FUJITSU

# FUJITSU Software NetCOBOL V11.0

# J Adapter Class Generator User's Guide

Windows

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# Preface

The "NetCOBOL J Adapter Class Generator" is a tool that generates a COBOL class (adapter class) used to call a Java class. Using the adapter class thus generated makes the Java class library available from COBOL.

A Java runtime environment must be installed to execute the generator or the adapter class generated. See "1.4 Preparation" for required products.

## Purpose of This Manual

This manual provides information on how to enable COBOL programs to use Java classes. The information includes the ways of creating adapter classes, writing programs, and running the programs.

Refer to the "NetCOBOL Language Reference" for the COBOL syntax. For information on how to develop programs using Fujitsu NetCOBOL, refer to the "NetCOBOL User's Guide".

## Intended Readers

This manual is intended for persons who develop COBOL programs using Java classes.

## Prerequisites

Readers are required to have the following knowledge to read this manual:

- Basic knowledge of COBOL syntax
- Basic knowledge of COBOL object-oriented programming
- Basic knowledge of Java

## Organization of This Manual

This manual consists of the following chapters:

Chapter 1. Outline of J Adapter Class Generator

Chapter 1 explains the function and operating environment of the J adapter class generator.

Chapter 2. J Adapter Class Generator Framework

Chapter 2 explains the framework of the J adapter class generator.

Chapter 3. Developing Programs

Chapter 3 explains how to develop programs that uses Java classes.

Chapter 4. Using the Generator Command

Chapter 4 explains how to use the generator command (java2cob).

Chapter 5. Adapter Class Reference

Chapter 5 provides detailed information on the FJ-JAVA-BASE, FJ-JAVA-CONTROL and FJ-JAVA-ERROR classes provided by the J adapter class generator, and adapter classes generated by the J adapter class generator.

Appendix A. Message List

Appendix A explains the messages output by the J adapter class generator, including the operator responses to the messages.

Appendix B. Exception Type List

The Appendix B describes the types of exception generated by the J adapter class generator and their remedial measures.

## How to Use This Manual

When using the J adapter class generator for the first time, begin to read from Chapter 1. Chapter 1 provides an outline of the J adapter class generator, Chapter 2 explains the framework, and Chapter 3 explains the procedures from development to execution.

Chapters 4 and 5 provide detailed information on how to use commands and classes. Read these chapters for program development.

The Appendix A describes the messages that are output form the J adapter class generator and the Appendix B describes the exception types that the J adapter class generator sets. Read them as necessity requires.

## Product Names

| Product Name | Abbreviation |
|---|---|
| Microsoft® Windows Server® 2012 R2 Datacenter<br>Microsoft® Windows Server® 2012 R2 Standard<br>Microsoft® Windows Server® 2012 R2 Essentials<br>Microsoft® Windows Server® 2012 R2 Foundation | Windows Server 2012 R2 |
| Microsoft® Windows Server® 2012 Datacenter<br>Microsoft® Windows Server® 2012 Standard<br>Microsoft® Windows Server® 2012 Essentials<br>Microsoft® Windows Server® 2012 Foundation | Windows Server 2012 |
| Microsoft® Windows Server® 2008 R2 Foundation<br>Microsoft® Windows Server® 2008 R2 Standard<br>Microsoft® Windows Server® 2008 R2 Enterprise<br>Microsoft® Windows Server® 2008 R2 Datacenter | Windows Server 2008 R2 |
| Windows® 8.1<br>Windows® 8.1 Pro<br>Windows® 8.1 Enterprise | Windows 8.1 |
| Windows® 8<br>Windows® 8 Pro<br>Windows® 8 Enterprise | Windows 8 |
| Windows® 7 Home Premium<br>Windows® 7 Professional<br>Windows® 7 Enterprise<br>Windows® 7 Ultimate | Windows 7 |

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August 2015

# Contents

# Chapter 1 Outline of J Adapter Class Generator

This chapter explains the function and operating environment of the J adapter class generator.

## 1.1 What is the J Adapter Class Generator?

Taking advantage of the object-oriented function, NetCOBOL enables programming using class libraries. The NetCOBOL also provides many useful foundation classes. Meantime, as Java becomes popular, many Java class libraries are also provided. However, the class structure varies from language to language and therefore Java class libraries cannot normally be used from COBOL.

The J adapter class generator provides a framework that enables COBOL to use Java classes.

The J adapter class generator enables a COBOL program to:

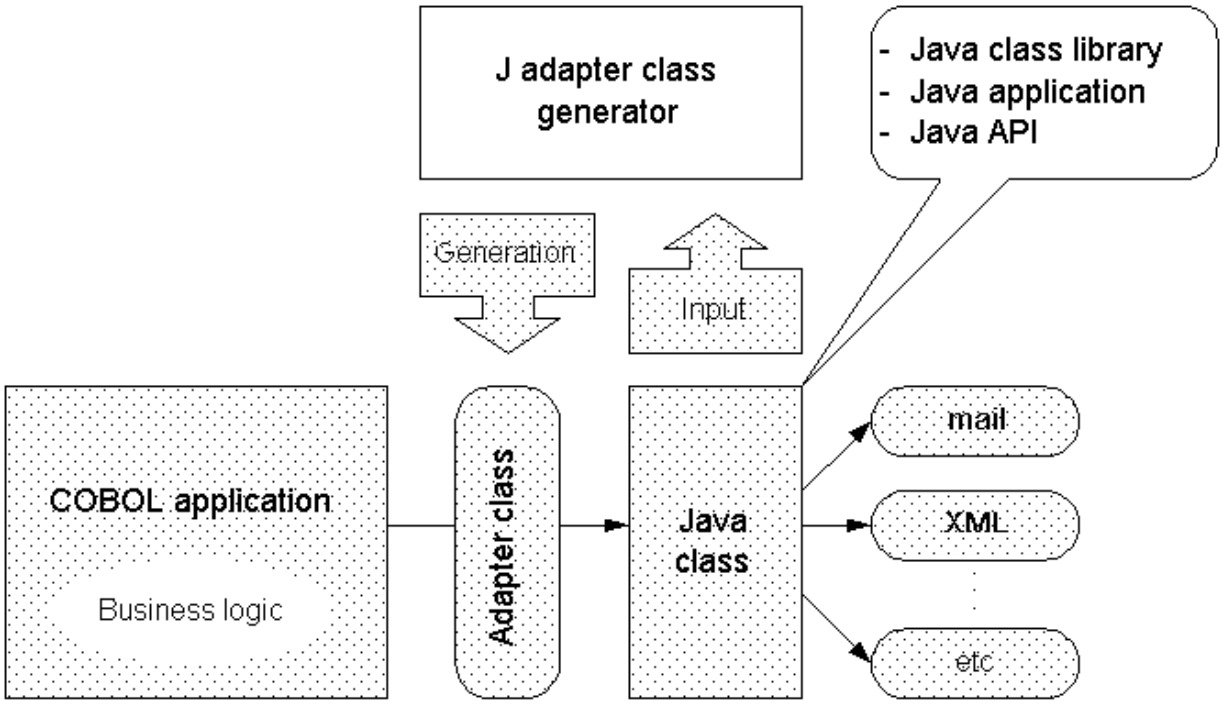
- Use a Java class library.
- Call a Java application.
- Use an application program interface (API) provided for Java.

The J adapter class generator enables COBOL to be used for systems that previously could only have been implemented in Java.

Use of the J adapter class generator is recommended in the following situations:

- Constructing a COBOL system using Java common parts such as EJB components.
- Constructing a COBOL system using whole Java applications.

An outline of the J adapter class generator is given below:




The Java class interface must be converted into the COBOL interface for a COBOL program to use Java classes. The J adapter class generator generates an adapter class that converts the Java interface into the COBOL interface.

## 1.2 What the J Adapter Class Generator Can Do

Using adapter classes generated by the J adapter class generator enables the following types of operation for Java.

To COBOL programs, Java objects seem to be COBOL objects. Therefore, Java objects can be handled the same way as ordinary COBOL objects.

### Accessing a class variable

Access to a public class variable (static field) declared in a Java class is enabled. COBOL handles it as a factory property.

### Invoking a class method

A public class method (static method) declared in a Java class can be invoked. COBOL handles it as a factory method.

### Generating an instance object (invoking a constructor)

Invoking a constructor can create a Java instance object. COBOL handles it as a factory method that returns an object.

### Accessing an instance variable

Access to a public instance variable (non-static field) of a Java instance object is enabled. COBOL handles it as an object property.

### Invoking an instance method

A public instance method (non-static method) of a Java instance object can be invoked. COBOL handles it as an object method.

### Receiving an exception

An exception caused when a class method, constructor, or instance method is invoked can be trapped to perform error processing. COBOL uses the USE statement to receive an exception object.

## 1.3 What the J Adapter Class Generator Cannot Do

The J adapter class generator cannot perform the following types of operation:

### Inheriting a Java class

A COBOL class inheriting a Java class cannot be defined. Even if a COBOL class inherits an adapter class, the Java class function cannot be overwritten.

### Passing a COBOL object as a parameter

No COBOL object can be passed as a parameter for invoking a method, nor can a COBOL object be set for a Java field. Only an adapter object produced by wrapping a Java object can be passed to Java.

Therefore, the following restrictions apply to COBOL:

- Listener

  Java registers a listener object, in which event processing logic is written, within an object that generates an event. However, since no COBOL object can be registered in a Java object, COBOL cannot be used to write listeners.

- Collection class

  No COBOL object can be registered in a Java collection class. When using COBOL objects as a collection, use a COBOL collection class.

### Invoking COBOL from Java

No COBOL program can be invoked from Java. A COBOL program invoked from Java can use no adapter class.

## 1.4 Preparation

The following products are required for the development or execution environment for using the J adapter class generator.

### 1.4.1 NetCOBOL or NetCOBOL Runtime System

NetCOBOL is required to develop programs using the J adapter class generator. NetCOBOL or NetCOBOL Runtime System is required to execute applications developed by the J adapter class generator.

## 1.4.2 Java Development Kit or Java Runtime Environment

Java SE Development Kit (JDK) is required to develop Java applications using the J adapter class generator.

Java SE Runtime Environment (JRE) is required to execute Java applications developed by the J adapter class generator. JDK includes JRE.

Refer to "J Adapter Class Generator Software Release Guide" for JDK and JRE that can be combined with the J adapter class generator.

# Chapter 2 J Adapter Class Generator Framework

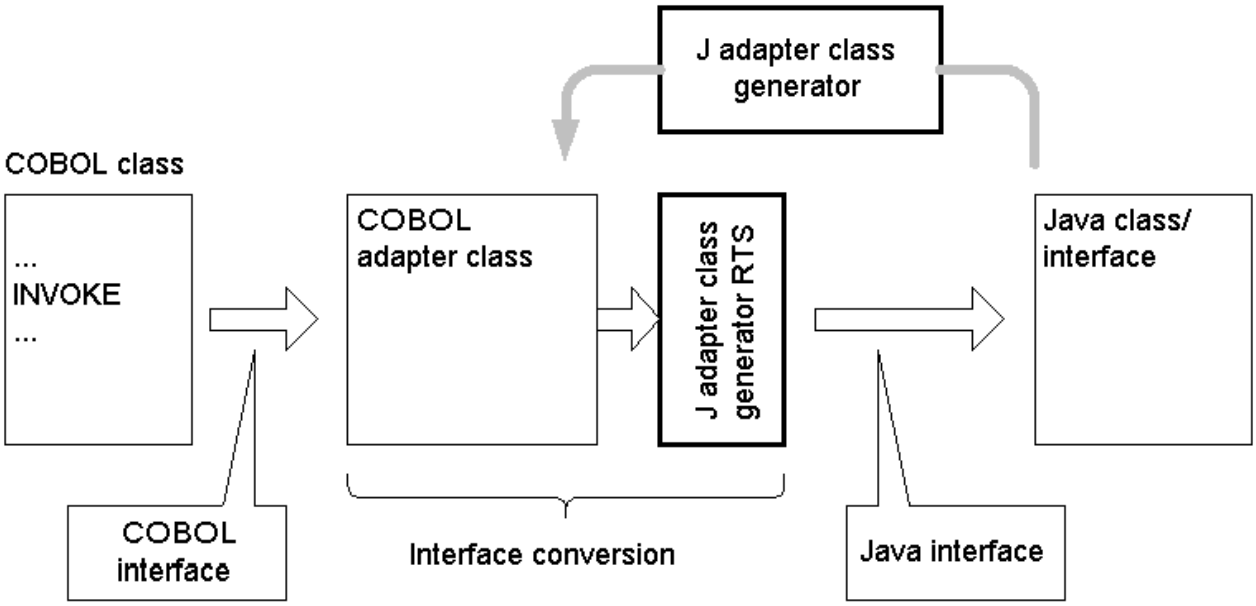
This chapter explains the framework of the J adapter class generator.

## 2.1 Adapter Class

To make Java classes available to COBOL, a mechanism for converting the Java class interface into the COBOL interface is required. The J adapter class generator works as an interface converting mechanism to generate adapter classes corresponding to Java classes. To use a Java class from a COBOL program, the adapter class created by the generator can be called. The adapter class is written in COBOL and therefore can be called in the same manner as a COBOL class.

The relationship between the Java class/interface and adapter class is shown below:

Figure 2.1 Java class/interface and adapter class



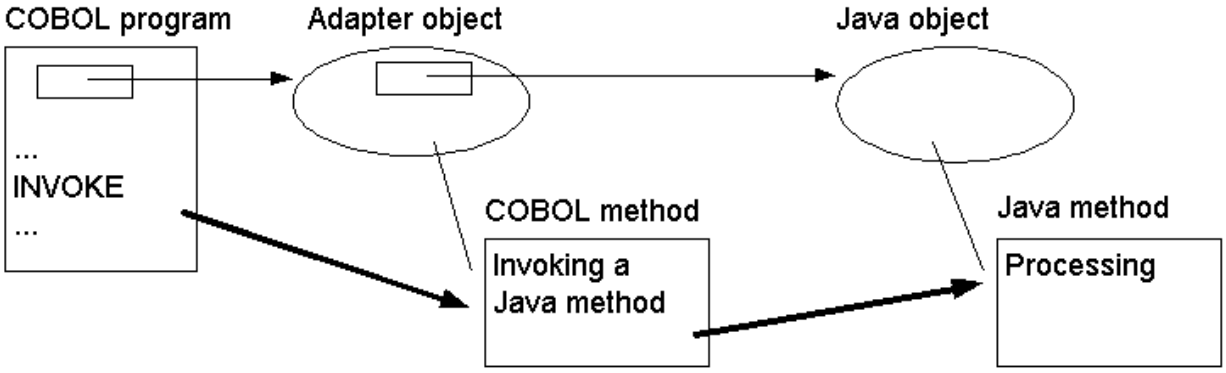

## 2.2 Adapter Object

At execution time, an adapter class generates the adapter object corresponding to a Java instance object. The adapter object:

- Holds the pointer to the corresponding Java instance object.
- Calls the corresponding Java method of the corresponding Java instance object

Only the adapter object can be seen from the COBOL program. Every operation on the adapter object is transmitted to the corresponding Java object. To the COBOL program, the adapter object seems as if it were a Java object. The adapter object, since it works for the Java object, is also called a proxy object. The relationship between the Java object and adapter object is shown below:

Figure 2.2 Java object and adapter object



# Chapter 3 Developing Programs

This chapter explains how to develop programs that use Java classes.

