 0.
   10 HBRA-CONN-RULEAPP-PATH PIC X(256) VALUE SPACES.
   10 HBRA-RESPONSE-AREA VALUE SPACES.
      15 HBRA-RESPONSE-MESSAGE PIC X(1024).
   10 HBRA-RA-INIT VALUE LOW-VALUES.
      15 HBRA-RESERVED04 PIC X(1792).
   10 HBRA-RA-PARMETERS REDEFINES HBRA-RA-INIT.
      15 HBRA-RA-PARMS OCCURS 32.
         20 HBRA-RA-PARAMETER-NAME PIC X(48).
         20 HBRA-RA-DATA-ADDRESS USAGE POINTER.
         20 HBRA-RA-DATA-LENGTH PIC 9(8) BINARY.
   10 HBRA-RESERVED.
      15 HBRA-RESERVED05 PIC X(12).
      15 HBRA-RESERVED06 PIC X(64).
      15 HBRA-RESERVED07 PIC X(64).
      15 HBRA-RESERVED08 PIC X(128).
      15 HBRA-RESERVED09 PIC X(132).

HBRC copybook

** Completion codes
   10 HBR-CC-OK PIC S9(9) BINARY VALUE 0.
   10 HBR-CC-WARNING PIC S9(9) BINARY VALUE 4.
   10 HBR-CC-ERROR PIC S9(9) BINARY VALUE 8.
   10 HBR-CC-SEVERE PIC S9(9) BINARY VALUE 12.
** Reason codes
** The call completed normally.
   10 HBR-RC-NONE PIC S9(9) BINARY VALUE 0.
** An unexpected error occurred.
   10 HBR-RC-UNEXPECTED PIC S9(9) BINARY VALUE 2195.
** Unable to load Decision Server load modules.
   10 HBR-RC-ERROR-HBRBCON PIC S9(9) BINARY VALUE 3001.
** Unable to load Decision Server load modules.
10 HBR-RC-ERROR-HBRCON PIC S9(9) BINARY VALUE 3002.
** Unable to load Decision Server load modules.
10 HBR-RC-ERROR-HBBRDSC PIC S9(9) BINARY VALUE 3003.
** Unable to load Decision Server load modules.
10 HBR-RC-ERROR-HBRCDSC PIC S9(9) BINARY VALUE 3004.
** The subsystem specified by the HBRSSID variable in
** the HBBENVPR data set is not defined to z/OS.
10 HBR-RC-SERVER-NOT-DEFINED PIC S9(9) BINARY VALUE 3005.
** The subsystem specified by the HBRSSID variable in
** the HBBENVPR data set is not active.
10 HBR-RC-SERVER-NOT-ACTIVE PIC S9(9) BINARY VALUE 3006.
** A parameter is incorrectly specified in the HBRA-R
** A-PARMS structure in the HBRA-CONN-AREA data area.
** The number of the invalid parameter is returned
** in the HBRA-RESPONSE-MESSAGE field of the HBRA-CON
** N-AREA data area.
10 HBR-RC-INVALID-NUMBER-PARMS PIC S9(9) BINARY VALUE 3007.
** The subsystem specified by the HBRSSID variable in
** the HBBENVPR data set is already in use.
10 HBR-RC-SERVER-ID-INVALID PIC S9(9) BINARY VALUE 3008.
** The server is unable to accept work because it is
** paused.
10 HBR-RC-NOT-ACCEPTING-WORK PIC S9(9) BINARY VALUE 3009.
** The CICS version used to connect to the server is
** unsupported. zRule Execution Server for z/OS suppo
** rts only CICS version 3.2, 4.1, and 4.2.
10 HBR-RC-ERROR-INVALID-CICS PIC S9(9) BINARY VALUE 3010.
** The version of CICS used with HBRUSEJVMS=YES is un
** supported. The HBRUSEJVMS=YES parameter is support
** ed only on CICS TS version 4.1 or later.
10 HBR-RC-INVALID-JVMS-RELEASE PIC S9(9) BINARY VALUE 3011.
** An attempt to obtain storage has failed. There is
** not enough storage available to complete the reque
** st.
10 HBR-RC-ERROR-STORAGE-FAIL PIC S9(9) BINARY VALUE 3012.
** The connection to JVM Server HBRJVM has failed as
** the JVM Server is not installed.
10 HBR-RC-CICS-NO-JVMSERVER PIC S9(9) BINARY VALUE 3013.
** The connection to JVM Server HBRJVM has failed as
** the JVM Server is not enabled.
10 HBR-RC-CICS-NOTENABLED-JVMS PIC S9(9) BINARY VALUE 3014.
** Unable to load Decision Server load modules.
10 HBR-RC-ERROR-HBRICON PIC S9(9) BINARY VALUE 3015.
** Unable to load Decision Server load modules.
10 HBR-RC-ERROR-HBRIDSC PIC S9(9) BINARY VALUE 3016.
