Murach's Java Programming (6th Edition)

Chapter 1

An introduction to Java

Objectives

Applied

1. Given a NetBeans or Eclipse project that contains the source code for a Java application, use NetBeans or Eclipse to open the project, view and compile the source code, and run the application.
2. Given the source code for a Java application, use NetBeans or Eclipse to create a project, enter the source code, compile the source code, and run the application.

Knowledge

1. Describe how Java compares with C++ and C# based on these features: syntax, platform independence, speed, and memory management.
2. Name and describe two types of desktop applications that you can create with Java.
3. Describe how Java compiles and interprets code.
4. Explain how the use of bytecode lets Java achieve platform independence.

Objectives (continued)

5. Describe the benefits of using a Java IDE like NetBeans or Eclipse.
6. Explain why you don’t need to compile the source code for an application before you use NetBeans or Eclipse to run the application.

Java timeline

Year	Month	Release
1996	January	JDK 1.0
1997	February	JDK 1.1
1998	December	SDK 1.2
1999	August	Java 2 Platform, Standard Edition (J2SE)
	December	Java 2 Platform, Enterprise Edition (J2EE)
2000	May	J2SE with SDK 1.3
2002	February	J2SE with SDK 1.4
2004	September	J2SE 5.0 with JDK 1.5
2006	December	Java SE 6 with JDK 1.6
2011	July	Java SE 7 with JDK 1.7
2014	March	Java SE 8 with JDK 1.8
2017	September	Java SE 9 with JDK 1.9

Java timeline (continued)

Year	Month	Release
2018	March	Java SE 10 with JDK 10
2018	September	Java SE 11 with JDK 11
2019	March	Java SE 12 with JDK 12
2019	September	Java SE 13 with JDK 13
2020	March	Java SE 14 with JDK 14
2020	September	Java SE 15 with JDK 15
2021	March	Java SE 16 with JDK 16
2021	September	Java SE 17 with JDK 17

Java editions

- Java SE (Standard Edition)
- Java EE (Enterprise Edition)
- Java ME (Micro Edition)

Operating systems that support Java

- Windows
- macOS
- Linux
- Most versions of UNIX
- Android
- Most other modern operating systems

Java compared to C++

Feature	Description
Syntax	Java syntax is similar to C++ syntax.
Operating system	Compiled Java code can run on any operating system that has a Java runtime environment. C++ code must be compiled once for each type of system that it's going to be run on.
Speed	C++ runs faster than Java in some contexts, but Java runs faster in other contexts.
Memory	Java handles most memory operations automatically, but C++ programmers must write code that manages memory.

Java compared to C#

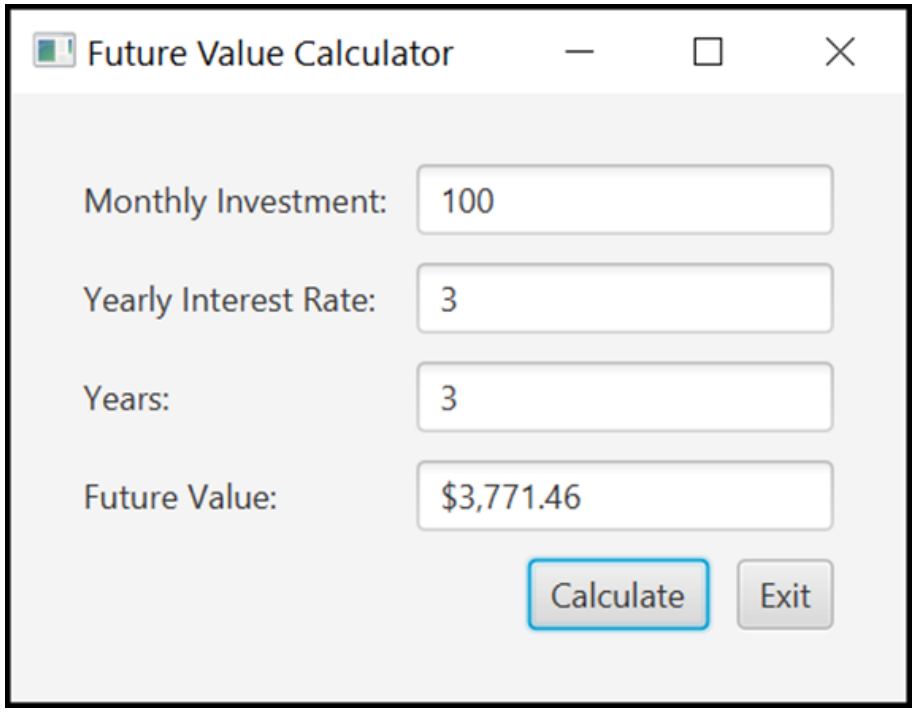
Feature	Description
Syntax	Java syntax is similar to C# syntax.
Operating system	Like Java, compiled C# code can run on any operating system that has a runtime environment for it.
Speed	Java runs faster than C# in most contexts.
Memory	Like Java, C# handles most memory operations automatically.