## 3.1 Creating Adapter Classes

This section explains how to generate an adapter class from a Java class.

### 3.1.1 Investigating the Java Class

First investigate the specifications of the Java class and interface to be used (class name, package name, usage, and so on) to check whether the J adapter class generator can handle the class and interface. See "1.2 What the J Adapter Class Generator Can Do" and "1.3 What the J Adapter Class Generator Cannot Do" for information on which classes and interfaces can be used.

### 3.1.2 Generating Adapter Class Source

If the target Java class and interface can be used, generate adapter class source. Use the java2cob command to generate adapter classes. The java2cob command reads the class file (extension .class) of the Java class/interface and generates the corresponding adapter class source.

The java2cob command generates adapter classes of not only the class specified by the option but also every other class/interface required to use the class.

An example of generating adapter class source from the java.util.Date class is shown below.

```
d:\home\j2cob\samples>java2cob java.util.Date
java/lang/Object
java/io/Serializable
java/lang/Cloneable
java/lang/Comparable
java/util/Date
java/lang/reflect/GenericDeclaration
java/lang/reflect/Type
java/lang/reflect/AnnotatedElement
java/lang/Class
java/lang/Throwable
java/lang/Exception
java/lang/InterruptedException
java/lang/CharSequence
java/lang/String
java/lang/reflect/TypeVariable
java/lang/annotation/Annotation
java/lang/ClassLoader
java/lang/ClassNotFoundException
java/lang/InstantiationException
```

Note

The class file referenced by the class/interface may not always be available, depending on the execution environment. For information on how to generate adapter classes when the class file is not available, see "3.1.4 Generating an Adapter Class When the Class File is Not Available".

### 3.1.3 Building an Adapter Class

Finally, compile and link-edit the generated adapter class source to create an adapter class library (DLL).

Refer to the "Fujitsu NetCOBOL User's Guide" for information on how to use the COBOL project manager.

Follow the procedure below to build an adapter class:

1. Create a new project using the project manager.
2. Register the target DLL.
3. Create a COBOL source file folder and store the generated adapter class in it.
4. Specify compiler options.
   - Specify folder-name\REP (folder-name is the J adapter class generator install folder) for REPIN.
   - Specify ALPHAL (WORD).
   - When creating an adapter class running with Unicode, specify ENCODE(UTF8).
   - When creating a multi thread application, specify THREAD(MULTI).
5. To determine the compilation order, select "Repository File Search" from the "Edit" menu and then select "All".
6. Create a library folder and store the runtime library F3BIJART.LIB of the J adapter class generator in it. F3BIJART.LIB exists in the install folder.
7. Execute "build."

The following files are generated. These files are required for using adapter class:

- Adapter class DLL file (required for execution)
- Adapter class LIB file (required for link-edit)
- Adapter class repository file (required for compilation)

## 3.1.4 Generating an Adapter Class When the Class File is Not Available

The J adapter class generator references the following class information when generating an adapter class:

- Super class/interface
- Class/interface specified in the public method, constructor parameter, or return value
- Class/interface specified in the public variable

Therefore, an adapter class cannot be generated normally without these class files. These class files may not be available depending on the environment. In this case, to create an adapter class normally, dummy class files having these file names must be prepared.

Prepare a dummy class file as follows:

1. Create a folder corresponding to the package name. For package name aaa.bbb.ccc, for instance, create a folderwith name aaa\bbb \ccc.
2. Create a Java source program satisfying the following. Assign this file the name "ClassName.java".

```
package PackageName;
public class ClassName {}
```

3. Compile the source program with the Java compiler.

```
c:\> javac FolderName\ClassName.java
```

4. Enter the java2cob command.

```
c:\> java2cob PackageName.ClassName
```

Note

If a class file is referred to, but does not exist when attempting to generate an adapter class, processing is terminated with message "*Class information was not found. Generation was interrupted.*"

## 3.1.5 Reducing the Size of Adapter Class

The adapter class source generated by the J adapter class generator may be simply compiled and linked before it is used.

Since, however, the adapter source class can include class files, which are not used by the applications, there might be cases where the size of the DLL file of the adapter class is significantly larger than necessary. In a case like this, the size of the adapter class can be reduced by the following methods:

- Specifying the constructor/method/field
- Specifying the -om option or the "Option ReduceClass" parameter

### 3.1.5.1 Specifying the Constructor/Method/Field

When the constructors, methods, and fields that are used in the application are known, the number of the adapter classes generated can be reduced by specifying them.

The J adapter class generator generates only the adapter classes that are required by the specified constructors/methods/fields.

Refer to -r option, -gc option, -gm option, -gf option and "Class class-name/interface-name" parameters for details of the procedure of specifying the constructor/method/field.

Example

When an application uses only the println (Object) method of the java.io.PrintStream class, specify as follows:

```
c:\> java2cob -r java.io.PrintStream -gm "println(java.lang.Object)"
```

### 3.1.5.2 Specifying the -om Option or the "Option ReduceClass" Parameter

Specifying the -om option or the "Option ReduceClass" parameter can reduce the number of adapter classes generated. To check for parameter validity at method invocation, the J adapter class generator generates adapter classes corresponding to individual parameters. Thus many adapter classes are generated for one class.

When the -om option or the "Option ReduceClass" parameter is specified, all object-type method parameters are mapped to the java-lang-Object class. This function suppresses the generation of adapter classes corresponding to the method parameters and thereby reduces the number of adapter classes generated.

Note

- When the method of the adapter class generated with the -om option or the "Option ReduceClass" parameter specified is invoked, BY CONTENT must be specified as an object reference parameter.
- When the -om option or the "Option ReduceClass" parameter is specified, the object reference types of method parameters excluding the return value become java-lang-Object and therefore the original parameter types become uncertain. Therefore, for a parameter whose object reference type becomes java-lang-Object, a parameter name is generated according to the following rules so that the original type information is included in the parameter name.

```
Pn-ClassName
```

- P is followed by a parameter serial number (1 to 99).
- The hyphen "-" is followed by an external class name excluding a package name after conversion into uppercase.
- A parameter name exceeding 30 characters is truncated after the 30th character.

Example

When the -om option or the "Option ReduceClass" parameter is not specified, adapter class source java-io-PrintStream.cob of the java.io.PrintStream class becomes as shown below, and the java-io-OutputStream class is required.

```
  ...
REPOSITORY.
    CLASS J-OUTPUTSTREAM AS "java-io-OutputStream"
  ...
LINKAGE SECTION.
01 PARA-1 OBJECT REFERENCE J-OUTPUTSTREAM.
  ...
```

When the -om option or the "Option ReduceClass" parameter is specified, the parameter becomes the java-lang-Object type. Therefore, the java-io-OutputStream class is not required or generated.

```
  ...
REPOSITORY.
    CLASS J-OBJECT AS "java-lang-Object"
  ...
LINKAGE SECTION.
01 P1-OUTPUTSTREAM OBJECT REFERENCE J-OBJECT.
  ...
```

# 3.2 Developing an Application That Uses an Adapter Class

This section explains how to develop a program that uses an adapter class.

## 3.2.1 Creating a COBOL Program

The flow of program processing using the adapter class is as follows:

1. Initialization of the Java VM.
2. In the case of a multithreaded application, connection of the current thread to the Java VM .
3. Generation of the object.
4. Calling the method.
5. In the case of a multi threaded application, disconnection from the Java VM .
6. Termination of the Java VM.

Also, be careful when performing the following operations:

- Manipulating a variable
- Comparing object references
- Assignment to a subclass
- Mapping java.lang.String into PIC X.
- End control of character string
- Exception processing

### 3.2.1.1 Initializing the Java VM

To use an adapter class, the Java virtual machine (VM) must first be initialized . Use the JVM-INIT method or the JVM-ATTACH method of the FJ-JAVA-CONTROL class to initialize the Java VM.

A coding sample is shown below:

```
  ...
REPOSITORY.
    CLASS FJ-JAVA-CONTROL
  ...
PROCEDURE DIVISION.
```

```
  ...
    INVOKE FJ-JAVA-CONTROL "JVM-INIT".
  ...
```

### 3.2.1.2 Terminating the Java VM

When an adapter class is no longer used, the Java VM must be terminated. Use the JVM-TERMINATE method of the FJ-JAVA-CONTROL class to terminate the Java VM.

A coding sample is shown below:

```
  ...
REPOSITORY.
    CLASS FJ-JAVA-CONTROL
  ...
PROCEDURE DIVISION.
  ...
    INVOKE FJ-JAVA-CONTROL "JVM-TERMINATE".
  ...
```

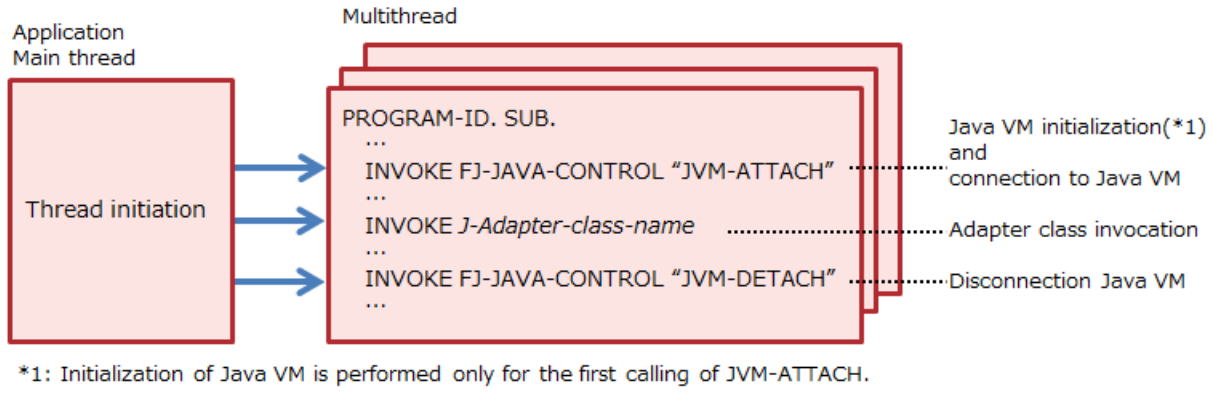
### 3.2.1.3 Developing a Multithread Application

A multithread application using an adapter class must connect the current thread to the Java virtual machine (VM). When the multithread application is terminated, the current thread must first be disconnected from the Java VM.

Use the JVM-ATTACH method of the FJ-JAVA-CONTROL class to connect the current thread to the Java VM.

To disconnect the current thread from the Java VM, use the JVM-DETACH method of the FJ-JAVA-CONTROL class.

A multithread application sample is shown below:




### 3.2.1.4 Generating an Object

Generate an object by invoking the adapter class factory method corresponding to the constructor. Generate the factory method with the following name.

```
Create-JavaClassName-nn  (nn is 01 to 99)
```

An example of generating a Date class object is shown below:

```
  ...
REPOSITORY.
    CLASS J-Date AS "java-util-Date"
  ...
WORKING-STORAGE SECTION
01  anDate OBJECT REFERENCE J-Date.
  ...
PROCEDURE DIVISION.
```

```
  ...
    INVOKE J-Date "Create-Date-01" RETURNING anDate.
  ...
```

Note

Since the adapter class name is very long, it is recommended that an alias be assigned by specifying AS in the REPOSITORY paragraph.

### 3.2.1.5 Invoking a Method

Invoke an instance method by invoking the corresponding adapter class object method. The method name is the same as that of Java. However, if more than one method is defined with the same name, append a numeric suffix to distinguish them (see "5.5.5 Class method ″and "5.5.7 Instance Method").

An example of invoking the getTime method of the Date class is shown below:

```
  ...
REPOSITORY.
    CLASS J-Date AS "java-util-Date"
  ...
WORKING-STORAGE SECTION
01  anDate OBJECT REFERENCE J-Date.
01  currentTime PIC S9(9) COMP-5.
  ...
PROCEDURE DIVISION.
  ...
    INVOKE anDate "getTime" RETURNING currentTime.
  ...
```

### 3.2.1.6 Manipulating a Variable

Manipulate a variable through the corresponding adapter class property. The property name is a Java field name with the prefix "*JF-*". However, if more than one field is defined with the same name, append a numeric suffix to distinguish them.

An example of referencing the class variable AM_PM_FIELD (static field) of the DateFormat class is shown below:

```
  ...
REPOSITORY.
    CLASS J-DateFormat AS "java-text-DateFormat"
  ...
WORKING-STORAGE SECTION
01  FMT-Type PIC S9(9) COMP-5.
  ...
PROCEDURE DIVISION.
  ...
    MOVE JF-AM_PM_FIELD OF J-DateFormat TO FMT-Type.
  ...
```

### 3.2.1.7 Comparing Object References

COBOL uses "=" to check whether multiple object references point to the same object. To check whether the Java objects pointed to by the adapter objects are the same, COBOL uses the J-EQUALS method of the adapter class instead of "=". The adapter class always has the J-EQUALS method.

An example of comparing two Date objects is shown below. The condition is met when Date-1 and Date-2 point to the same Java object.

```
  ...
REPOSITORY.
    CLASS J-Date AS "java-util-Date"
  ...
WORKING-STORAGE SECTION
```

```
01  Date-1 OBJECT REFERENCE J-Date.
01  Date-2 OBJECT REFERENCE J-Date.
01  rst    PIC 1.
  ...
PROCEDURE DIVISION.
  ...
    INVOKE Date-1 "J-EQUALS" USING CONTENT Date-2 RETURNING rst.
    IF rst = B"1" THEN
        Condition met
  ...
```

### 3.2.1.8 Assignment to a Subclass

COBOL uses AS to assign an object to a subclass. However, it uses the J-NARROW method instead of AS to assign an adapter object. The adapter class always has the J-NARROW method.

An example of assigning an object, which has been referenced with Object class data, into Data class data is shown below:

```
  ...
REPOSITORY.
    CLASS J-Object AS "java-lang-Object"
    CLASS J-Date AS "java-util-Date"
  ...
WORKING-STORAGE SECTION
01  anDate OBJECT REFERENCE J-Date.
01  anObject OBJECT REFERENCE J-Object.
  ...
PROCEDURE DIVISION.
  ...
    INVOKE J-Date "J-NARROW" USING CONTENT anObject RETURNING anDate.
  ...
```

### 3.2.1.9 Mapping java.lang.String into PIC X

The java.lang.String is mapped into the java-lang-String class in the generation of the normal adapter class. In this case, creation of the user's application becomes somewhat complicated because conversion between the String object and the COBOL data items must be performed using the java-lang-String class method (such as NEW-STRING-X, GET-STRING-X).