** The code page specified in HBRA_CONN_RULE_CCSID is
** invalid.
10 HBR-RC-ERROR-INVALID-CCSID PIC S9(9) BINARY VALUE 3017.
** A HBRSSIDLIST value is missing in a data set specif
** iced by the HBBENVPR DD card.
10 HBR-RC-INVALID-HBRSSIDLIST PIC S9(9) BINARY VALUE 3018.
** The HBRSSIDLIST value is incorrect. Please provide
** a comma separated list of up to 32 SSIDs of 4 cha
** racters  e.g. HBR1,HBR2,HBR3
10 HBR-RC-INVALID-HBRSSIDLIST PIC S9(9) BINARY VALUE 3019.
** No valid zRule Execution Server was found in the HBRSSIDLIST property.
  10 HBR-RC-NO-VALID-SERVER-CONN PIC S9(9) BINARY VALUE 3020.
** A zRule Execution Server in the HBRSSIDLIST property could not be connected to.
  10 HBR-RC-WARNING-SERVER-LIST PIC S9(9) BINARY VALUE 3021.
** No valid zRule Execution Server was found to execute the rule request.
  10 HBR-RC-NO-VALID-SERVER-RULE PIC S9(9) BINARY VALUE 3022.
** Could not open HBRENVPR which is defined in the HBRSSIDLIST property.
  10 HBR-RC-INVALID-CICS-ENV-DD PIC S9(9) BINARY VALUE 3023.
** The user ID of the application issuing the HBRCONN API call is not authorized to connect to the server.
  10 HBR-RC-CONN-NOT-AUTH PIC S9(9) BINARY VALUE 4035.
** Missing Ruleapp name.
  10 HBR-RC-MISSING-RA-NAME PIC S9(9) BINARY VALUE 4084.
** Invalid Ruleapp name.
  10 HBR-RC-INVALID-RA-NAME PIC S9(9) BINARY VALUE 4085.
** CICS is not connected to zRule Execution Server for z/OS.
  10 HBR-RC-ADAPTER-NOT-AVAILABLE PIC S9(9) BINARY VALUE 4086.
** The HBRC structure in the HBRA-CONN-AREA data area passed either to the HBRCONN API or the HBRRULE API is invalid or contains invalid data.
  10 HBR-RC-INVALID-HBRC PIC S9(9) BINARY VALUE 4087.
** The user ID is already connected to the server. The user ID is passed back in the HBRA-RESPONSE-MESSAGE field of the HBRA-CONN-AREA data area.
  10 HBR-RC-ALREADY-CONNECTED PIC S9(9) BINARY VALUE 4088.
** A HBRSSID value is missing in a data set specified by the HBRENVPR DD card.
  10 HBR-RC-MISSING-HBRSSID PIC S9(9) BINARY VALUE 4089.
** The application is not connected to the server.
  10 HBR-RC-NOT-CONNECTED PIC S9(9) BINARY VALUE 4090.
** An unexpected exception occurred in the JRules engine.
  10 HBR-RC-JRULES-UNEXPECTED PIC S9(9) BINARY VALUE 5000.
** An exception occurred in the JRules engine.
  10 HBR-RC-JRULES-EXCEPTION PIC S9(9) BINARY VALUE 5001.
** An exception occurred converting the parameter data.
  10 HBR-RC-RAW-DATA-EXCEPTION PIC S9(9) BINARY VALUE 5002.
** An exception occurred parsing the rule application path.
  10 HBR-RC-ILR-FORMAT-EXCEPTION PIC S9(9) BINARY VALUE 5003.
** Unable to load WOLA load modules.
  10 HBR-RC-WOLA-LOAD PIC S9(9) BINARY VALUE 6000.
** The WAS server specified by HBRWOLASERVER cannot be located.
  10 HBR-RC-WOLA-BAD-DAEMON-GROUP PIC S9(9) BINARY VALUE 6001.
** The node name or server name is not found.
  10 HBR-RC-WOLA-BAD-CELL-OR-NODE PIC S9(9) BINARY VALUE 6002.
** An error occurred while connecting to WAS.
10 HBR-RC-WOLA-WAS-ERROR PIC S9(9) BINARY VALUE  6003.
** The WOLA EJB could not be found.
10 HBR-RC-WOLA-EJB-NOT-FOUND PIC S9(9) BINARY VALUE  6004.
HBRENVPR DD statement

This appendix discusses the HBRENVPR DD statement for the following two cases:

- Rules Execution Server on z/OS
- Rules Execution Server on WebSphere Application Server for z/OS
Rules Execution Server on z/OS

Rule Execution Server for z/OS instances are configured as server groups to enable rule execution to be transferred to another server in case a server fails, or if there is a planned outage.