A console application

Select C:\Windows\System32\cmd.exe - java FutureValueApp

```
Microsoft Windows [Version 10.0.18362.1256]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\murach\java\files>java FutureValueApp
Welcome to the Future Value Calculator

Enter monthly investment:   100
Enter yearly interest rate: 3
Enter number of years:      3
Future value:               $3,771.46

Continue? (y/n):
```

A GUI application



The code for a console application (part 1)

```
import java.util.Scanner;
import java.text.NumberFormat;

public class FutureValueApp {

    public static void main(String[] args) {
        System.out.println(
            "Welcome to the Future Value Calculator\n");

        Scanner sc = new Scanner(System.in);
        String choice = "y";
        while (choice.equals("y")) {

            // get the input from the user
            System.out.print(
                "Enter monthly investment:   ");
            String input = sc.nextLine();
            double monthlyInvestment =
                Double.parseDouble(input);
            System.out.print(
                "Enter yearly interest rate: ");
            input = sc.nextLine();
            double interestRate = Double.parseDouble(input);
```

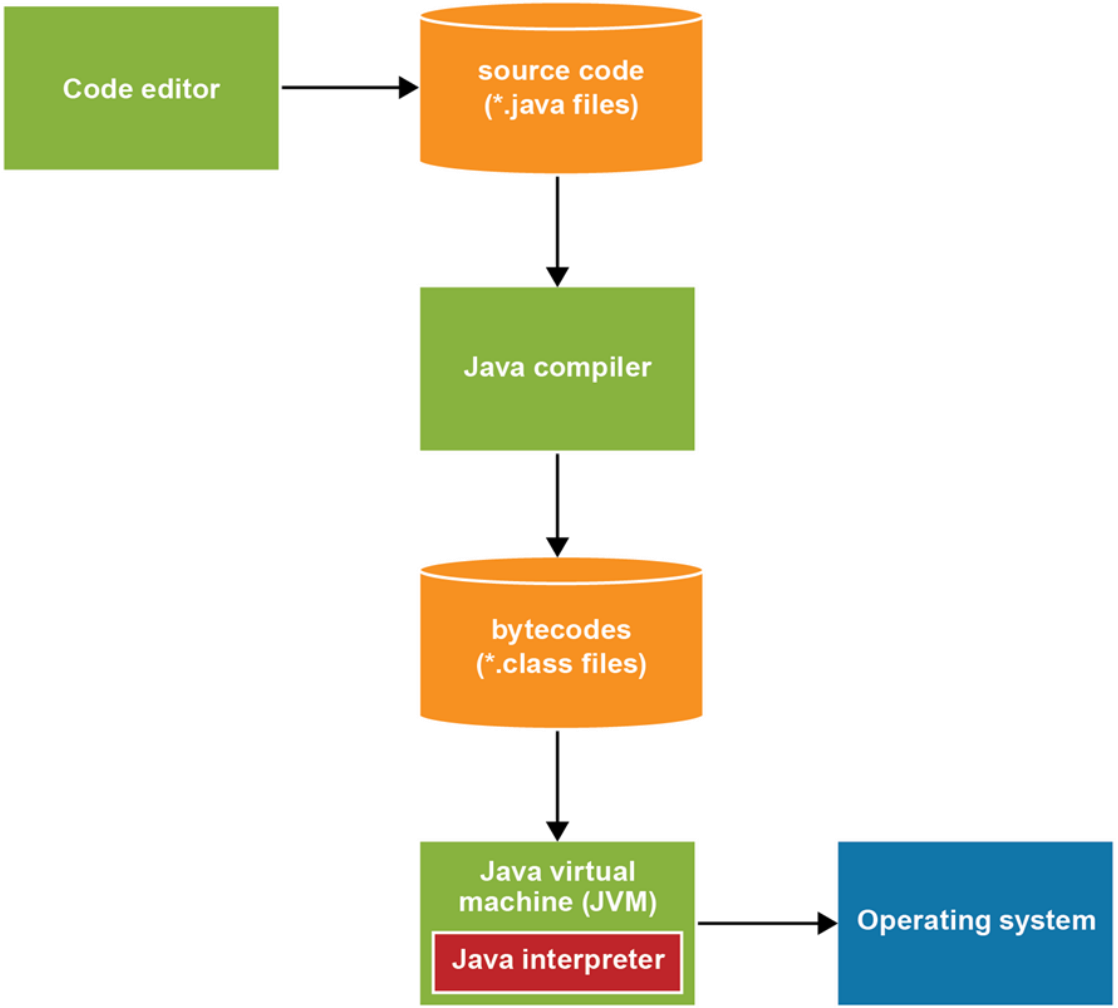
The code for a console application (part 2)

```
        System.out.print(
            "Enter number of years:      ");
        input = sc.nextLine();
        int years = Integer.parseInt(input);

        // calculate the future value
        double futureValue = calculateFutureValue(
                monthlyInvestment,
                interestRate, years);

        // format and display the result
        NumberFormat currency =
            NumberFormat.getCurrencyInstance();
        System.out.println("Future value:                "
                + currency.format(futureValue));
        System.out.println();

        // see if the user wants to continue
        System.out.print("Continue? (y/n): ");
        choice = sc.nextLine();
        System.out.println();
    }
}
```