When the adapter class is generated by specifying the -s option or by specifying the "Option String" parameter, the following items can be handled as alphanumeric items in the user's applications, since the java.lang.String type is mapped into PIC X ANY LENGTH:

- Return values of the java.lang.String type in the method
- Argument of the java.lang.String type in the constructor and method
- Fields (class variables and instance variables) of the java.lang.String type

#### Example

When the -s option and "Option String" parameter are not specified, the conversion between the String object and the COBOL data items must be performed in the user's application using the java-lang-String class method (such as NEW-STRING-X and GET-STRING-X).

```
  :
REPOSITORY.
    CLASS J-Date AS "java-util-Date"
    CLASS J-String AS "java-lang-String"
    CLASS J-DateFormat AS "java-text-DateFormat"
  :
WORKING-STORAGE SECTION
01  aDateFormat  OBJECT REFERENCE J-DateFormat.
01  aDate        OBJECT REFERENCE J-Date.
01  dateString   OBJECT REFERENCE J-String.
01  dateValue    PIC X(30).
```

```
  :
PROCEDURE DIVISION.
  :
    MOVE "2000/01/01" & X"00" TO dateValue.
    INVOKE J-String "NEW-STRING-X" USING dateValue RETURNING dateString.
    INVOKE aDateFormat "parse" USING dateString RETURNING aDate.
    :
    INVOKE aDate "toString" RETURNING dateString.
    INVOKE dateString "GET-STRING-X" RETURNING dateValue.
  :
```

When the -s option or the "Option String" parameter is specified, the conversion between the String object and the COBOL data items is not necessary since an alphanumeric item can be specified as the String type argument and returns a value directly.

```
  :
REPOSITORY.
    CLASS J-Date AS "java-util-Date"
    CLASS J-DateFormat AS "java-text-DateFormat"
  :
WORKING-STORAGE SECTION
01  aDateFormat  OBJECT REFERENCE J-DateFormat.
01  aDate        OBJECT REFERENCE J-Date.
01  dateValue    PIC X(30).
  :
PROCEDURE DIVISION.
  :
    MOVE "2000/01/01" & X"00" TO dateValue.
    INVOKE aDateFormat "parse" USING dateValue RETURNING aDate.
    :
    INVOKE aDate "toString" RETURNING dateValue.
  :
```

### Note

- The return value of the java.lang.String class constructor is the java.lang.String class
- When the String object method is used, the creation of the object (calling the String constructor or calling the NEW-STRING-X method) is necessary.
- To refer/set the java.lang.String type field (class variable or instance variable), specify its size using -s option or "Option String" parameter.
- When you want to handle the String type NULL object, do not use the -s option and "Option String" parameter.

## 3.2.1.10 Using national data (Unicode)

NetCOBOL processes Unicode data using national data item definitions encoded in UTF-16. UTF-16 data can be stored in either big-endian or little-endian format.

Big-endian

"AB12" --> X"0041 0042 0031 0032"

Little-endian

"AB12" --> X"4100 4200 3100 3200"

NetCOBOL of this system is little-endian by default. To change encoding to big-endian use compiler option ENCODE(UTF8,UTF16,BE). For details, refer to the "NetCOBOL User's Guide".

The generated java adapter class encoding much match the encoding of the program. If the program is UTF-16 little-endian, the adapter class must be UTF-16 little-endian. If the program is UTF-16 big-endian, the adapter class must be UTF-16 big-endian.

Note

The adapter class cannot process the Unicode data whose national class is UTF-32.

### 3.2.1.11 End Control of Character String

When passing a character string that is shorter than the data item length to an ordinary adapter class, the end of string (X"00") must be set. The following example shows that "ABC" is copied to alphanumeric item initialValue having length of 50 characters and is passed to the NEW-STRING-X method:

```
    :
REPOSITORY.
    CLASS J-String AS "java-lang-String"
    :
WORKING-STORAGE SECTION.
01  initialValue  PIC X(50).
01  aString       OBJECT REFERENCE J-String.
    :
PROCEDURE DIVISION.
    :
    MOVE "ABC" & X"00" TO initialValue.
    INVOKE J-String "NEW-STRING-X" USING initialValue RETURNING aString.
```

If an adapter class is generated by specifying the -t option or the "Option Terminal" parameter, the character string that is shorter than the data item length can be passed to a method without setting the end of string, since the end (X "00") of the character string is set in the adapter class.

The following example shows that "ABC" is copied to alphanumeric item initialValue having the length of 50 characters and is passed to the NEW-STRING-X method:

```
    :
REPOSITORY.
    CLASS J-String AS "java-lang-String"
    :
WORKING-STORAGE SECTION.
01  initialValue  PIC X(50).
01  aString       OBJECT REFERENCE J-String.
    :
PROCEDURE DIVISION.
    :
    MOVE "ABC" TO initialValue.
    INVOKE J-String "NEW-STRING-X" USING initialValue RETURNING aString.
```

### 3.2.1.12 Exception Processing

When an adapter class detects an error during processing, the exception object is generated. FJ-JAVA-ERROR class is the class of the exception object.

In order to detect an exception generated in the adapter class, using the "exception object", the "exception handling" needs be described in the declaratives of the procedure division of the program, using the USE statement. When the method of the FJ-JAVA-ERROR class is used in the exception handling, the exception message, exception type and Java exception information can be extracted. For the details of the exception handling using the USE statement, refer to "Defining Exception Processes" of the "NetCOBOL User's Guide".

Example of coding of the exception handling is shown as follows:

```
  :
REPOSITORY.
    CLASS FJ-JAVA-ERROR
  :
WORKING-STORAGE SECTION
01 errMessage     PIC X(256).
01 expMessage     PIC X(1024).
```

```
01 expClass       PIC X(256).
01 errCode        PIC S9(9) COMP-5.
01 errMessageLen  PIC S9(9) COMP-5.
01 expMessageLen  PIC S9(9) COMP-5.
01 expClassLen    PIC S9(9) COMP-5.
01 rc             PIC S9(9) COMP-5.
  :
PROCEDURE DIVISION.
DECLARATIVES.
ERR SECTION.
  USE AFTER EXCEPTION FJ-JAVA-ERROR.
  INVOKE EXCEPTION-OBJECT "GET-CODE" RETURNING errCode.
  INVOKE EXCEPTION-OBJECT "GET-MESSAGE"
         USING errMessage RETURNING errMessageLen.
  INVOKE EXCEPTION-OBJECT "GET-EXCEPTION"
         USING expMessage expMessageLen expClass expClassLen
         RETURNING rc.
  DISPLAY "Error Code:    " errCode.
  DISPLAY "Error Message: " errMessage(1:errMessageLen).
  IF rc NOT = -1 THEN
    DISPLAY "Java Class Name:        " expClass(1:expClassLen)
    DISPLAY "Java Exception Message: " expMessage(1:expMessageLen)
  END-IF.
END DECLARATIVES.
  :
```

Note

When the exception handling is not described in a program, the program runtime error (JMP0104I-U) occurs due to the occurrence of the exception object.

## 3.2.2 Constructing a Program

This section explains how to construct a program that uses an adapter class, by using the COBOL project manager.

The following files generated from the adapter class are required to construct a program:

- Adapter class LIB file (for linkage)
- Adapter class repository file (for compilation)

Construct a program as follows:

1. Create a new project using the project manager.
2. Register the target executable program (EXE).
3. Create a COBOL source file folder and store the program source in it.
4. Create a library file folder, and store the adapter class LIB file and J adapter class generator runtime library F3BIJART.LIB in it. F3BIJART.LIB exists in the install folder.
5. Specify compiler and link options:
   - For REPIN, specify folder-name\REP (folder-name is the J adapter class generator install folder) and the folder containing the adapter class repository.
   - Specify ALPHAL (WORD) or NOALPHAL.
   - When creating a program running with Unicode, specify ENCODE(UTF8).
   - When creating a multi thread application, specify THREAD(MULTI).
   - Refer to the "NetCOBOL User's Guide" for other options.
6. Execute "build."

## 3.3 Running a Program

The following file generated from the adapter class is required to run a program:

### Adapter class DLL file

Before running the program, add the folder containing the adapter class DLL file to environment variable PATH.

The program can be run in the same manner as any other COBOL application. Refer to the "NetCOBOL User's Guide" for details.

Note

The Java VM operating environment can be customized by specifying environment variables.

# Chapter 4 Using the Generator Command

This chapter explains how to use the generator command (java2cob), optional file and output result.

Enter the java2cob command using the NetCOBOL command prompt.

## 4.1 Starting the J Adapter Class Generator

### 4.1.1 Command Syntax

#### When the constructor/method/field is not specified:

```
java2cob [-classpath class-path] [-d output-folder] [-ov] [-om] [-oi] [-c{s|u|ul|ub}] [-s[n]] [-t]
class-name/interface-name ...
```

#### When the constructor/method/field is specified:

```
java2cob [-classpath class-path] [-d output-folder] [-ov] [-oi] [-c{s|u|ul|ub}] [-s[n]] [-t] -r class-
name/interface-name [-gc ["constructor-name [(parameter-type)] [,...]"]] [-gm ["method-name
[(parameter-type)] [,...]"]] [-gf [field-name [,...]]] ...
```

#### When the optional file is specified:

```
java2cob -i optional-file
```

#### Notes on Describing the Command

- The clause that is enclosed by square brackets can be omitted.
- Symbol of the curly brackets indicates selection of clause that is delimited by "|".
- Dot (...) indicates repeated specification.
- Italic type indicates variable character string.

### 4.1.2 Options

-classpath *class-path*

Specifies the Java class/interface search path. When specifying two or more folders, separate them with a semicolon ";".

When this option is specified, environment variable CLASSPATH is ignored.

This option must be specified right after the java2cob command.

Unicode native character cannot be specified for the class path.

-c{s|u|ul|ub}

Specifies the code used for execution. Specify the same code as the COBOL program that uses Java classes. The default is native code.

-cs: native code is used for the execution-time code.

-cu: Unicode and UTF-16 as system endian is used for the execution-time code. In this system, it has the same meaning as -cul.

-cul: Unicode and UTF-16 as litter endian is used for the execution-time code.

-cub: Unicode and UTF-16 as big endian is used for the execution-time code.

-d *output-folder*

Specifies the folder to which an adapter class source is output. The default is the current folder.

-gc ["*constructor-name* [(*parameter-type*)] [,...]"]

Specify the constructor name generated as an adapter class, for the last class-name/interface-name specified before this option. If the constructor name is omitted, all of the constructors within the corresponding class/interface are generated. When specifying two or more constructors, they must be delimited by comma (,) or a blank.

When two or more constructors of the same name exist, only the constructor that matches the parameter type is generated by specifying the parameter-type. If a parameter type is omitted, all of the constructors of the same name are generated. When specifying a parameter type, enclose the parameter type with parenthesis ((and)), and enclose the entire option with double quotation (") to specify a parameter. A parameter type can be specified with the data type name or with the class name that is modified by the package name. When specifying an internal class name as the parameter type, specify dollar ($) instead of using period (.) for the internal class.

This option is valid when the -r option is specified.

This option is exclusive with the -om option.

-gf [*field-name* [,...]]

Specify the field name generated as an adapter class, for the last class-name/interface-name specified before this option. If the field name is omitted, all of the fields within the corresponding class/interface are generated. When specifying more than one field, they must be delimited by comma (,) or a blank.

This option is valid when the -r option is specified.

This option has exclusive relation with the -om option.

-gm ["*method-name* [(*parameter-type*)] [,...]"]

Specify the method name generated as an adapter class, for the last class-name/interface-name specified before this option. If the method name is omitted, all of the methods within the corresponding class/interface are generated. When specifying more than one method, they must be delimited by comma (,) or a blank.

When more than one method of the same name exist, only the method that matches the parameter type is generated by specifying the parameter-type. If a parameter type is omitted, all of the methods of the same name are generated. When specifying a parameter type, enclose the parameter type with parenthesis (( )), and enclose the entire option with double quotation (") to specify a parameter. A parameter type can be specified by data type name or by the class name that is qualified by the package name. When specifying an internal class name as the parameter type, specify dollar ($) instead of period (.) for the internal class name.

This option is valid when the -r option is specified.

This option has exclusive relation with the -om option.

-i optional-file

Specify an optional file.

When this option is specified, other options in the command line are ignored.

-oi

Specifies that a method name cross-reference list file (listing adapter class methods corresponding to Java class methods) be output. The method name cross-reference list file is output with name "adapter-class-source-file-name.txt" for each Java class.

-om

Specified to reduce the number of adapter classes generated. When this parameter is specified, the object reference types of all parameters excluding RETURNING become java-lang-Object. Instead, the parameter names are generated so that they include original type information (see "3.1.5.2 Specifying the -om Option or the "Option ReduceClass" Parameter"). The class browser can identify almost every method. If the class browser cannot identify methods such as because parameter names are too long, the method name cross-reference list file can be used for identification.

This option is exclusive with the -r option, -gc option, -gm option and -gf option.

-ov

Specifies that any existing adapter class with the same name be overwritten. If this parameter is omitted, no adapter class is overwritten.

-r

Specify this option when specifying a constructor/method/field generated as an adapter class, for the *class-nam*e/interface-name specified right after this option. By doing so, the size of an adapter class can be reduced.

Refer to the -gc option for the procedure of specifying the constructor, to the -gm option for the procedure of specifying the method and to the -gf option for the procedure of specifying the field, respectively.

Specify the class-name/interface-name right after this option.

When specifying constructor/method/field for more than one class-names/interface-name, specify the -r option for each class-name/interface-name.

If there is no single -gc option or -gm option or -gf option that corresponds to this option, the adapter class without constructor/method/field is generated.

This option has exclusive relation with the -om option.

When this option is used, be sure to create all of the adapters using the java2cob command only once. If the adapter classes are generated by using the java2cob command two or more times, a correct adapter class may not be generated.

Creation of an adapter class by specifying the constructor/method/field without specifying a constructor/method/field is not permitted.

-s[n]

Specify this option when creating the adapter class in which the java.lang.String type is mapped into alphanumeric item (PIC X). (see "3.2.1.9 Mapping java.lang.String into PIC X")

*n* specifies the parameter size (PIC X(*n*)) of the property method that corresponds to the String type field. When omitted, it is assumed that 256 is specified.

-t

Specify this option when creating an adapter class in which the end of the character string needs to be set. (see "3.2.1.11 End Control of Character String")

*class-name/interface*-name

Specifies the Java class name or interface name, for which an adapter class is to be generated, by qualifying it with a package name. When specifying an internal class name, replace the period "." of the internal class name with a dollar sign "$". More than one class name or interface name can be specified.

## 4.1.3 Environment Variable

CLASSPATH

Specifies the Java class/interface search path. When -classpath is specified, the CLASSPATH environment variable is ignored.