A server group can include from 1 - 32 server instances. You specify the list of Rule Execution servers in a data set pointed to by the HBRENVPR DD statement in your job control language (JCL). There are several ways to code this list in the HBRENVPR DD data set.

You can code:

```
HBRSSIDLIST=++HBRSSIDLIST++
```

This means that the list comes from the server group membership list variable, `++HBRSSIDLIST++`, in the `SHBRPARM(HBRINST)` data set member.

Alternatively, you can specify your own list, for example:

```
HBRSSIDLIST=HBR1,HBR2,HBR3
```

Here the server group consists of three servers whose subsystem IDs are HBR1, HBR2, and HBR3.

The execution JCL for an IMS application program that uses the Rule Execution Server for Rules checking must include a data set pointed to by the HBRENVPR DD statement.

Rule execution begins on the first available server in the list. Other servers execute rulesets only if rule execution is transferred to them. To route rule execution to a particular server, specify its ID first.

If a server crashes, hangs, abnormally ends, or shuts down, rule execution transfers automatically to the next active server in the list. The inactive server remains in the server group, and when it restarts, rule execution automatically transfers back to the original server. No action is required by the COBOL application to accomplish these transfers.
Rules Execution Server on WebSphere Application Server for z/OS

If you are using WebSphere z/OS Optimized Local Adapters (WOLA), a different set of parameters is required. You can see an example of this in the SHBRPARM(HBRWOLA) data set member. These values are required to identify the specific WOLA in use to the COBOL application.

This data set consists of the following parameters:

- **HBRWOLALOADLIBRARY**, the WOLA load library, for example:
  
  HBRWOLALOADLIBRARY=USER.V80.WOLA.LOADLIBRARY

- **HBRTARGETRES**, an indication that you are connecting to WebSphere Application Server via WOLA, for example:
  
  HBRTARGETRES=WOLA

- **HBRWOLACELL**, the short name of the WebSphere Application Server cell in use, for example:
  
  HBRWOLACELL=CIL1

- **HBRWOLANODE**, the short name of the WebSphere Application Server node in use, for example:
  
  HBRWOLANODE=NIL1

- **HBRWOLASERVER**, the WebSphere Application Server server name, for example:
  
  HBRWOLASERVER=server1
Sample miniloan application program

This appendix contains the source code for a sample miniloan application program, as shown in Example C-1.

Example C-1  Sample miniloan application program

* @START_COPYRIGHT_NONOC@  
* Licensed Materials - Property of IBM  
*  
* 5655-Y07, 5655-ILG  
* (c) Copyright IBM Corp. 2011 All Rights Reserved.  
* US Government Users Restricted Rights - Use, duplication or  
* disclosure restricted by GSA ADP Schedule Contract with  
* IBM Corp.  
* @END_COPYRIGHT_NONOC@  

IDENTIFICATION DIVISION.  
PROGRAM-ID. HBRMINI.  

ENVIRONMENT DIVISION.  
INPUT-OUTPUT SECTION.  
FILE-CONTROL.  
SELECT SCENARIO-FILE  
ASSIGN TO S-SCENARIO  
ORGANIZATION IS SEQUENTIAL.  
DATA DIVISION.  
FILE SECTION.  
FD SCENARIO-FILE  
RECORDING MODE IS F  
LABEL RECORD STANDARD.  
01 SCENARIO-AREA.  
05 SCENARIO-DATA PIC X(496).  