The code for a console application (part 3)

```
    private static double calculateFutureValue(
            double monthlyInvestment,
            double interestRate, int years) {
        // convert yearly to monthly
        double monthlyInterestRate = interestRate / 12 / 100;
        int months = years * 12;

        double futureValue = 0.0;
        for (int i = 1; i <= months; i++) {
            futureValue = (futureValue + monthlyInvestment)
                    * (1 + monthlyInterestRate);
        }
        return futureValue;
    }
}
```

How Java compiles and interprets code



A command prompt for Windows

Command Prompt - java FutureValueApp

```
Microsoft Windows [Version 10.0.18362.1256]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\Joel>cd /murach/java/files

C:\murach\java\files>javac FutureValueApp.java

C:\murach\java\files>java FutureValueApp
Welcome to the Future Value Calculator

Enter monthly investment:   100
Enter yearly interest rate: 3
Enter number of years:      3
Future value:               $3,771.46

Continue? (y/n):
```

How to start a command prompt

For Windows

- Select the Command Prompt app from the Start menu. To do that, you can search the Start menu for the Command Prompt app.

For macOS

- Use Finder to select Applications. Then, expand Utilities and double-click on Terminal.

Syntax to change the current directory

```
cd /dir1/dir2/dir3
```

A note on using slashes

- When you change the current directory, front slashes work for both Windows and macOS, but backslashes only work for Windows.

How to compile and run a Java application

Syntax to compile a Java application

```
javac ProgramName.java
```

Syntax to run a Java application

```
java ProgramName
```

Popular Java IDEs

- NetBeans
- Eclipse
- IntelliJ IDEA
- Android Studio

Features provided by most IDEs

- A code editor with code completion and error detection.
- Automatic compilation of classes when you run the application.
- A debugger that lets you set breakpoints, step through code, and view the values of active variables.

NetBeans with a Java project

ch01_FutureValueConsole - Apache NetBeans IDE 12.3

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help

Projects | Files | Services

- ch01_FutureValueConsole
  - Source Packages
    - <default package>
      - FutureValueApp.java
  - Libraries

Navigator

Members <empty>

- FutureValueApp
  - FutureValueApp()
  - calculateFutureValue(double monthlyInvestment, do
  - main(String[] args)