## 4.1.4 Notes

- When specifying constructor/method/field, be sure to specify the -r option, *class-name/interface-name*, -gc option, -gm option and -gf option successively. If another option is specified among these options, specification error is generated.
- When Unicode is specified for the execution-time code, specify RCS(UTF16) in a compiler option (see "3.1.3 Building an Adapter Class").
- When you specify Unicode for the runtime code set, specify compiler option ENCODE(UTF8).
- When the class name, interface-name, method name or field name exceeds 30 characters, the adapter class is not generable. These names must not exceed 30 characters.

## 4.1.5 Example

Using the options is described in the following examples of the java2cob command.

- All of the adapter classes that are related to the java.io.PrintStream class and the java.util.Date class are generated.

```
c:\> java2cob java.io.PrintStream java.util.Date
```

- The adapter class that is related to all println methods of the java.io.PrintStream class and that is related to all constructors of the java.util.Date class are generated.

```
c:\> java2cob -r java.io.PrintStream -gm println -r java.util.Date -gc
```

- Only the adapter classes that are related to the println(Object) of the java.io.PrintStream class and to the Date() constructor of the java.util.Date class are generated.

```
c:\> java2cob -r java.io.PrintStream -gm "println(java.lang.Object)" -r java.util.Date -gc "Date()"
```

# 4.2 Optional File

The optional file is a text format file used to define generator options in a file instead of on the command line. The optional file is specified in a command line of the java2cob command.

For example, specifying the many method names, etc. in the command line every time is troublesome during the specification of the constructor/method/field. It can be more readily and accurately accomplished by creating the optional file. (see "When the optional file is specified")

Create an optional file with the following code system.

- ANSI
- UTF8(*)
- UTF16(LE)(*)

*: Specify BOM (Byte Order Mark) for the head of an optional file.

## 4.2.1 Format

The parameters that can be placed in an optional file, are as follows:

| Parameter name | Explanation | Note |
|---|---|---|
| Class class-name/interface-name | Specify a class name or interface name of Java that generates the adapter class. If necessary, specify the constructor/method/field generated as an adapter class. | Omission is not allowed. Multiple settings are allowed. |
| Option ClassPath | Specify a search path of the Java class/interface. | Omission is allowed. Multiple setting is not allowed. |
| Option Code | Specify a code system during execution time. | Omission is allowed. Multiple setting is not allowed. |
| Option UCS2Encoding | When Unicode is used for the code at runtime, The endian of UTF-16 is specified. | Omission is allowed. Multiple setting is not allowed. |
| Option CommandOptions | Specify directly options of the java2cob command. | Omission is allowed. Multiple setting is not allowed. |
| Option GenOnlyUsed | Specify whether or not to specify a constructor/method/field generated as an adapter class. | Omission is allowed. Multiple setting is not allowed. |
| Option MethodTable | Specify whether or not to output the method name cross-reference list file. | Omission is allowed. Multiple setting is not allowed. |
| Option OutPutPath | Specify a folder to output the source of the adapter class. | Omission is allowed. Multiple setting is not allowed. |
| Option OverWrite | Specify to overwrite an existing adapter class or not to overwrite it when an adapter class of the same name already exists. | Omission is allowed. Multiple setting is not allowed. |

| Parameter name | Explanation | Note |
|---|---|---|
| Option ReduceClass | Specify whether or not to reduce the number of adapter classes. | Omission is allowed. Multiple setting is not allowed. |
| Option String | Specify whether or not to generate an adapter class in which the java.lang.String type is mapped into alphanumeric item. | Omission is allowed. Multiple setting is not allowed. |
| Option Terminal | Specify whether or not to generate an adapter class in which the end character string setting is made, for the method that has the parameter of String type field and the String type. | Omission is allowed. Multiple setting is not allowed. |

### Notes on describing the optional file

- Clauses enclosed by square brackets can be omitted.
- Curly brackets indicate selection of clause that is delimited by "|".
- Italic type indicates a variable character string.

### Class class-name/interface-name

Specification format

```
Class class-name/interface-name [ = constructor/method/field-specifying-option ]
```

Specification contents

Specify the Java class name or interface name that generates an adapter class.

Also specify constructor/method/field specifying options when constructor/method/fields are generated as an adapter class, for that *class-name/interface-name*.

Meaning of the parameter

class-name/interface-name

Specifies a class name or interface name that is qualified by the package name.

When specifying an internal class name as the parameter type, specify dollar ($) instead of period (.) of the internal class.

*constructor/method/field-specifying-option*

Specify a constructor/method/field using the format of -gc option, -gm option and -gf option of the java2cob command.

The *constructor/method/field-specifying-option* is valid when the "Option GenOnlyUsed" parameter specifies YES.

If *constructor/method/field-specifying-option* is not specified even though the "Option GenOnlyUsed" parameter specifies YES, an adapter class without constructor/method/field is generated.

### Option ClassPath

Specification format

```
Option ClassPath = class-path
```

Specification contents

Specify a search path of the Java class/interface. When specifying two or more folders, delimit the folders using semicolon (;).

When a blank is included in the class path, enclose the entire class path with double quotation (").

When this option is specified, the environment variable CLASSPATH is ignored.

Unicode native character cannot be specified for the class path.

### Option Code

Specification format

```
Option Code = { SJIS | UNICODE }
```

Specification contents

Specify a code system during execution time. Specify the same code system as that of the COBOL program that uses the Java class.

When omitted, it is assumed that SJIS is specified.

Meaning of the parameter

SJIS

Specify it when the code system during execution time is native code.

UNICODE

Specify it when the code system during execution time is Unicode.

### Option UCS2Encoding

Specification format

```
Option UCS2Encoding = { Litter | Big }
```

Specification contents

When Unicode is used for the code at runtime, The endian of UTF-16 is specified. Specify the same endian as that of the COBOL program that uses the Java class.

When omitted, it is assumed that Litter is specified.

Meaning of the parameter

Litter

The little endian is used for the encoding of UTF-16

Big

The big endian is used for the encoding of UTF-16

### Option CommandOptions

Specification format

```
Option CommandOptions = command-options
```

Specification contents

Specify options of the java2cob command directly. But the -i option cannot be specified.

When a parameter of the same type as the *command-options* is specified as an optional file, the specified value of the *command-options* overrides the option file.

### Option GenOnlyUsed

Specification format

```
Option GenOnlyUsed = { YES | NO }
```

Specification contents

Specify whether or not specify a constructor/method/field generated as an adapter class. When a constructor/method/field is specified, size of the adapter class can be reduced.

When omitted, it is assumed that NO is specified.

The specification value of the "Option GenOnlyUsed" parameter affects all of the "Class *class-name/interface-name*" inside the optional file.

The "Option GenOnlyUsed" parameter is exclusive with the "Option ReduceClass" parameter.

Meaning of the parameter

YES

Specifies the constructor/method/field.

NO

Does not specify constructor/method/field.

### Option MethodTable

Specification format

```
Option MethodTable { YES | NO }
```

Specification contents

Specify whether or not to output the method name cross-reference list file (list of adapter class methods that correspond to the Java class methods). If omitted, it is assumed that NO is specified.

The method name cross-reference list file is output using the format of "*source-file-name*.txt" of the adapter class for each Java class.

Meaning of the parameter

YES

The method name cross-reference list file is output.

NO

The method name cross-reference list file is not output.

### Option OutPutPath

Specification format

```
Option OutPutPath= output-folder
```

Specification contents

Specify the folder to which source of the adapter class is output.

When a folder include a blank, enclose the entire output target folder with double quotation (").

If omitted, it is generated in the current directory.

### Option OverWrite

Specification format

```
Option OverWrite = { YES | NO }
```

Specification contents

Specify whether to overwrite an existing adapter class or to overwrite it when an adapter class of the same name already exists.

If omitted, it is assumed that NO is specified.

Meaning of the parameter

YES

Overwrite is executed.

NO

Overwrite is not executed.

### Option ReduceClass

Specification format

```
Option ReduceClass = { YES | NO }
```

Specification contents

Specify whether or not to reduce the number of adapter classes. When YES is specified, the type of object reference except RETURNING becomes java-lang-Object, and the parameter name is generated so as to include the original type information instead. (see "3.1.5.2 Specifying the -om Option or the "Option ReduceClass" Parameter".) Thus, method can be distinguished with the class browser in most cases. If method cannot be distinguished with the class browser because the parameter name is too long and because of other reasons, it can be distinguished using the method name cross-reference list file.

If omitted, it is assumed that NO is specified.

Meaning of the parameter

YES

Reduces the number of adapter classes.

NO

The number of adapter classes is not reduced.

### Option String

Specification format

```
Option String = { YES [n] | NO }
```

Specification contents

Specify whether or not to generate an adapter class in which the java. lang. String type is mapped into the alphanumeric item (PIC X). (see "3.2.1.9 Mapping java.lang.String into PIC X.")

If omitted, it is assumed that NO is specified.

Meaning of the parameter

YES [*n*]

The java.lang.String type is mapped into the alphanumeric item.

*n* specifies the parameter size (PIC X(*n*)) of the property method that corresponds to the String type field. If omitted, it is assumed that 256 is specified.

NO

The java.lang.String type is not mapped into the alphanumeric item.

### Option Terminal

Specification format

```
Option Terminal = { YES | NO }
```

Specification contents

Specify whether or not to generate an adapter class allowed to set end character strings, for the method that has string-type fields and string-type parameters. (see "3.2.1.11 End Control of Character String")

If omitted, it is assumed that NO is specified.

Meaning of the parameter

YES

Generate an adapter class in which the end character string setting is made.

NO

Does not generate an adapter class in which the end character string setting is made.

### 4.2.2 Example

When creating only an adapter class that is related to the println (Object) method of the java.io.PrintStream class or related to the Date ( ) constructor of the java.util.Date class, specify as follows.

```
Option GenOnlyUsed = YES
Class java.io.PrintStream = -gm "println(java.lang.Object)"
Class java.util.Date = -gc "Date()"
```

### 4.2.3 Notes

- When two or more parameter of the same type are specified, the parameter that is specified last becomes valid. But the parameters of "Class *class-name/interface-name*" become valid respectively.
- The line in which "#" is described in the first column is ignored as the comment line.
- The line in which "\" is described as the end of the line is continued on to the next line.

## 4.3 Output

The generator outputs the following files:

- Adapter class source file
- Generation name management file
- Method name cross-reference list file

### 4.3.1 Adapter Class Source File

The adapter class source file corresponding to the specified Java class or interface is generated. If the specified class or interface refers to other classes or interfaces, the adapter classes corresponding those classes or interfaces are also generated. This processing is recursive until the following conditions are met:

- No other classes or interfaces are referenced.
- Adapter classes corresponding to the referenced classes or interfaces have all been generated.
- A source file with the same name already exists in the output destination while overwriting is not specified.

The name of a generated source file is created from the class name or interface name qualified by the package name according to the following rules:

- Period and dollar are converted into hyphen.
- The extension is fixed to "*.cob*".

When the java2cob command is executed, the names of the adapter classes being generated are displayed.

```
d:\home\j2cob\samples> java2cob java.util.Date
java/lang/Object
java/io/Serializable
java/lang/Cloneable
java/lang/Comparable
java/util/Date
java/lang/reflect/GenericDeclaration
java/lang/reflect/Type
java/lang/reflect/AnnotatedElement
java/lang/Class
java/lang/Throwable
java/lang/Exception
```

```
java/lang/InterruptedException
java/lang/CharSequence
java/lang/String
java/lang/reflect/TypeVariable
java/lang/annotation/Annotation
java/lang/ClassLoader
java/lang/ClassNotFoundException
java/lang/InstantiationException
```

## 4.3.2 Generation Name Management File

In order to manage the correspondence between the Java class method name and the adapter class method name, the Java2cob command outputs a generation name management file (java2cob.mgt).

The generation name management file is generated in the adapter class output folder.

When you regenerate the adapter class from a Java class that you have used at least once, the Java2cob command inputs the generation name management file from the folder where the adapter class is stored.

When there is a change in the content of Java class, it is reflected in the generation name management file. When there is a postscript, it is recorded.

## 4.3.3 Method Name Cross-Reference List File

A method name cross-reference list file is output so that the operator can check the correspondence between Java class methods and adapter class methods. The method name cross-reference list file is generated, when the -oi option or the "Option MethodTable" parameter is specified, in the adapter class output folder according to the following rules:

- Period or dollar used in the class name or interface name qualified by a package name is changed to hyphen.
- The extension is fixed to "*.txt*".

A method name cross-reference list file is output in the following format:

```
[Java]  java-class-name
[COBOL] cobol-external-class-name
(1) [Java]  type  java-method-name (argument-type)
     [COBOL] cobol-external-method-name
(2) [Java]  type  java-method-name (argument-type) OVERRIDE
     [COBOL] -None-
  ...
(n) [Java]  type  java-method-name ()
     [COBOL] cobol-external-method-name
```

| java-class-name | Class name or interface name qualified by a package name |
|---|---|
| cobol-external-class-name | External class name of the adapter class corresponding to the Java class |
| java-method-name | Java class method |
| type | Return type of Java method |
| argument-type | Argument type of Java method |
| OVERRIDE | Added when a super class method is overridden |
| cobol-method-name | External method name of the adapter class corresponding to the Java method |
| -None- | Indicated when no adapter class method corresponds to the Java method |

No method name cross-reference list file is output for the following adapter class:

- Array adapter class

The following methods of the java-lang-String class are not output to the method name cross-reference list file:

- NEW-STRING-X

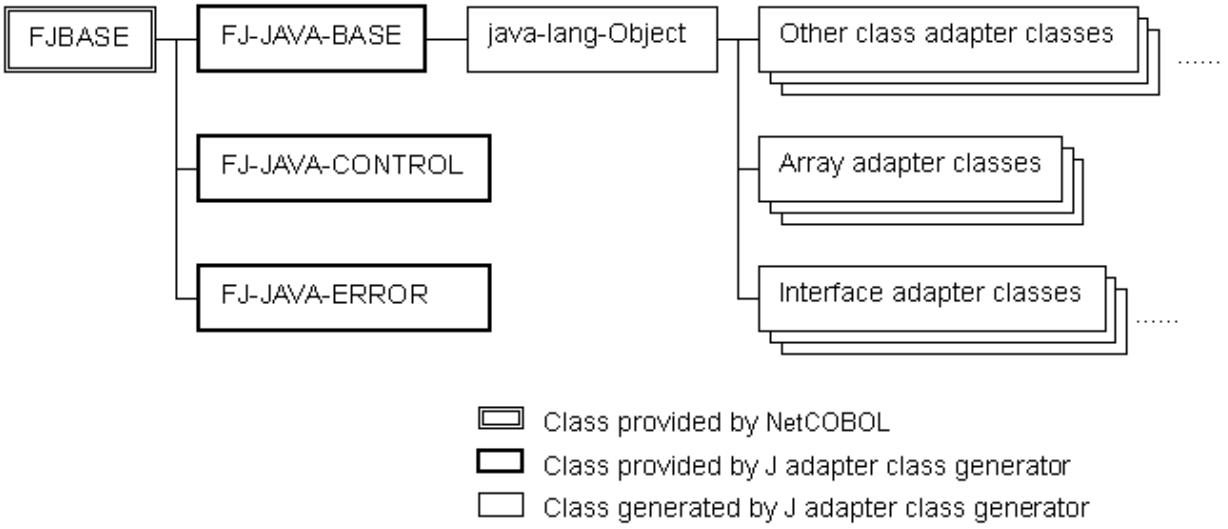
- NEW-STRING-N
- GET-STRING-X
- GET-STRING-N
- GET-STRING-LENGTH-X
- GET-STRING-LENGTH-N

# Chapter 5 Adapter Class Reference

This chapter provides detailed information on the FJ-JAVA-BASE, FJ-JAVA-CONTROL and FJ-JAVA-ERROR classes provided by the J adapter class generator, and adapter classes generated by the J adapter class generator.