WORKING-STORAGE SECTION.
01 WS-EOF PIC X VALUE "N".
88 AT-EOF VALUE "Y".
88 NOT-AT-EOF VALUE "N".
01 WS-IN.
05 WS-IN-data PIC X(50) occurs 30 times.
01 MY-LOCAL-STORE.
02 WS-PROGRAM PIC X(8) VALUE "MINILOAN".
02 FILLER PIC X(4) VALUE "-WS>".
COPY HBRLDAT1.
01 WS-maxMessageLen PIC 9(10).
01 ws-customerNumber PIC 9(4) VALUE ZERO.
01 ws-msgcount PIC 9(10).
01 ws-demo-outcome PIC X VALUE "T".
01 WS-REASON-CODES.
COPY HBRC.
COPY HBRWS.
PROCEDURE DIVISION.
Display WS-PROGRAM ' -Miniloan Demo on zOS Batch '
* 
* Open input file 
* 
OPEN INPUT SCENARIO-FILE
* 
* Connect 
* 
DISPLAY WS-PROGRAM ' --Connecting to zRule Execution Server'
call 'HBRCONN' using HBRA-CONN-AREA
IF HBRA-CONN-COMPLETION-CODE NOT EQUAL HBR-CC-OK THEN
move 'F' to ws-demo-outcome
DISPLAY WS-PROGRAM ' -'
'HBRCONN FAILED'
'-CC->' HBRA-CONN-COMPLETION-CODE
'-RC->' HBRA-CONN-REASON-CODE
ELSE
perform until WS-EOF IS EQUAL TO 'Y'
READ SCENARIO-FILE AT END
MOVE 'Y' TO WS-EOF
END-READ
IF NOT-AT-EOF THEN
add 1 to ws-customerNumber
perform PROCESS-DATA
END-IF
end-perform
END-IF
*
* Disconnect 
*
DISPLAY WS-PROGRAM
' --disconnecting from zRule Execution Server'
call 'HBRRDISC' using HBRA-CONN-AREA
IF HBRA-CONN-COMPLETION-CODE NOT EQUAL HBR-CC-OK THEN
move 'F' to ws-demo-outcome
DISPLAY WS-PROGRAM ' -'
'HBRDISC FAILED'
'-CC->' HBRA-CONN-COMPLETION-CODE
"-RC->' HBRA-CONN-REASON-CODE
END-IF

* Close input file
*
CLOSE SCENARIO-FILE
if ws-demo-outcome is equal to 'T'
display WS-PROGRAM ' --SUCCESSFUL COMPLETION of demo'
MOVE ZERO to RETURN-CODE
else
display WS-PROGRAM ' --demo completed with ERRORS'
display WS-PROGRAM ' --please review logs and rerun '
display WS-PROGRAM ' --with trace as needed.'
MOVE 8 to RETURN-CODE
end-if
MOVE ZERO to RETURN-CODE
GOBACK.

* For each scenario....
*
PROCESS-DATA.

* Initialize call parameters
*
MOVE ALL SPACES TO Borrower Loan
MOVE ALL LOW-VALUES TO HBRA-RA-PARMETERS
MOVE "/MiniLoanDemoRuleApp/MiniLoanDemo" TO HBRA-CONN-ROLEAPP-PATH
move LENGTH OF Borrower to HBRA-RA-DATA-LENGTH(1)
move "borrower" to HBRA-RA-PARAMETER-NAME(1)
set HBRA-RA-DATA-ADDRESS(1) to address of Borrower
move LENGTH OF Loan to HBRA-RA-DATA-LENGTH(2)
multiply length of messages by 99 giving WS-maxMessageLen
add WS-maxMessageLen to HBRA-RA-DATA-LENGTH(2)
move "loan" to HBRA-RA-PARAMETER-NAME(2)
set HBRA-RA-DATA-ADDRESS(2) to address of Loan
*
* Read scenario data
*
MOVE ALL LOW-VALUES TO WS-IN
UNSTRING SCENARIO-DATA DELIMITED BY '"','
  INTO
  WS-IN-data(1) WS-IN-data(2) WS-IN-data(3)
  WS-IN-data(4) WS-IN-data(5) WS-IN-data(6)
  WS-IN-data(7) WS-IN-data(8)
MOVE WS-IN-data(1) TO name
Compute creditScore = Function numval(WS-IN-data(2))
Compute yearlyIncome = Function numval(WS-IN-data(3))
Compute age = Function numval(WS-IN-data(4))
Compute amount = Function numval(WS-IN-data(5))
Compute yearlyInterestRate = Function numval(WS-IN-data(6))
Compute yearlyRepayment = Function numval(WS-IN-data(7))
MOVE WS-IN-data(8) TO effectDate
MOVE 'T' TO approved
MOVE 0 TO messageCount
display WS-PROGRAM ' --Loan customer ' ws-customerNumber
*  
* Invoke the rule
*  
DISPLAY WS-PROGRAM
'--Invoking rules in zRule Execution Server'
call 'HBRRULE' using HBRA-CONN-AREA
*  
* Display rule responses, or error code, as appropriate
*  
IF HBRA-CONN-COMPLETION-CODE = HBR-CC-OK THEN
  DISPLAY WS-PROGRAM '-'
    '-name->' name
    '-loan amount->' amount
    '-approved->' approved
move 1 to ws-msgcount
display WS-PROGRAM '-'
  '- messages->'
perform until ws-msgcount > messageCount
display WS-PROGRAM '->' messages(ws-msgcount)
add 1 to ws-msgcount
end-perform
ELSE
move 'F' to ws-demo-outcome
DISPLAY WS-PROGRAM '-'
  '-CC->' HBRA-CONN-COMPLETION-CODE
  '-RC->' HBRA-CONN-REASON-CODE
  '-MSG->' HBRA-RESPONSE-MESSAGE
END-IF
Appendix D. JCL to run an IMS DLIBatch program or BMP that uses Rule Execution Server for z/OS