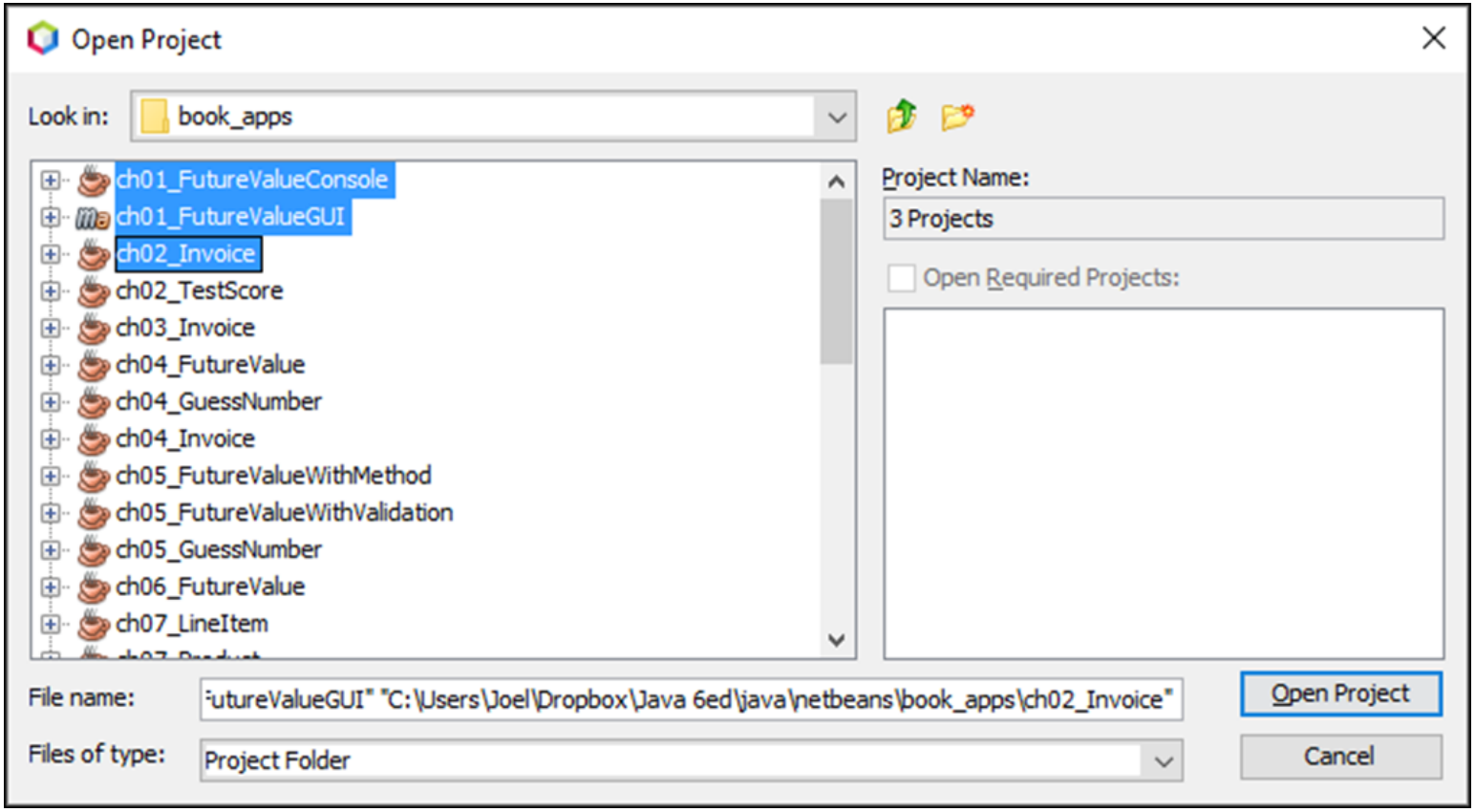
FutureValueApp.java

Source History

```
1  import java.util.Scanner;
2  import java.text.NumberFormat;
3
4  public class FutureValueApp {
5
6      public static void main(String[] args) {
7          System.out.println("Welcome to the Future Value Calcul
8          System.out.println(); // blank line
9
10         Scanner sc = new Scanner(System.in);
11         String input;
12
13         String choice = "y";
14         while (!choice.equalsIgnoreCase("n")) {
15             // get the input from the user
16             System.out.print("Enter monthly investment:   ");
17             input = sc.nextLine();
18             double monthlyInvestment = Double.parseDouble(inpu
19
20             System.out.print("Enter yearly interest rate: ");
21             input = sc.nextLine();
```

1:1 INS Windows (CRLF)