## 5.1 Class Configuration

The figure below shows the hierarchical relationships among the FJ-JAVA-BASE, FJ-JAVA-CONTROL and FJ-JAVA-ERROR classes provided by the J adapter class generator, and adapter classes generated by the J adapter class generator.




### Class Hierarchy

- FJ-JAVA-BASE: Super class of every adapter class
- FJ-JAVA-CONTROL: Initializes or terminates the Java VM, or connects or disconnects a thread to the Java VM.
- FJ-JAVA-ERROR: Class of exception object generated in the adapter class.
- Class adapter class: An adapter class (java-lang-Object) of the java.lang.Object class is generated as a subclass of FJ-JAVA-BASE. Other adapter classes having the same inheritance relationships as Java classes are generated. An adapter class of the class in which a Java interface is installed inherits an interface adapter class as well.
- Interface adapter class: The adapter class of an interface that inherits no other interface is generated as a subclass of java-lang-Object. The adapter class of an interface that inherits another interface is generated so that it has the same inheritance relationship as the Java interface.
- Array adapter class: Every array adapter class is generated as a subclass of java-lang-Object.

## 5.2 FJ-JAVA-BASE class

The FJ-JAVA-BASE class is the super class of every adapter class.

The FJ-JAVA-BASE class has the methods shown below.

| Method name | Type | Function |
|---|---|---|
| J-NARROW | Factory | Assigns an object to a subclass. |
| J-DUPLICATE | Object | Duplicates an adapter object. |
| J-EQUALS | Object | Checks whether the Java objects indicated by two adapter objects are equal. |

## 5.2.1 J-NARROW Method (factory method)

### Explanation

This method assigns an adapter object to a subclass.

### Syntax

```
INVOKE class-name "J-NARROW" USING object-1 RETURNING object-2
```

### Parameter and return value

class-name:

Specifies the class name of assignment target data.

object-1 (attribute: OBJECT REFERENCE FJ-JAVA-BASE)

Specifies the object to be assigned.

object-2 (attribute: OBJECT REFERENCE SELF)

Returns the object that was converted into the assignment target class.

## 5.2.2 J-DUPLICATE Method (object method)

### Explanation

This method duplicates an adapter object. It duplicates no Java object. A duplicated adapter object points to the same Java object as the original adapter object.

### Syntax

```
INVOKE anObject "J-DUPLICATE" RETURNING duplicatedObject
```

### Parameter and return value

anObject (attribute: OBJECT REFERENCE adapter class)

Specifies the adapter object to be duplicated.

duplicatedObject (attribute: OBJECT REFERENCE CLASS OF SELF)

Returns the duplicated object.

## 5.2.3 J-EQUALS Method (object method)

### Explanation

This method checks whether the Java objects indicated by two adapter objects are equal.

### Syntax

```
INVOKE object-1 "J-EQUALS" USING object-2 RETURNING result
```

### Parameter and return value

object-1, object-2 (attribute: OBJECT REFERENCE FJ-JAVA-BASE)

Specifies the adapter objects to be compared.

result (attribute: PIC 1)

Returns B'1' if a match occurs; otherwise, returns B'0'.

# 5.3 FJ-JAVA-CONTROL class

The FJ-JAVA-CONTROL class controls the Java VM.

The FJ-JAVA-CONTROL class has the methods shown below:

Table 5.1 Methods used to control Java VM

| Method name | Type | Function |
|---|---|---|
| JVM-INIT | Factory | Initializes the Java VM (Only at the first calling). Connects the current thread to the Java VM |
| JVM-ATTACH | Factory | Same as JVM-INIT |
| JVM-TERMINATE | Factory | Terminates the Java VM (Only at the last calling). Disconnects the current thread from the Java VM |
| JVM-DETACH | Factory | Disconnects the current thread from the Java VM |

## 5.3.1 JVM-INIT Method (factory method)

### Explanation

When it is called initially in a process, Java VM is initialized. This must be executed before using the adapter class.

Also, the current thread is connected to Java VM. In the multithread applications, the current thread must be connected to Java VM for each thread.

This is equivalent to the JVM-ATTACH method.

### Syntax

```
INVOKE FJ-JAVA-CONTROL "JVM-INIT"
```

### Environment variable

The Java VM execution environment can be customized by specifying the following environment variables. Refer to the "NetCOBOL User's Guide" for information on how to specify the environment variables.

| Environment variable name | Function |
|---|---|
| COBJNI_MAX_NSTACK | Specifies the maximum size (bytes) of the stack used for the native code. The default is 128 kilobytes. |
| COBJNI_JAVA_STACK | Specifies the maximum size (bytes) of the stack used for the Java code. The default is 400 kilobytes. |
| COBJNI_MIN_HEAP | Specifies the startup size of the memory allocation pool in bytes. The default is 1 megabyte. |
| COBJNI_MAX_HEAP | Specifies the maximum size of the memory allocation pool in bytes. The default is 16 megabytes. |
| COBJNI_CLASSPATH | Specifies the execution-time class path.<br>Environment variable CLASSPATH specifies the generation-time class path and has no effect at execution time. |

An error occurs when this method is invoked two or more times in one process.

### 5.3.2 JVM-TERMINATE Method (factory method)

#### Explanation

The current thread is isolated from the Java VM. In the multithread applications, the current thread must be isolated from Java VM before the thread is terminated.

Also, when it is called by the last thread in a process, Java VM is terminated. It is used when the adapter class is used no more.

#### Syntax

```
INVOKE FJ-JAVA-CONTROL "JVM-TERMINATE"
```

Note

An error occurs when this method is invoked two or more times in one process.

### 5.3.3 JVM-ATTACH Method (factory method)

#### Explanation

The current thread is isolated from the Java VM. In the multithread applications, the current thread must be isolated from Java VM before the thread is terminated.

#### Syntax

```
INVOKE FJ-JAVA-CONTROL "JVM-ATTACH"
```

### 5.3.4 JVM-DETACH method (factory method)

#### Explanation

This is equivalent to the JVM-TERMINATE method.

#### Syntax

```
INVOKE FJ-JAVA-CONTROL "JVM-DETACH"
```

## 5.4 FJ-JAVA-ERROR class

The adapter class generates the exception object when some error is detected during execution period. The FJ-JAVA-ERROR class is the class of that exception object. The exception message, exception type and exception information of Java can be acquired by using the FJ-JAVA-ERROR class method.

Refer to "NetCOBOL User's Guide" for details of the exception processing.

The FJ-JAVA-ERROR class has the following methods.

Table 5.2 Methods that Acquire Exception Information

| Method name | Type | Function |
|---|---|---|
| GET-MESSAGE | Object | Returns the exception message. |
| GET-CODE | Object | Returns the type of exception |
| GET-EXCEPTION | Object | Returns the Java exception information. |

### 5.4.1 GET-MESSAGE method (object method)

### Explanation

Returns the exception message. It is used to indicate the error content.

### Syntax

```
INVOKE EXCEPTION-OBJECT "GET-MESSAGE" USING message RETURNING messageLength
```

### Parameter and return value

message (attribute: PIC X ANY LENGTH)

Specifies the data item that stores the exception message.

messageLength (attribute: PIC S9(9) COMP-5)

Length (number of bytes) of the exception message is returned.

## 5.4.2 GET-CODE method (object method)

### Explanation

Returns the type of exception.

### Syntax

```
INVOKE EXCEPTION-OBJECT "GET-CODE" RETURNING code
```

### Parameter and return value

code (attribute: PIC S9(9) COMP-5)

Type of exception is returned.

## 5.4.3 GET-EXCEPTION method (object method)

### Explanation

The Java exception information is returned.

### Syntax

```
INVOKE EXCEPTION-OBJECT "GET-EXCEPTION" USING message messageLength class classLength RETURNING result
```

### Parameter and return value

message (attribute: PIC X ANY LENGTH)

Specifies the data item that stores the Java exception message.

messageLength (attribute: PIC S9(9) COMP-5)

Length (number of bytes) of Java exception message is returned.

class (attribute: PIC X ANY LENGTH)

Specifies the data item that stores the Java exception class.

classLength (attribute: PIC S9(9) COMP-5)

Length (number of bytes) of Java exception message is returned.

result (attribute: PIC S9(9) COMP-5)

"0" is returned when Java exception information exists. "-1" is returned when Java exception information does not exist.

Note

The Java exception information can be acquired only when the exception type is "1".

## 5.5 Class or Interface Adapter Class

A COBOL class (adapter class) is generated for a Java class or interface. This section explains how Java class and interface elements are mapped to COBOL class elements.

The Java language elements are mapped to the COBOL language elements as shown below:

| Java | COBOL |
|---|---|
| Class | Class |
| Interface | Class |
| Constructor | Factory method |
| Class variable (static field) | Factory property |
| Class method (static method) | Factory method |
| Instance variable (nonstatic field) | Object property |
| Instance method (nonstatic field) | Object method |
| Java basic data type | COBOL basic data type |

Only public elements are mapped to COBOL. Any class, interface, constructor, field, and method that are not public are not mapped to COBOL.

### 5.5.1 Data types

The Java data types are mapped to the COBOL data types as shown below:

| Java data type | COBOL data type |
|---|---|
| boolean | PIC 1 |
| byte | PIC X |
| char | PIC X(2)<br>- When an ANK character is stored, the first byte is used and the second byte is X'00'.<br>- When a national character is stored, two bytes are used.<br>- Data is mapped when code option -cs (native code) or no code option is specified. |
| | PIC N<br>- When an ANK character is stored, the first byte is used and the second byte is X'00'.<br>- When a national character is stored, two bytes are used.<br>- Data is mapped when code option -cu (Unicode) is specified. |
| short | PIC S9(4) COMP-5 |
| int | PIC S9(9) COMP-5 |
| long | PIC S9(18) COMP-5 |
| float | COMP-1 |
| double | COMP-2 |
| Array | Object reference array adapter class |

| Java data type | COBOL data type |
|---|---|
| Object | Object reference adapter class |

## 5.5.2 Class and interface

### Explanation

Public classes and interface are mapped to COBOL classes. The inheritance relationships of adapter classes are the same as those of the corresponding Java classes. Note that the following Java class inherits no other classes or interfaces but the adapter classes generated inherit JF-JAVA-BASE.

- java.lang.Object class

Similarly, the following interface inherits no other classes or interfaces but the adapter classes generated inherit java.lang.Object.

- Interface that inherits no other interface

### Expansion format

```
CLASS-ID. internal-class-name-1 AS "external-class-name" INHERITS internal-class-name-2.
    ...
FACTORY.
    ...
  <<Factory method corresponding to a constructor>>
  <<Property method corresponding to a class variable>>
  <<Factory method corresponding to a class method>>
END FACTORY.
OBJECT.
    ...
  <<Property method corresponding to an instance variable>>
  <<Object method corresponding to an instance method>>
END OBJECT.
END CLASS internal-class-name-1.
```

### Generation rules

1. Internal class names 1 and 2 are internally used by the J adapter class generator and are not viewed from the class user.
2. The external class name is used to identify the class. The class user can identify the class with the external class name.
3. An external class name is generated according to the following rules:

   ```
   [PackageName-[PackageName-...]] ClassName/InterfaceName
   ```

   - Period "." used in the class name or interface name fully qualified with a package name is replaced with hyphen "-".
   - A name exceeding 160 characters is truncated after the 160th character.
4. The following three methods are generated in the FACTORY definition:
   - Factory method corresponding to a constructor
   - Property method corresponding to a class variable
   - Factory method corresponding to a class method
5. The following two methods are generated in the OBJECT definition:
   - Property method corresponding to an instance variable
   - Object method corresponding to an instance method

### Generation example

The adapter class of the java.util.Date class is generated as shown below:

```
CLASS-ID. J-DATE AS "java-util-Date" INHERITS J-OBJECT.    [1]
    ...
REPOSITORY.
    CLASS J-OBJECT AS "java-lang-Object".                  [2]
    ...
END CLASS J-DATE.
```

1. The name of the adapter class of the java.util.Date class is java-util-Date.
2. The external name of J-OBJECT in the INHERIT clause is java-lang-Object. That is, java-util-Date inherits java-lang-Object.

NetCOBOL does not distinguish between uppercase and lowercase letters of a class name. Therefore, class names whose external class names are different only in uppercase and lowercase letters cannot be used concurrently.

### Supplement

When the adapter class of java.lang.String is generated, the public method defined in the java.lang.String class is generated. In addition, a method for referencing or setting character string data is generated. (see "5.6 java-lang-String class".)

## 5.5.3 Constructor

### Explanation

A public constructor is mapped to a COBOL factory method.

### Expansion format

```
METHOD-ID internal-method-name AS "external-method-name".
    ...
DATA DIVISION.
LINKAGE SECTION.
01 generated-object OBJECT REFERENCE SELF.
[parameter ...]
PROCEDURE DIVISION [USING parameter ...] RETURNING generated-object
                               [RAISING exception-class-name].
END METHOD internal-method-name.
```

### Generation rules

1. The internal method name is internally used by the J class method generator and are not viewed from the class user.
2. The external method name is used to identify the method. The class user can identify the method with the external method name.
3. An external method name is generated according to the following rules:

   ```
   Create-JavaClassName-nn
   ```

   - "Create-" is followed by a Java class name with a hyphen "-" followed by a two-digit number (nn).
   - The Java class name does not include the package name.
   - nn is a serial number assigned in order from 01 to 99 to methods having the same Java class name.
   - If a super class has classes having the same Java class names, serial numbers are assigned to such classes in order from the super class. (see "5.8 Numbering Names".)
   - A name exceeding 160 characters is truncated after the 160th character.
4. When a parameter is declared for the constructor, the corresponding parameter is generated. See "5.5.1 Data types" for the correspondence between parameter data types.

5. The generated object is the unique object reference name used to store the object reference to the generated adapter object.
6. When an exception is declared for the constructor, the RAISING specification is generated.