This appendix contains Job Control Language (JCL) code to run an IMS DLIBatch or batch message processing program (BMP) that uses Rule Execution Server for z/OS, which is shown in Example D-1.

Example D-1   JCL to run an IMS DLIBatch or BMP that uses Rule Execution Server for z/OS

```
//HBRMINI JOB NOTIFY=&SYSUID,MSGCLASS=A
//**********************************************************************
//* @START_COPYRIGHT_NONOCO@
//* Licensed Materials - Property of IBM                               *
//*                                                                    *
//* 5655-Y17, 5655-Y31                                                 *
//* (c) Copyright IBM Corp. 2012  All Rights Reserved.                 *
//* US Government Users Restricted Rights - Use, duplication or        *
//* disclosure restricted by GSA ADP Schedule Contract with            *
//* IBM Corp.                                                          *
//* @END_COPYRIGHT_NONOCO@                                             *
//**********************************************************************
//JCLLIB JCLLIB ORDER=(++IMSREGHLQ++.PROCLIB)
//*
//*Select whether BMP or DLI is required.
//*For DLI, replace <IMSPLEX> with the name of your IMSPLEX and
//*uncomment the additional STEPLIB line below.
//HBRSAMP2 EXEC PROC=IMSBATCH,
//*HBRSAMP2 EXEC PROC=DLIBATCH,IMSPLEX=<IMSPLEX>,
// MBR=HBRMINI,PSB=HBRMINI,
// IMSID=++IMSREGID++,SOUT='*',TIME=(60)
// SET HBRHLQ=++HBRHLQ++
// SET HBRWDS=++HBRWDS++
// SET IMSHLQ=++IMSHLQ++
```
// SET IMSREG=++IMSREGHLQ++
//STEPLIB DD DISP=SHR, DSN=&HBRHLQ..SHBRLOAD
// DD DSN=&IMSHLQ..&SYS2.SDFSRESL, DISP=SHR
// DD DSN=&IMSREG..PGMLIB, DISP=SHR
// *Uncomment the following line if running DLI.
// * DD DSN=&IMSREG..MDALOCAL, DISP=SHR
//SYSUDUMP DD SYSOUT=* 
// * ADDITIONAL DD STATEMENTS
// */
//IMS DD DISP=SHR, DSN=&IMSREG..PSBLIB
// DD DISP=SHR, DSN=&IMSREG..DBDLIB
//DFSSTAT DD SYSOUT=* 
// */
// *INPUT FOR MINILOAN PROGRAM. 
//SCENARIO DD DISP=SHR, DSN=&HBRWDS..SHBRPARM(HBRSCEN)
// IDENTIFY THE ZRULES SERVER. 
//HBRENVPR DD DISP=SHR, DSN=&HBRWDS..SHBRPARM(HBRBATCH)
// */
//***************************************************************************
// See miniloan-test.xls
// * name,creditscore,yearlyIncome,age,amount,
// * yearlyinterestRate,yearlyRepayment, effectiveDate
// */
Further rules definitions

You can write rules in a variety of ways, not all of which are described in the main part of this paper. This appendix describes a few ways to write rules.
A decision table is concerned with decisions that are more than 2-way, and allow multiple responses to the rules to be considered. The best way to illustrate the decision table is with an example similar to the one used in Chapter 2, “Setting up rules in ODM” on page 3.

A loan request is made, and whether it is approved or rejected is based on two factors, the amount of the loan and the age of the customer, based on the following table delete, as shown in Table E-1.