The dialog box for opening a project in NetBeans



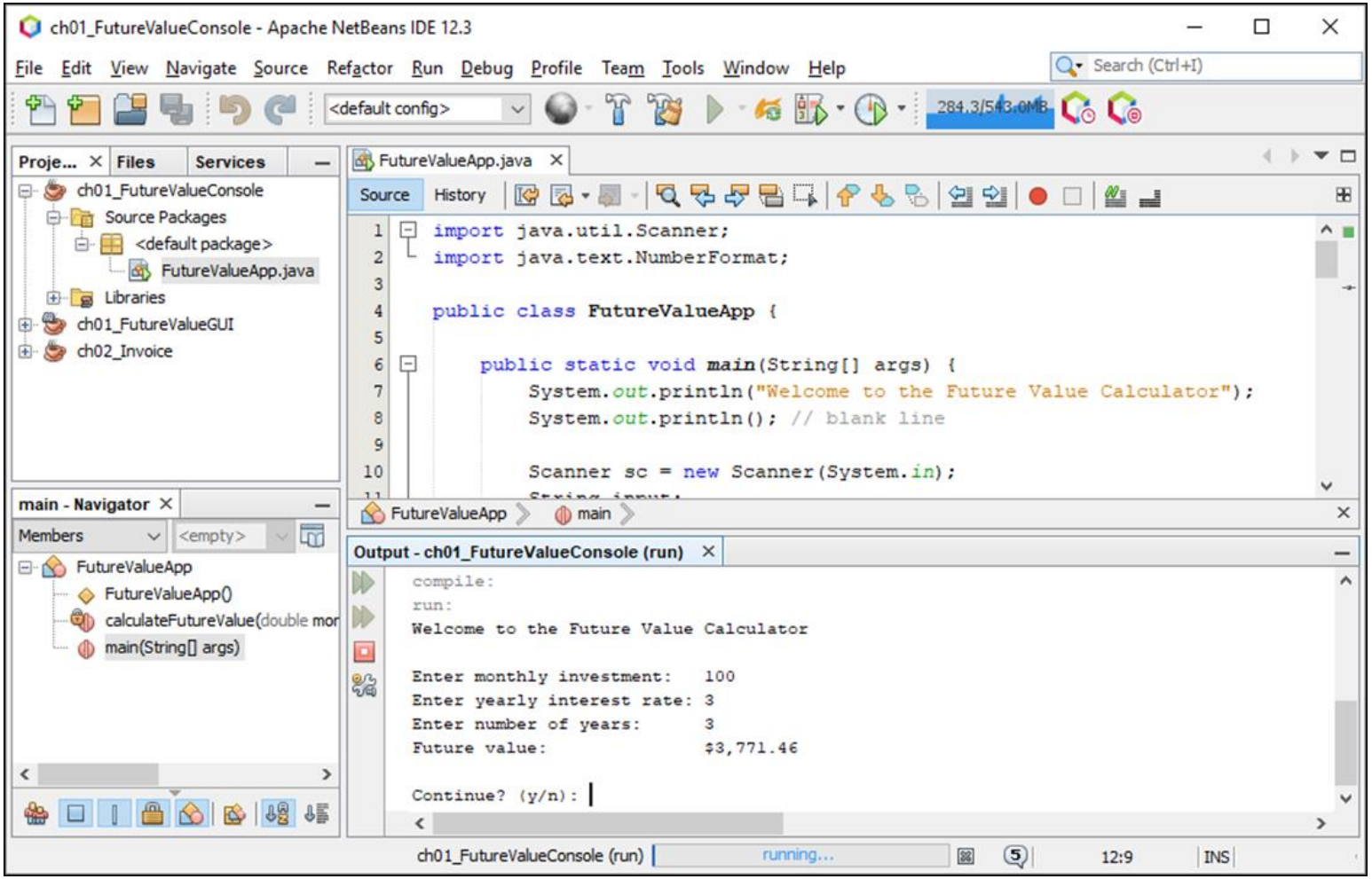
How to open and close a project in NetBeans

- To open a project, click the Open Project button in the toolbar or select File→Open Project from the menu system. Then, use the Open Project dialog box that's displayed to locate and select the project and click the Open Project button.
- You can also open a project by selecting File→Open Recent Project and then selecting the project from the list that's displayed.
- To close a project, right-click on the project in the Projects window and select Close, or select the project and then use the File→Close Project command.
- You can use the Open Project dialog box to open multiple projects. To do that, hold down the Ctrl key, select the projects that you want to open, and click the Open Project button.

How to right-click with macOS

- Enable right-clicking by editing the system preferences for the mouse.
- Control-click instead of right-clicking.