### Generation example

The factory method corresponding to constructor Date() of the java.util.Date class is generated as shown below:

```
METHOD-ID. CREATE-01 AS "Create-Date-01".                    [1]
    ...
LINKAGE SECTION.
01  CREATED-OBJECT  OBJECT REFERENCE SELF.
PROCEDURE DIVISION RETURNING CREATED-OBJECT.
    ...
END METHOD CREATE-01.
```

- The factory method of java-util-Date is generated with name "Create-Date" followed by a number.

The factory method corresponding to the constructor Date (long) of the java.sql.Date class (java.util.Date subclass) is generated as shown below:

```
METHOD-ID. CREATE-08 AS "Create-Date-08".                    [1]
    ...
LINKAGE SECTION.
01  CREATED-OBJECT  OBJECT REFERENCE SELF.
01  PARA-1  PIC S9(18) COMP-5.
PROCEDURE DIVISION USING PARA-1 RETURNING CREATED-OBJECT.
    ...
END METHOD CREATE-08.
```

- The factory method of java-sql-Date is also generated with name "Create-Date" followed by a number. To prevent name duplication, serial numbers including java-util-Date factory methods are assigned.

### Supplement

A factory method name is generated from a constructor, a number is assigned to the name to secure the uniqueness of the name. The class browser or method name cross-reference list file can be used to check the correspondence between constructors and factory methods. In the case of class browser, it can be identified from the parameter that appears during method selection. In the case of 4.3.3 Method Name Cross-Reference List File, it can be identified from the type of argument of the constructor.

## 5.5.4 Class variable

### Explanation

A public class variable (static field) is mapped to a COBOL property method (factory).

### Expansion format

```
METHOD-ID. GET PROPERTY property-name.
    ...
LINKAGE SECTION.
01 property-value data-description-entry.
PROCEDURE DIVISION RETURNING property-value.
    ...
END METHOD property-name.
METHOD-ID. SET PROPERTY property-name.
    ...
LINKAGE SECTION.
01 property-value data-description-entry
PROCEDURE DIVISION USING property-value.
    ...
END METHOD property-name.
```

### Generation rules

1. The property name is used to identify the property. The class user can identify the property with the property name.
2. A property name is generated according to the following rules:

```
JF-JavaFieldName[-nn]
```

   - "JF-" is followed by a Java field name in uppercase.
   - If the property name has already been assigned, the second and subsequent property names are each suffixed with a hyphen "-" followed by a two-digit number (01 to 99) to prevent name duplication. (see "5.8 Numbering Names".)
   - A name exceeding 30 characters is truncated after the 30th character.

3. When FINAL is specified, no property method with the SET specification is generated.
4. The property value is a parameter used to transfer a property value. The data description entry expands the COBOL description entry corresponding to the Java field attribute. See "5.5.1 Data types" for the correspondence of data types.

### Generation rules

The property method corresponding to the class variable out (static final field) of the java.lang.System class is generated as shown below:

```
METHOD-ID. GET PROPERTY JF-OUT.                                  [1]
    ...
LINKAGE SECTION.
01  GET-VALUE  OBJECT REFERENCE J-PRINTSTREAM.                   [2]
PROCEDURE DIVISION RETURNING GET-VALUE.
    ...
END METHOD JF-OUT.
```

1. The property name is generated by adding "OUT", which is the uppercase of the Java field name, to "JF-".
2. "out" is mapped to J-PRINTSTREAM (internal class name of java-io-PrintStream) because its attribute is java.io.PrintStream.

### Supplement

When a property name is generated from a field name, a number is assigned to secure the uniqueness of the name. The class browser can be used to check the correspondence between fields and properties.

## 5.5.5 Class method

### Explanation

A public class method (static method) is mapped to a COBOL factory method.

### Expansion format

```
METHOD-ID. internal-method-name AS "external-method-name" [OVERRIDE].
    ...
DATA DIVISION.
LINKAGE SECTION.
[parameter ...]
[return-value ...]
PROCEDURE DIVISION [USING parameter ...] [RETURNING return-value]
                                  [RAISING exception-class-name].
END METHOD internal-method-name.
```

### Generation rules

1. The internal method name is internally used by the J adapter class generator and cannot be viewed from the class user.
2. The external method name is used to identify the method. The class user identifies the method with the external method name.

3. An external method name is generated according to the following rules:

```
JavaMethodName[-nn]
```

   - A Java method name is used as is as a COBOL method name.
   - If a same method name has already been assigned, the second and subsequent method names are each suffixed with a hyphen "-" followed by a two-digit number (01 to 99) to prevent name duplication. (see "5.8 Numbering Names".)
   - A name exceeding 160 characters is truncated after the 160th character.

4. When a parameter is declared for the method, the corresponding parameter is generated. See "5.5.1 Data types" for the correspondence between parameter data types.
5. When a return value is declared for the method, the corresponding return value is generated. See "5.5.1 Data types" for the correspondence between return value data types.
6. When an exception is declared for the constructor, the RAISING specification is generated.

### Generation example

The factory method corresponding to class method abs (long) of the java.lang.Math class is generated as shown below:

```
METHOD-ID. JM-ABS-01 AS "abs-01".                              [1]
    ...
LINKAGE SECTION.
01  RTN-VALUE  PIC S9(18) COMP-5.
01  PARA-1  PIC S9(18) COMP-5.
PROCEDURE DIVISION USING PARA-1 RETURNING RTN-VALUE.
    ...
END METHOD JM-ABS-01.
```

- Since more than one "abs" method is declared, a method with name "abs-01" is generated for abs (long) that is declared second.

### Supplement

When a COBOL method name is generated from a Java method name, a number is assigned to secure the uniqueness of the name. The class browser or method name cross-reference list file can be used to check the correspondence between Java methods and COBOL methods. In the case of class browser, it can be identified from the parameter that appears during method selection. In the case of method name cross-reference list file, it can be identified from the type of argument of the constructor.

## 5.5.6 Instance variable

### Explanation

A public instance variable (non-static field) is mapped to a COBOL property method (object).

### Expansion format

```
METHOD-ID. GET PROPERTY property-name.
    ...
LINKAGE SECTION.
01 property-value data-description-entry.
PROCEDURE DIVISION RETURNING property-value.
    ...
END METHOD property-name.
METHOD-ID. SET PROPERTY property-name.
    ...
LINKAGE SECTION.
01 property-value data-description-entry
PROCEDURE DIVISION USING property-value.
    ...
END METHOD property-name.
```

### Generation rules

1. The property name is used to identify the property. The class user can identify the property with the property name.
2. A property name is generated according to the following rules:

```
JF-JavaFieldName[-nn]
```

   - "JF-" is followed by a Java field name in uppercase.
   - If a same property name has already been assigned, the second and subsequent property names are each suffixed with a hyphen "-" followed by a two-digit number (01 to 99) to prevent name duplication. (see "5.8 Numbering Names".)
   - A name exceeding 30 characters is truncated after the 30th character.

3. When FINAL is specified, no property method with the SET specification is generated.
4. The property value is a parameter used to transfer a property value. The data description entry expands the COBOL description entry corresponding to the Java field attribute. See "5.5.1 Data types" for the correspondence of data types.

### Generation rules

The property method corresponding to the instance variable nval of the java.io.StreamTokenizer class is generated as shown below:

```
METHOD-ID. GET PROPERTY JF-NVAL.                        [1]
    ...
LINKAGE SECTION.
01  GET-VALUE  COMP-2.                                 [2]
PROCEDURE DIVISION RETURNING GET-VALUE.
    ...
END METHOD JF-NVAL.
METHOD-ID. SET PROPERTY JF-NVAL.                        [3]
    ...
LINKAGE SECTION.
01  SET-VALUE  COMP-2.
PROCEDURE DIVISION USING SET-VALUE.
    ...
END METHOD JF-NVAL.
```

1. The property name is generated by adding "NVAL", which is the uppercase of the Java field name, to "JF-".
2. "nval" is mapped to COMP-2 because its attribute is double.
3. Since FINAL is not specified, a property method with the SET specification is also generated.

### Supplement

When a property name is generated from a field name, a number is assigned to secure the uniqueness of the name. The class browser can be used to check the correspondence between fields and properties.

## 5.5.7 Instance Method

### Explanation

A non-public instance method (non-static method) is mapped to a COBOL object method.

### Expansion format

```
METHOD-ID. internal-method-name AS "external-method-name" [OVERRIDE].
    ...
DATA DIVISION.
LINKAGE SECTION.
[parameter ...]
[return-value ...]
```

```
PROCEDURE DIVISION [USING parameter ...] [RETURNING return-value]
                                    [RAISING exception-class-name].
END METHOD internal-method-name.
```

### Generation rules

1. The internal method name is internally used by the J adapter class generator and cannot be viewed from the class user.
2. The external method name is used to identify the method. The class user identifies the method with the external method name.
3. An external method name is generated according to the following rules:

   ```
   JavaMethodName[-nn]
   ```

   - A Java method name is used as is as a COBOL method name.
   - If a same method name has already been assigned, the second and subsequent method names are each suffixed with a hyphen "-" followed by a two-digit number (01 to 99) to prevent name duplication. (see "5.8 Numbering Names".)
   - A name exceeding 160 characters is truncated after the 160th character.
4. When a parameter is declared for the method, the corresponding parameter is generated. See "5.5.1 Data types" for the correspondence between parameter data types.
5. When a return value is declared for the method, the corresponding return value is generated. See "5.5.1 Data types" for the correspondence between return value data types.
6. When an exception is declared for the constructor, the RAISING specification is generated.

### Generation example

The object method corresponding to instance method getTime() of the java.util.Date class is generated as shown below:

```
METHOD-ID. JM-GETTIME AS "getTime".                              [1]
    ...
LINKAGE SECTION.
01  RTN-VALUE  PIC S9(18) COMP-5.
PROCEDURE DIVISION RETURNING RTN-VALUE.
    ...
END METHOD JM-GETTIME.
```

- Since there is only one method with name "getTime," a method with name "getTime" is generated with no number assigned.

### Supplement

When a COBOL method name is generated from a Java method name, a number is assigned to secure the uniqueness of the name. The class browser or method name cross-reference list file can be used to check the correspondence between Java methods and COBOL methods. In the case of class browser, it can be identified from the parameter that appears during method selection. In the case of method name cross-reference list file, it can be identified from the type of argument of the constructor.

## 5.6 java-lang-String class

Like other classes, the java.lang.String class is mapped to the java-lang-String class. However, the java-lang-String class has the following methods for referencing or setting character string data, in addition to the methods defined in the java.lang.String class:

| Method name | Type | Function |
|---|---|---|
| NEW-STRING-X | Factory | Generates a String object having the specified alphanumeric data item as the initial value. |
| NEW-STRING-N | Factory | Generates a String object having the specified national data item as the initial value. |
| GET-STRING-X | Object | Fetches the character string as an alphanumeric data item. |

| Method name | Type | Function |
|---|---|---|
| GET-STRING-N | Object | Fetches the character string as a national data item. |
| GET-STRING-LENGTH-X | Object | Determines alphanumeric data item length. |
| GET-STRING-LENGTH-N | Object | Determines national data item length. |

## 5.6.1 NEW-STRING-X method (factory method)

### Explanation

This method generates a String object having the character string specified for the alphanumeric data item as an initial value.

### Syntax

```
INVOKE class-name "NEW-STRING-X" USING initialValue RETURNING createdObject
```

### Parameter and return value

class-name

Specifies the internal class name of the java-lang-String class declared in the REPOSITORY paragraph.

initialValue (attribute: PIC X ANY LENGTH)

Specifies an alphanumeric data item as the initial value of the String object.

createdObject (attribute: OBJECT REFERENCE SELF)

Returns the generated object.

### Supplement

When a data name is specified for initialValue, a String object as long as data item length is generated. However, inserting X"00" in the statement can generate a String object shorter than data item length.

```
    ...
REPOSITORY.
    CLASS J-String AS "java-lang-String"
    ...
WORKING-STORAGE SECTION.
01  initialValue  PIC X(50).
01  aString       OBJECT REFERENCE J-String.
    ...
PROCEDURE DIVISION.
    ...
    MOVE "ABC" TO initialValue.
    INVOKE J-String "NEW-STRING-X" USING initialValue RETURNING aString.  [1]
    ...
    MOVE "ABC" & X"00" TO initialValue.
    INVOKE J-String "NEW-STRING-X" USING initialValue RETURNING aString.  [2]
```

1. A String object consisting of 50 characters with the last 47-character area padded with blanks is generated.
2. A String object consisting of three characters is generated.

## 5.6.2 NEW-STRING-N method (factory method)

### Explanation

This method generates a String object having the character string specified for the national data item as an initial value.

### Syntax

```
INVOKE class-name "NEW-STRING-N" USING initialValue RETURNING createdObject
```

### Parameter and return value

class-name

Specifies the internal class name of the java-lang-String class declared in the REPOSITORY paragraph.

initialValue (attribute: PIC N ANY LENGTH)

Specifies a national data item as the initial value of the String object.

createdObject (attribute: OBJECT REFERENCE SELF)

Returns the generated object.

### Supplement

When a data name is specified for initialValue, a String object as long as data item length is generated. However, inserting X"0000" in the statement can generate a String object shorter than data item length.

```
 ...
REPOSITORY.
 CLASS J-String AS "java-lang-String"
 ...
WORKING-STORAGE SECTION.
01  initialValue  PIC N(50).
01  aString       OBJECT REFERENCE J-String.
 ...
PROCEDURE DIVISION.
 ...
 MOVE NC"Two-byte-code" TO initialValue.
 INVOKE J-String "NEW-STRING-N" USING initialValue RETURNING aString.  [1]
 ...
 MOVE NC"Two-byte-code" & X"0000" TO initialValue.
 INVOKE J-String "NEW-STRING-N" USING initialValue RETURNING aString.  [2]
```

1. A String object consisting of 50 characters with the last 47-character area padded with blanks is generated.
2. A String object consisting of three characters is generated.

## 5.6.3 GET-STRING-X method (object method)

### Explanation

This method fetches the character string from the String object as an alphanumeric data item.

### Syntax

```
INVOKE anObject "GET-STRING-X" RETURNING stringValue
```

### Parameter and return value

anObject

Specifies the String object from which a character string is to be fetched.

stringValue (attribute: PIC X ANY LENGTH)

Returns the character string fetched from the String object. If the specified data item is shorter than the fetched character string, it is truncated. If the specified data item is longer than the fetched character string, the trailing area is padded with blanks.

## 5.6.4 GET-STRING-N method (object method)

### Explanation

This method fetches the character string from the String object as a national data item.

### Syntax

```
INVOKE anObject "GET-STRING-N" RETURNING stringValue
```

### Parameter and return value

anObject

Specifies the String object from which a character string is to be fetched.

stringValue (attribute: PIC N ANY LENGTH)

Returns the character string fetched from the String object. If the specified data item is shorter than the fetched character string, it is truncated. If the specified data item is longer than the fetched character string, the trailing area is padded with blanks.

## 5.6.5 GET-STRING-LENGTH-X method (object method)

### Explanation

This method returns the length of the character string of the String object as the length (number of characters) of the alphanumeric data item.