Table E-1  Decision factors for loan

<table>
<thead>
<tr>
<th>Amount of loan</th>
<th>Age</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than the yearly income of borrower</td>
<td>&lt;=21</td>
<td>Approved</td>
</tr>
<tr>
<td></td>
<td>21&lt; age &lt;=60</td>
<td>Approved</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>Approved</td>
</tr>
<tr>
<td>More than the yearly income but less than 3x yearly income</td>
<td>&lt;=21</td>
<td>Rejected</td>
</tr>
<tr>
<td></td>
<td>21&lt; age &lt;=60</td>
<td>Approved</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>Approved</td>
</tr>
<tr>
<td>Greater than the yearly income</td>
<td>&lt;=21</td>
<td>Rejected</td>
</tr>
<tr>
<td></td>
<td>21&lt; age &lt;=60</td>
<td>Approved</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>Rejected</td>
</tr>
</tbody>
</table>
This information can be expressed by using a decision table, which makes it easier for you to view. Follow these steps:

1. In the Rules Designer, click **New → Create Decision Table**, as shown in Figure E-1.

![Create a decision table](image)
2. Select a source folder, enter the name `DecideOnLoan`, and click **Finish**, as shown in Figure E-2.

```
Figure E-2   New decision table details
```

3. There are two columns in your decision table, and the default created is three, so remove one of the condition columns. Right-click column C and select **Remove Condition Column**, as shown in Figure E-3.

```
Figure E-3   Remove a condition column
```
4. To display the Condition Definition panel, right-click the heading of column A and select **Edit Condition Column**, as shown in Figure E-4.

![Edit Condition Column](image)

*Figure E-4  Edit a condition column*

5. Enter these values, as shown in Figure E-5. You can use the editor to help enter this information:

   a. In the Test field, enter the amount of 'the loan' is more than `<min>` and at most `<max>`.

   b. In the Title field, enter *Amount*.

   c. In the Expression Placeholders field, enter `<> a boolean [a boolean]`.

![Condition Definition](image)

*Figure E-5  Values for the Amount condition column*
6. Click **OK** to populate the column.

7. In row 1, column A, right-click and select **Operator** and then select the less than or equal to symbol (**<=**), as shown in Figure E-6.

![Figure E-6  Select an operator](image)

8. Repeat the process for row 3, except this time, select the greater than symbol (**>**).

9. Populate the values in this column. Click row 1, column Amount to display the rule, as shown in Figure E-7.

![Figure E-7  Populating values](image)

10. Click **<a number>** to display the help. Select the yearly income of **<a borrower>**, as shown in Figure E-8.

![Figure E-8  Selecting a value](image)
11. Enter the borrower, so that the decision is the amount of ‘the loan’ is at most the yearly income of ‘the borrower’, as shown in Figure E-9.

![Figure E-9 Entering a value](image)

12. Repeat this process to populate the cells, as shown in Figure E-10.

![Figure E-10 Completed values](image)

13. Select column B, and populate the Condition Column box using the following information, as shown in Figure E-11 on page 68:

   a. In the Test field, enter the age of ‘the borrower’ is more than <min> and at most <max>.
   b. In the Title field, enter Age.
14. In row 1, column Age, right-click and select **Add → Insert New Row After**, as shown in Figure E-12.

---

**Figure E-11   Condition Column values**

**Figure E-12   Insert new row to decision table**
15. Repeat this step to add an extra row. Add more rows so that there are three rows opposite each of the three possible entries in the Amount row. The table now shows columns for Amount (with min and max) and Age (with min and max), as shown in Figure E-13. There are three possibilities (rows) for Age next to each possible Amount (income).

<table>
<thead>
<tr>
<th>Amount</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min</td>
</tr>
<tr>
<td>≤ the yearly income of the borrower</td>
<td></td>
</tr>
<tr>
<td>the yearly income of the borrower</td>
<td></td>
</tr>
<tr>
<td>the yearly income of the borrower * 3</td>
<td></td>
</tr>
<tr>
<td>&gt; the yearly income of the borrower * 3</td>
<td></td>
</tr>
</tbody>
</table>

Figure E-13  Adding more rows

16. Add the less than or equal to (\(\leq\)) operator to row 1 for Age, and the greater than (\(>\)) operator to row 3. Enter 21 for the minimum and 60 for the maximum, as shown in Figure E-14.

<table>
<thead>
<tr>
<th>Age</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21</td>
<td>60</td>
</tr>
</tbody>
</table>

Figure E-14  Age values and operators

17. Use copy and paste operations to copy the contents of these cells to the corresponding cells beneath them, so that each set of rows has the same values, as shown in Figure E-15.

<table>
<thead>
<tr>
<th>Amount</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min</td>
</tr>
<tr>
<td>≤ the yearly income of the borrower</td>
<td></td>
</tr>
<tr>
<td>the yearly income of the borrower</td>
<td></td>
</tr>
<tr>
<td>the yearly income of the borrower * 3</td>
<td></td>
</tr>
<tr>
<td>&gt; the yearly income of the borrower * 3</td>
<td></td>
</tr>
</tbody>
</table>

Figure E-15  Age values and operators filled across decision table
You are now ready to populate the actions. First, create a new action column. Right-click the header of column C, and select **Insert Action Column After**, as shown in Figure E-16.