### Syntax

```
INVOKE anObject "GET-STRING-LENGTH-X" RETURNING stringLength
```

### Parameter and return value

anObject

Specifies the String object whose character length is to be checked.

stringLength (attribute: PIC S9(9) COMP-5)

Returns character string length.

## 5.6.6 GET-STRING-LENGTH-N method (object method)

### Explanation

This method returns the length of the character string of the String object as the length (number of characters) of the national data item.

### Syntax

```
INVOKE anObject "GET-STRING-LENGTH-N" RETURNING stringLength
```

### Parameter and return value

anObject

Specifies the String object whose character length is to be checked.

stringLength (attribute: PIC S9(9) COMP-5)

Returns character string length.

# 5.7 Array Adapter Class

A Java array is handled as an object in COBOL. Therefore, an adapter class is generated for each array attribute (element type and number of dimensions). This section explains how Java arrays are mapped to COBOL classes.

## 5.7.1 Array class

### Explanation

An adapter class corresponding to the array is generated when:

- An array is used as a parameter of a public constructor.
- The type of a public field (static or non-static) is an array.
- An array is used as a parameter or return value of a public method (static or non-static).

Arrays whose attributes shown below match are associated with the same adapter class:

- Array element type
- Number of dimensions

### Expansion format

```
CLASS-ID. internal-class-1 AS "external-class-name" INHERITS internal-class-name-2.
    ...
FACTORY.
    ...
  <<NEW-ARRAY method>>
END FACTORY.
OBJECT.
    ...
  <<GET-ARRAY-LENGTH method>>
  <<GET-ARRAY-ELEMENT method>>
  <<SET-ARRAY-ELEMENT method>>
END OBJECT.
END CLASS internal-class-name-1.
```

### Generation rules

1. Internal class names 1 and 2 are internally used by the J adapter class generator and are not viewed from the class user.
2. The external class name is used to identify the class. The class user can identify the class with the external class name.
3. An external class name is generated according to the following rules:

   ```
   JA-NumberOfDimensions-ElementTypeName
   ```

   - "JA-" is followed by the number of dimensions (1 to 9) and element type name with a hyphen "-" inserted in between them.
   - An element type name is generated depending on the type in the following format:
     - Object: External class name of the adapter class corresponding to the Java class (see "5.5.2 Class and interface".)
     - Basic type: Java keyword representing a type (boolean, byte, char, short, int, long, float, or double)
   - An external class name exceeding 160 characters is truncated after the 160th character.
4. The following methods are generated in the factory or method definition:

| Method name | Type | Function |
|---|---|---|
| NEW-ARRAY | Factory | Generates an array object. |
| GET-ARRAY-LENGTH | Object | Obtains the number of elements of an array. |

| Method name | Type | Function |
|---|---|---|
| GET-ARRAY-ELEMENT | Object | Fetches a value from an array element. |
| SET-ARRAY-ELEMENT | Object | Sets a value in an array element. |

5. An n-dimensional array is handled as a one-dimensional array having an n-1-dimensional array as an element. Therefore, for n-dimensional array, n adapter classes (JA-n-XYZ, JA-(n-1)-XYZ, ..., JA-1-XYZ) are generated. JA-n-XYZ is a one-dimensional array having JA-(n-1)-XYZ as an element.

### Generation example

The adapter class for java.lang.String[] is generated as shown below:

```
CLASS-ID. JA-1-STRING AS "JA-1-java-lang-String" INHERITS J-OBJECT.
    ...
END CLASS JA-1-STRING.
```

Adapter classes of int [] [] [] are generated as shown below:

```
CLASS-ID. JA-3-INT AS "JA-3-int" INHERITS J-OBJECT.             [1]
    ...
END CLASS JA-3-INT.
CLASS-ID. JA-2-INT AS "JA-2-int" INHERITS J-OBJECT.             [2]
    ...
END CLASS JA-2-INT.
CLASS-ID. JA-1-INT AS "JA-1-int" INHERITS J-OBJECT.             [3]
    ...
END CLASS JA-1-INT.
```

1. One-dimensional array having a JA-2-int class object as an element
2. One-dimensional array having a JA-1-int class object as an element
3. One-dimensional array having int as an element

No array exceeding 9 dimensions can be handled.

## 5.7.2 NEW-ARRAY method (factory method)

### Explanation

This method generates an array object.

### Syntax

```
INVOKE class-name "NEW-ARRAY" USING elmNum RETURNING createdObject
```

### Parameter and return value

class-name

Specifies the internal class name of the array class declared in the REPOSITORY paragraph.

elmNum (attribute: PIC S9(9) COMP-5)

Specifies the number of elements of the array to be generated.

createdObject (attribute: OBJECT REFERENCE SELF)

Returns the array object generated.

### Supplement

When a multidimensional array is generated, a (n-1)-dimensional array is generated and stored in each element of the n-dimensional array. For instance, a (n x m) two-dimensional array is generated as follows:

```
    ...
REPOSITORY.
    CLASS JA-2-INT AS "JA-2-int"
    CLASS JA-1-INT AS "JA-1-int"
    ...
01  anArray  OBJECT REFERENCE JA-2-INT.
01  wArray  OBJECT REFERENCE JA-1-INT.
    ...
    INVOKE JA-2-INT "NEW-ARRAY" USING n RETURNING anArray.       [1]
    PERFORM VARYING I FROM 0 BY 1 UNTIL I >= n
        INVOKE JA-1-INT "NEW-ARRAY" USING m RETURNING wArray     [2]
        INVOKE anArray "SET-ARRAY-ELEMENT" USING I wArray        [3]
    END-PERFORM.
    SET wArray TO NULL.
```

1. A two-dimensional array object of int is generated (number of elements = n).
2. A one-dimensional array object of int is generated (number of elements = m).
3. The one-dimensional array generated in [2] is set in each element of the first dimension of anArray.

## 5.7.3 GET-ARRAY-LENGTH method (object method)

### Explanation

This method returns the number of elements of an array object.

### Syntax

```
INVOKE anObject "GET-ARRAY-LENGTH" RETURNING elmNum
```

### Parameter and return value

anObject

Specifies the array object from which the number of elements is obtained.

elmNum (attribute: PIC S9(9) COMP-5)

Returns the number of elements of an array.

## 5.7.4 GET-ARRAY-ELEMENT method (object method)

### Explanation

This method fetches an element from an array object.

### Syntax

```
INVOKE anObject "GET-ARRAY-ELEMENT" USING inx RETURNING elemValue
```

### Parameter and return value

anObject

Specifies the array object from which an element is to be fetched.

inx (attribute: PIC S9(9) COMP-5)

Specifies the subscript of the element to be fetched. The subscript begins from~0.

elemValue (attribute: Array element type)

Returns the value of the array element fetched.

## 5.7.5 SET-ARRAY-ELEMENT method (object method)

### Explanation

This method sets an element of an array object.

### Syntax

```
INVOKE anObject "SET-ARRAY-ELEMENT" USING inx elemValue
```

### Parameter and return value

anObject

Specifies the array object in which an element is to be set.

inx (attribute: PIC S9(9) COMP-5)

Specifies the subscript of the element to be set. The subscript begins from 0.

elemValue (attribute: Array element type)

Specifies the value to be set in the array element.

# 5.8 Numbering Names

The J adapter class generator generates adapter class names from the names used for Java classes or interfaces. However, some names cannot be used in both Java and COBOL because different syntax rules are used. For instance, Java permits multiple methods with the same name to be defined within the same class if they have different parameters, while COBOL does not permit such definition. In this case, methods with the same name in Java must be generated so that they correspond to different names in COBOL. The J adapter class generator generates a unique name from each corresponding Java name by adding a hyphen "-" followed by a number.

This section explains the rules of assigning numbers to names used for adapter classes.

## 5.8.1 Effective range of name

The names handled by the J adapter class generator are classified into the following three types depending on the effective range of a name:

- Name that is always unique according to generation rules
  - Class name
  - Array class name
- Name that needs to be unique between super classes/subclasses
  - Factory method name corresponding to constructor
- Name that needs to be unique within an entire run unit
  - Method name (class/instance)
  - Field (variable) name (class/instance)

## 5.8.2 Name that is always unique according to generation rules

A class name is generated from a class name or interface name qualified by a Java package name. Since the qualified name is unique, the COBOL name generated from it is always unique. The same applies to an array class name.

Thus, no class names and array class names are numbered.

## 5.8.3 Name that needs to be unique between super classes/subclasses

A factory method name corresponding a constructor is generated from a class name that is not qualified by a package name. Factory method names including methods inherited from the super classes must all be unique to one another. However, names conflict when:

- Super classes have a same name qualified by different packages.
- Two or more constructors are defined for one class.

In this case, the J adapter class generator assigns numbers to the methods with a same name according to the following rules:

1. Number 01 is assigned to the name that appears first and then serial numbers are assigned in ascending order to the subsequent names.
2. The above rule is applied to names in order from the constructor defined in the super class. When two or more constructors are defined for one class, the rule is applied to them in order they are defined.

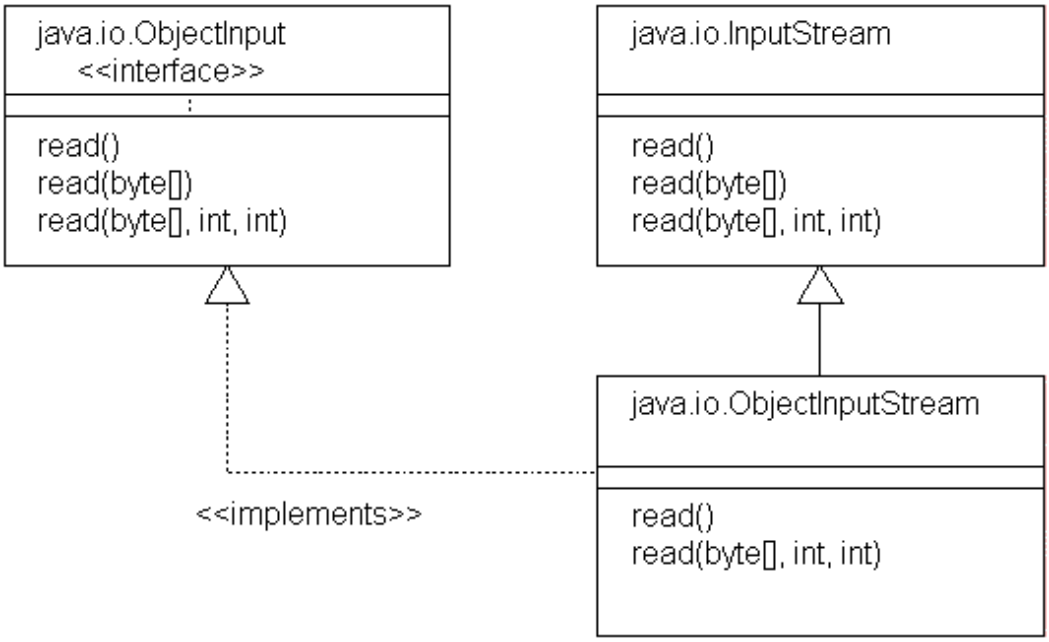
### Example

The factory methods corresponding to the constructor of the java.util.Date class and java.sql.Date class (subclass of the java.util.Date class) are assigned names as shown below:

| Java constructor | | COBOL factory method | |
|---|---|---|---|
| java.util.Date class | Date() | ava-util-Date class | Create-Date-01 |
| | Date(int, int, int) | | Create-Date-02 |
| | Date(int, int, int, int, int) | | Create-Date-03 |
| | Date(int, int, int, int, int, int) | | Create-Date-04 |
| | Date(long) | | Create-Date-05 |
| | Date(String) | | Create-Date-06 |
| java.sql.Date class | Date(int, int, int) | java-sql-Date class | Create-Date-07 |
| | Date(long) | | Create-Date-08 |

## 5.8.4 Name that needs to be unique within an entire run unit

Java method names are normally used as they are in COBOL. However, Java permits multiple methods with a same name to be defined if they have different parameters. In this case, numbers are assigned to COBOL method names for identification. However, to take advantage of polymorphism (diversification) that is the characteristics of object-oriented programming, methods having the same name and parameter are always assigned the same name. This correspondence relationship must be consistent within the run unit of the COBOL program that uses the J adapter class generator. For instance, the java.io.ObjectInputStream class inherits the java.io.ObjectInput interface and java.io.InputStream class (see the figure below).




### Relationships among java.io.ObjectInput interface, java.io.InputStream class, and java.io.ObjectInputStream class

For the adapter class corresponding to these interface and classes, methods of the same name must be generated for the read methods having the same parameters.

The J adapter class generator uses the generation name management file to manage the correspondence of method names across classes or interfaces. It then assigns numbers to methods with the same name according to the following rules:

1. The J adapter class generator searches the generation name management file for a method having the same name and parameter.
2. If a matching method is found, it uses the corresponding COBOL method name.
3. If no matching method is found, it generates a new COBOL method and adds it to the generation name management file.
4. A COBOL method name is generated according to the following rule:
   - The COBOL method name that is first added is the same as the Java method name.
   - The second and subsequent COBOL method names are assigned number in ascending order from 01.

### Example

The object methods corresponding to the read methods of the java.io.ObjectInput interface, java.io.InputStream class, and java.io.ObjectInputStream class are assigned names as shown below:

| Java method | | COBOL method | |
|---|---|---|---|
| java.io.ObjectInput interface | read() | java-io-ObjectInput class | read |
| | read(byte[]) | | read-01 |
| | read(byte[], int, int) | | read-02 |
| java.io.InputStream class | read() | java-io-InputStream class | read |
| | read(byte[]) | | read-01 |
| | read(byte[], int, int) | | read-02 |
| java.io.ObjectInputStream class | read() | java-io-ObjectInputStream class | read |
| | read(byte[], int, int) | | read-02 |

Note

The way of assigning numbers may be different depending on the order adapter classes are generated. Use the same generation name management file to generate adapter classes to be used under the same environment.

### Supplement

- These naming rules also apply to class methods.
- Java fields (variables) (class/instance) are associated with COBOL property methods. The same rules as those for methods also apply to property methods.
- The way of assigning numbers may be different depending on the version of JDK or J2SDK used for adapter class generation.

# Appendix A Message List

This appendix explains the messages output by the J adapter class generator, including the operator responses to the messages.

### Notes on Describing the Message

Italic type indicates variable character string.

## A.1 Java2cob Command Messages

This section explains the messages output by the java2cob command, including the operator responses to the messages.

**Adapter class generation failed because of a memory space shortage. Terminate unnecessary applications and retry.**

- A memory space shortage occurred. Terminate unnecessary applications, then reenter the java2cob command.

**Java VM could not be started. Check the JDK environment definition (PATH, CLASSPATH) and JDK installation.**

- The JDK or J2SDK environment contains an error. Check whether environment variables PATH and CLASSPATH are set normally and whether JDK or J2SDK is installed normally.