![Insert an action column](image)

Double-click the header of column C and enter the action, as shown in Figure E-17, using this information:

a. In the Action field, enter `reject 'the loan', reason: (<a string>).`

b. In the Title field, enter `RejectLoan`.

c. Select **Visible**.

d. In the Expression Placeholders field, enter `<> a string [a string].`

![Action Definition - RejectLoan](image)

Select **OK**. Enter the messages for each of the three cells, as shown in Figure E-18 on page 71:

a. For the first cell, enter `Borrower is below the age limit for this amount.`

b. For the second cell, enter `Borrower is below the age limit for this amount.`
c. For the third cell, enter Borrower is above the age limit for this amount.

![Table]

<table>
<thead>
<tr>
<th>Amount Note</th>
<th>Age Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ the yearly income of 'the borrower'</td>
<td>21 ≤ 21, 60</td>
</tr>
<tr>
<td>&gt; 21</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>the yearly income of 'the borrower'</td>
<td>21 ≤ 21, Borrower is below the age limit for this amount</td>
</tr>
<tr>
<td>&gt;= 60</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>&gt; the yearly income of 'the borrower' * 3</td>
<td>21 ≤ 21, Borrower is below the age limit for this amount</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>&gt; 60</td>
</tr>
</tbody>
</table>

Figure E-18  Entering messages for RejectLoan

21. In each of the remaining cells, right-click and select Enable / Disable Action to disable this action for each of these cells, as shown in Figure E-19.

![Image]

Figure E-19  Enable or disable the action

22. Double-click column D and enter information in the Action Column panel, as shown in Figure E-20 on page 72:
   a. In the Action field, enter set the approved of 'the loan' to <a string>.
   b. In the Properties field, enter Decision.
   c. In the Expression Placeholders field, enter <> a string [a string].
23. Click **OK** and populate the strings in the column, disabling the action in the appropriate cells, as shown in Figure E-21. The cells in the Reject Loan column without a message are disabled, and their corresponding cells in the Decision column have a value of T.

![Figure E-20 Add an Action and a Title](image)

![Figure E-21 Configure Actions for the Decision column](image)

24. Save the decision table.

You have created a 9-way decision matrix based on two parameters, *age* and *amount of loan*. Clearly, it is possible to extend this decision table much further to make more fine-grained decisions. In some circumstances, it is easier to view the rules in this way rather than using a rule flow. Not only does this method produce the decision, it also sends a message explaining any rejections.
Decision trees

A decision tree describes rules in a tree-like structure, providing an alternative way of viewing and managing sets of business rules. Conditions are declared in a diamond-shaped node. The branches of the tree represent the possible conditions, and the actions are declared at the end of those branches.

To create a decision tree, use the identical rules that you used to create the decision table in Table E-1 on page 62.

When you create your own rules, you can use whichever design is most appropriate for your configuration. Follow these steps:

1. In the Rules Designer, right-click the loan-decision-rules project and select New → Decision Tree, as shown in Figure E-22.

Figure E-22 Create a decision tree
2. Enter the name **LoanDecision**, as shown in Figure E-23.

![Figure E-23   New decision tree details](image)

3. Click **Finish** to display the Rules decision tree, as shown in Figure E-24.

![Figure E-24   Rules decision tree](image)
4. Construct the following tree:
   
   a. Click Node A to select it.
   
   b. Use the **Add Branch** icon not button at the top to add two new branches from node A. You must reselect node A in between creating the first and second branches.
   
   c. Now, select the branches to Rule 1 and Rule 2 in turn and insert an extra condition node, using the **Insert a Condition Node** icon button. Do not insert an extra condition node for Rule 0, as shown in Figure E-25.

   ![Figure E-25: Add condition nodes](image)

   d. Create an extra branch from node B to Rule 1 and Rule 2, and extra branches from node C to Rule 3, Rule 4, and Rule 5, so that the diagram looks like the diagram in Figure E-26 on page 76.
5. Label the nodes:
   a. Node A represents the decision made on the amount of the loan. Double-click node A to open the Node Editor, and enter Amount of Loan. Click OK, as shown in Figure E-27.

   b. In the same way, label node B Age more than 65, and label node C Age between 21 and 65. Both nodes are making a decision based on age, although the decision is different for each node.