**Java2cob class loading failed. Reinstall the J adapter class generator and retry.**

- The J adapter class generator is not installed normally. Reinstall the J adapter class generator.

**Failed to open the optional file. Check the file status. Generation was interrupted.**

- Check status of the optional file (if the filename that is specified with the -i option is correct or not, if the file is set to read protection), and re-execute the processing.

**Optional filename is not specified. Generation was interrupted.**

- Specify the filename of the -i option and re-execute the processing.

## A.2 Messages Output during Generation

This section explains the messages output during adapter class generation, including the operator responses to the messages.

The message format is shown below:

```
Message type:  Message text
```

The message types are shown below:

| Message type | Level | Meaning |
|---|---|---|
| Error | Severe | No adapter class is generated. |
| Warning | Cautionary | An adapter class is generated. However, the user must check whether it has been generated as expected. |

**Warning: An invalid option "*Option-name*" was specified. The option was ignored to continue processing.**

- Specify a valid option and retry.

### Warning: "*specified-name*" specified for class "*class-name*" was not generated. Check the specified name (and parameter).

- Check whether the correct constructor/method/field was specified, then retry.

### Warning: A valid directory name was missing. The option was ignored to continue processing.

- Specify a valid folder name and retry.

### Warning: The generation name management file could not be generated.

- Check whether the correct folder name was specified in the -d option or "Option OutPutPath" parameter, or whether the generation name management file (java2cob.mgt) is write-protected, then retry.

### Warning: The name of class "*class-name*" exceeded 160 characters. The characters after the first 160 characters were deleted.

- Check whether deleting the characters after the first 160 characters results in an unusable name.

### Warning: The property name of field "*field-name*" exceeded 30 characters. The characters after the first 30 characters were deleted.

- Check whether deleting the characters after the first 30 characters results in an unusable name.

### Warning: The name of method "*method-name*" exceeded 160 characters. The characters after the first 160 characters were deleted.

- Check whether deleting the characters after the first 160 characters results in an unusable name.

### Warning: The method name of constructor "*constructor-name*" exceeded 160 characters. The characters after the first 160 characters were deleted.

- Check whether deleting the characters after the first 160 characters results in an unusable name.

### Error: A required class name or interface name was missing. Generation was interrupted.

- Specify a valid class name or interface name and retry.

### Error: An invalid class name "*class-name*" was specified. Specify a Java class name or interface name qualified by a package name.

- Specify a valid class name or interface name and retry.

### Error: An invalid directory name "*directory-name*" was specified. Generation was interrupted.

- Specify a valid directory name and retry.

### Error: The suffix number exceeded 99. Generation was interrupted.

- Retry while specifying -r option, -gc option, -gm option, -gf option, -om option, constructor/method/field-specifying-option in "Class class-name/interface-name" parameter, or "Option ReduceClass" parameter to decrease the number of classes, fields (variables), or methods.

### Error: The status of file "*file-name*" is invalid for generation. Check the file status.

- Check the file status (whether the folder name specified in the -d option or "Option OutPutPath" parameter is valid or whether the file is write-protected), then retry.

### Error: An error occurred during writing to file "*file-name*".

- Check whether the output destination has enough free space, then retry.

**Error: Both of the -om option (Option ReduceClass) and the -r option (Option GenOnlyUsed) cannot be specified at the same time. Generation was interrupted.**

- Specify either -om option (or "Option ReduceClass" parameter) or the -r option (or "Option GenOnlyUsed" parameter) and re-execute the processing. The -r option (or "Option GenOnlyUsed" parameter) is recommended.

**Error: Both of the -om option (Option ReduceClass) and the -s option (Option String) cannot be specified at the same time. Generation was interrupted.**

- Specify either -om option (or "Option ReduceClass" parameter) or the -s option (or "Option String" parameter) and re-execute the processing.

**Error: Failed to open the optional file. Check the file status. Generation was interrupted.**

- Check status of the optional file (if the filename that is specified with the -i option is correct, if the file is set to read protection), and re-execute the processing.

**Error: An invalid definition "*specified-item*" was specified in the optional file. The definition was ignored to continue processing.**

- Specify the correct definition and re-execute the processing.

**Error: Class information was not found. Generation was interrupted.**

- Check whether there is a class/interface class file referenced from the class/interface (see "3.1.4 Generating an Adapter Class When the Class File is Not Available").

**Error: A memory space shortage occurred. Generation was interrupted.**

- Terminate unnecessary applications and retry.

**Error: A system error occurred. Generation was interrupted.**

- The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a supplier.

# A.3 Messages Output during Execution

This section explains the messages output during execution of programs using adapter classes, including the operator responses to the messages.

Messages given while execution is underway are output to the same target output as that of the DISPLAY statement that is specified by UPON SYSERR of COBOL. Refer to "NetCOBOL User's Guide" for the target output of the DISPLAY statement that is specified by UPON SYSERR of COBOL.

Output of the messages given while execution is underway can be suppressed by setting "YES" to the environment variable COBJNI_NOMESSAGE.

The message format is shown below:

```
Class name information:  Message text
```

Class name information indicates the adapter class in which an error occurred. The format of class name information varies depending on the class type.

| Adapter class type | | Format | Explanation |
|---|---|---|---|
| Class/interface | | package-name/ ... /class-name | Class name fully qualified by a package name. Package and class names are separated by "/". |
| Array of basic data type | boolean | [Z | The number of "[" indicates the number of dimensions. For instance, "[[Z" is used for a 2-dimensional array. |
| | byte | [B | The number of "[" indicates the number of dimensions. |

| Adapter class type | | Format | Explanation |
|---|---|---|---|
| | char | [C | The number of "[" indicates the number of dimensions. |
| | short | [S | The number of "[" indicates the number of dimensions. |
| | int | [I | The number of "[" indicates the number of dimensions. |
| | long | [J | The number of "[" indicates the number of dimensions. |
| | float | [F | The number of "[" indicates the number of dimensions. |
| | double | [D | The number of "[" indicates the number of dimensions. |
| Class/interface array | | [L package-name/ ... /class-name; | The number of "[" indicates the number of dimensions. A class name fully qualified by a package name is enclosed between "L" and ";". |

### Java VM initialization failed. Check the environment variables (PATH, COBJNI_CLASSPATH) and JDK or JRE install environment.

- The JDK, J2SDK, JRE, or J2RE environment contains an error. Check whether the environment variables PATH and COBJNI_CLASSPATH are correct or whether JDK, J2SDK, JRE, or J2RE is installed properly.

### The current thread could not be connected to Java VM.

- Check whether the program properly invokes the JVM-INIT method or the JVM-ATTACH method.

### The current thread could not be disconnected from Java VM.

- Check whether the program properly invokes the JVM-TERMINATE method or the JVM-DETACH method.

### The adapter class generated by the J adapter class generator contains a Java class name in invalid format. Contact the J adapter class generator supplier.

- The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a Supplier.

### A same name is used for a parent and its child in the Java class/interface definition. Use different names for the parent and child.

- The Java class/interface definition contains an error. Check the Java class/interface.

### A required Java class/interface definition is not found. Check the environment variable (COBJNI_CLASSPATH).

- No Java class/interface is found on the search path. Check whether the value of the environment variable (COBJNI_CLASSPATH) is valid.

### A memory space shortage occurred. Increase the values of environment variables (COBJNI_MAX_NSTACK, COBJNI_JAVA_STACK, COBJNI_MIN_HEAP, and COBJNI_MAX_HEAP), then retry.

- A memory space shortage occurred in the Java VM. Increase the values of environment variables (COBJNI_MAX_NSTACK, COBJNI_JAVA_STACK, COBJNI_MIN_HEAP, and COBJNI_MAX_HEAP) to increase memory space available for the Java VM.

### No Java interface/abstract class instance can be generated. Check whether the Java class/interface was changed after the J adapter class generator was executed.

- A constructor was executed in an abstract class. The Java class/interface was probably changed after generation of an adapter class. Check the Java class/interface.

### Type conversion failed. Check the parameter passed to the J-NARROW method.

- The object specified in the parameter is not a subclass or object of the class. Check the parameter passed to the J-NARROW method.

### No Java field is found. Check whether the Java class/interface was changed after execution of the J adapter class generator.

- The Java class/interface was probably changed after generation of an adapter class. Check the Java class/interface.

### Java class initialization failed. Call the J adapter class generator supplier.

- The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a Supplier.

### No Java method is found. Check whether the Java class/interface was changed after execution of the J adapter class generator.

- The Java class/interface was probably changed after generation of an adapter class. Check the Java class/interface.

### The character string could not be fetched from the String object. Call the J adapter class generator supplier.

- The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a Supplier.

### The subscript of the array object is invalid. Specify a subscript within the array range.

- The subscript value is outside the range from "0 to (element count - 1)." Specify a valid subscript.

### The class of the set object is invalid. Specify a subclass of the array element class.

- An attempt was made to set an invalid class object in an array element. Set an object of a valid class. An object of the array element class or its subclass must be set.

### An internal logical error (inconsistency between the return value and object reference) occurred. Call the J adapter class generator supplier.

- The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a Supplier.

### Java VM detected an error. Remove the error cause. (*exception name: supplementary information*)

- The Java VM detected an execution-time error. Determine the error cause from the exception name and supplementary information and remove it.

### An internal logical error (failure of the error detecting feature) occurred. Call the J adapter class generator supplier.

- The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a Supplier.

### Could not convert character encoding. ERRNO:$1

- A character code conversion failed while executing the method of the java-lang-String class. Remove the cause of the error by referring to the error code set in $1.

Table A.1 CHARACTER CODE CONVERSION ERROR

| $1 | Description | Programmer response |
|---|---|---|
| 7 | The code row region was insufficient for the converted data. | Ensure the length of the data item is large enough to handle the converted data. |
| 12 | Not enough space. | Refer to "NetCOBOL Messages"-"B.1 Virtual Memory Shortages". |
| 22 | There is an inappropriate code in the origin conversion data row. | Check if the character data of the origin conversion data is not incomplete when moved or partially referred. |

| $1 | Description | Programmer response |
|---|---|---|
| 42 | There is a non-existent code set in the origin conversion data row. | The origin conversion data is outside of code set. Check whether the data item that use different encoding method is not used by overlapping (REDEFINES phrase) or the binary data is stored other than the character-code. |

Refer to the system errno explanation for the error code other than the table "$1 of CHARACTER CODE CONVERSION ERROR".

Refer to "NetCOBOL User's Guide" for detail of CONVCHR compile option and environment variable @CBR_CONVERT_CHARACTER.

# Appendix B  Exception Type List

The exception types that can be acquired by the GET-CODE method of the FJ-JAVA-ERROR class are described in this Appendix.

---

**1**

### Meaning

Java VM detected an error. Remove the error cause.

### Response

The Java VM detected an execution-time error. Determine the error cause from the exception information returned by the GET-EXCEPTION method of FJ-JAVA-ERROR class, and remote it.

---

**2**

### Meaning

No Java method is found. Check whether the Java class/interface was changed after execution of the J adapter class generator.

### Response

The Java class/interface was probably changed after generation of an adapter class. Check the Java class/interface.

---

**3**

### Meaning

Java class initialization failed. Call the J adapter class generator supplier.

### Response

The J adapter class generator failed. Collect failure information. Collect failure information. Please open a support incident to obtain assistance from a supplier.

---

**4**

### Meaning

A memory space shortage occurred. Increase the values of environment variables (COBJNI_MAX_NSTACK, COBJNI_JAVA_STACK, COBJNI_MIN_HEAP, and COBJNI_MAX_HEAP), then retry.

### Response

A memory space shortage occurred in the Java VM. Increase the values of environment variables (COBJNI_MAX_NSTACK, COBJNI_JAVA_STACK, COBJNI_MIN_HEAP, and COBJNI_MAX_HEAP) to increase memory space available for the Java VM.

---

**5**

### Meaning

No Java field is found. Check whether the Java class/interface was changed after execution of the J adapter class generator.

### Response

The Java class/interface was probably changed after generation of an adapter class. Check the Java class/interface.

---

**6**

### Meaning

The subscript of the array object is invalid. Specify a subscript within the array range.

### Response

The subscript value is outside the range from "0 to (element count - 1)." Specify a valid subscript.

### 7

#### Meaning

The adapter class generated by the J adapter class generator contains a Java class name in invalid format. Contact the J adapter class generator supplier.

#### Response

The J adapter class generator failed. Collect failure information. Collect failure information. Please open a support incident to obtain assistance from a supplier.

### 8

#### Meaning

A same name is used for a parent and its child in the Java class/interface definition. Use different names for the parent and child.

#### Response

The Java class/interface definition contains an error. Check the Java class/interface.

### 9

#### Meaning

The class of the set object is invalid. Specify a subclass of the array element class.

#### Response

An attempt was made to set an invalid class object in an array element. Set an object of a valid class. An object of the array element class or its subclass can be set.

### 10

#### Meaning

A required Java class/interface definition is not found. Check the environment variable (COBJNI_CLASSPATH).

#### Response

No Java class/interface is found on the search path. Check whether the value of the environment variable (COBJNI_CLASSPATH) is valid.

### 11

#### Meaning

No Java interface/abstract class instance can be generated. Check whether the Java class/interface was changed after the J adapter class generator was executed.

#### Response

A constructor was executed in an abstract class. The Java class/interface was probably changed after generation of an adapter class. Check the Java class/interface.

### 12

#### Meaning

Java VM initialization failed. Check the environment variables (PATH, COBJNI_CLASSPATH) and JDK or JRE install environment.

#### Response

The JDK, J2SDK, JRE, or J2RE environment contains an error. Check whether the environment variables PATH and COBJNI_CLASSPATH are normal or whether JDK, J2SDK, JRE, or J2RE is installed normally.

### 13

### Meaning

The character string could not be fetched from the String object. Call the J adapter class generator supplier.

### Response

The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a supplier.

---

**14**

### Meaning

Type conversion failed. Check the parameter passed to the J-NARROW method.

### Response

The object specified in the parameter is not a subclass or object of the class. Check the parameter of the J-NARROW method.

---

**15**

### Meaning

An internal logical error (inconsistency between the return value and object reference) occurred. Call the J adapter class generator supplier.

### Response

The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a supplier.

---

**16**

### Meaning

Java VM detected an error. Remove the error cause. (exception name: supplementary information)

### Response

The Java VM detected an execution-time error. Determine the error cause from the exception name and supplementary information and remote it.

---

**17**

### Meaning

An internal logical error (failure of the error detecting feature) occurred. Call the J adapter class generator supplier.

### Response

The J adapter class generator failed. Collect failure information. Please open a support incident to obtain assistance from a supplier.

---

**18**

### Meaning

The current thread could not be connected to Java VM.

### Response

Check whether the program normally invokes the JVM-INIT method or the JVM-ATTACH method.

---

**19**

### Meaning

The current thread could not be disconnected from Java VM.

### Response

Check whether the program normally invokes the JVM-TERMINATE method or the JVM-DETACH method.

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