6. Populate the decision-making in the Amount of Loan node:
   a. Click the Amount of Loan is this correct? condition node to open the condition editor.
b. Enter the amount of 'the loan' is more than _<a number>_ and at most _<a number>_ as shown in Figure E-28 on page 77. Click the green check mark on the left to save your changes.

![Figure E-28 Adding conditions](image)

**Figure E-28** Adding conditions

c. Click the branch to Rule 0. Modify the rule so that it reads the amount of 'the loan' is at most the yearly income of 'the borrower'. Click the green check mark to save. When you click the diagram, the branch will be labeled accordingly, as shown in Figure E-29.

![Figure E-29 Decision tree with some labels](image)

**Figure E-29** Decision tree with some labels

d. Repeat for the other two branches. Remember to click the green check mark to save.

i. The text for the middle branch is the amount of 'the loan' is more than the yearly income of 'the borrower' and at most 3*the yearly income of 'the borrower'. Click the green check mark to save.

ii. The text for the right branch is the amount of 'the loan' is more than 3 * the yearly income of 'the borrower'. Click the green check mark to save.

e. The tree displays these changes, as shown in Figure E-30 on page 78.
7. Populate the Age 21 or over node:
   a. If you consider this example, loans between 1 and 3 times the borrower’s salary are only available to borrowers over the age of 21. Therefore, we have two possible outcomes, depending on whether the borrower is over 21, which is why there are two branches.
   b. Click the Age 21 or over node and populate the rule with the age of 'the borrower' is at least 21 is <a boolean>. Click the green check mark to save.
   c. Populate the branch to Rule 1 with the age of 'the borrower' is at least 21 is true. Click the green check mark to save.
   d. Right-click the branch to Rule 2 and select Set/Unset as Otherwise, as shown in Figure E-31.
   e. The diagram displays these changes, as shown in Figure E-32 on page 79.
8. Now, select and populate the **Age between 21 and 60 node**:

   a. Enter the rule as the age of 'the borrower' is more than `<a number>` and at most `<a number>`. Click the green check mark to save.

   b. On the first branch, modify the rule so that it reads the age of 'the borrower' is more than 21 and at most 60. Click the green check mark to save.

   c. On the middle branch, modify the rule so that it reads the age of 'the borrower' is at most 21. Click the green check mark to save.

   d. On the right branch, modify the rule so that it reads the age of 'the borrower' is more than 60. Click the green check mark to save.

   e. The diagram now displays these changes, as shown in Figure E-33.
9. Now, populate the actions. Rules 0, 1, and 3 need to indicate that the loan has been accepted.
   a. Right-click Rule 0, and select **Edit**. Enter **Approved** as the label for this rule. Click **OK** to save, as shown in Figure E-34.

   ![Figure E-34 Rule 0 is titled Approved](image)

   b. Click **<edit action>**, as shown in Figure E-35.

   ![Figure E-35 Edit Action](image)

   c. Replace the action with `set the approved of 'the loan' to "T"`. Click the green check mark to save the action, as shown in Figure E-36.

   ![Figure E-36 Edit Action](image)

   d. Repeat the process to populate Rules 1 and 3, as shown in Figure E-37 on page 81.
10. Rules 2 and 4 need to indicate that the borrower age is too young for this loan:
   a. Label these two Rules Rejected, age too low.
   b. Populate the action with reject 'the loan', reason: ("Borrower below the age limit for this amount"). Click the green check mark to save the action.

11. Rule 5 needs to indicate that the borrower's age is too old for this loan:
   a. Label this Rule Rejected, age too high.
   b. Populate the action with reject 'the loan', reason: ("Borrower above the age limit for this amount"). Click the green check mark to save the action.

12. The decision tree is now complete. The decisions are identical to the ones that you defined in the table, but are being viewed in a different way. It might be impossible to see the entire decision tree at one time, necessitating scrolling. If this is the case, you can change the view to horizontal layout by clicking Switch to horizontal layout for a different view, as shown in Figure E-38.

Figure E-38  Decision tree with final details, horizontal layout

Appendix E. Further rules definitions  81
IBM Operational Decision Manager (ODM) is an implementation of a Business Rule Management System (BRMS). It enables you to create, manage, test, and govern business rules and events. You can store these in a central repository where multiple individuals and software products can access them.

IBM ODM Version 8.0 provides support for IBM IMS COBOL programs. This IBM Redpaper publication walks you through a step-by-step approach for using IBM ODM for rules management from an IMS COBOL MPP, BMP, or DL/I BATCH program.

Provides a step-by-step guide for calling ODM from IMS MPP, BMP, and DL/I applications.

Discusses IMS applications' usage of ODM as a Rules System.

Considers the configuration changes required in IMS.