NetBeans with three open projects and an Output window



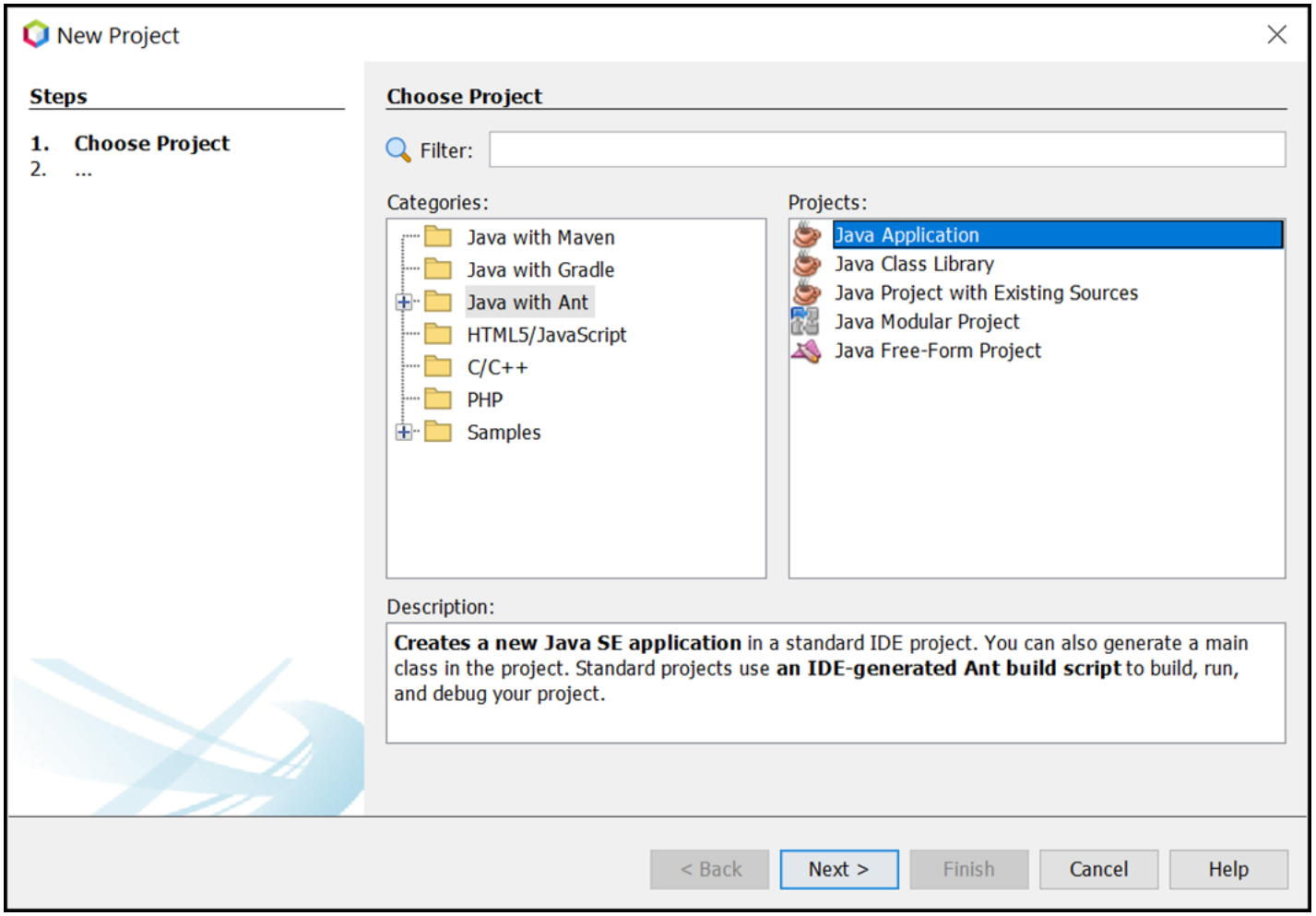
How to compile and run a project with NetBeans

- If you open multiple projects, they all appear in the Projects window. To select a project, click on it in the Projects window.
- To run the selected project, press F6 or click the Run Project button in the toolbar.
- When you run a project, NetBeans automatically compiles it.
- To compile a project without running it, right-click on the project and select Build.
- To delete all compiled files for a project and compile the project again, right-click the project and select Clean and Build. This removes files that are no longer needed.

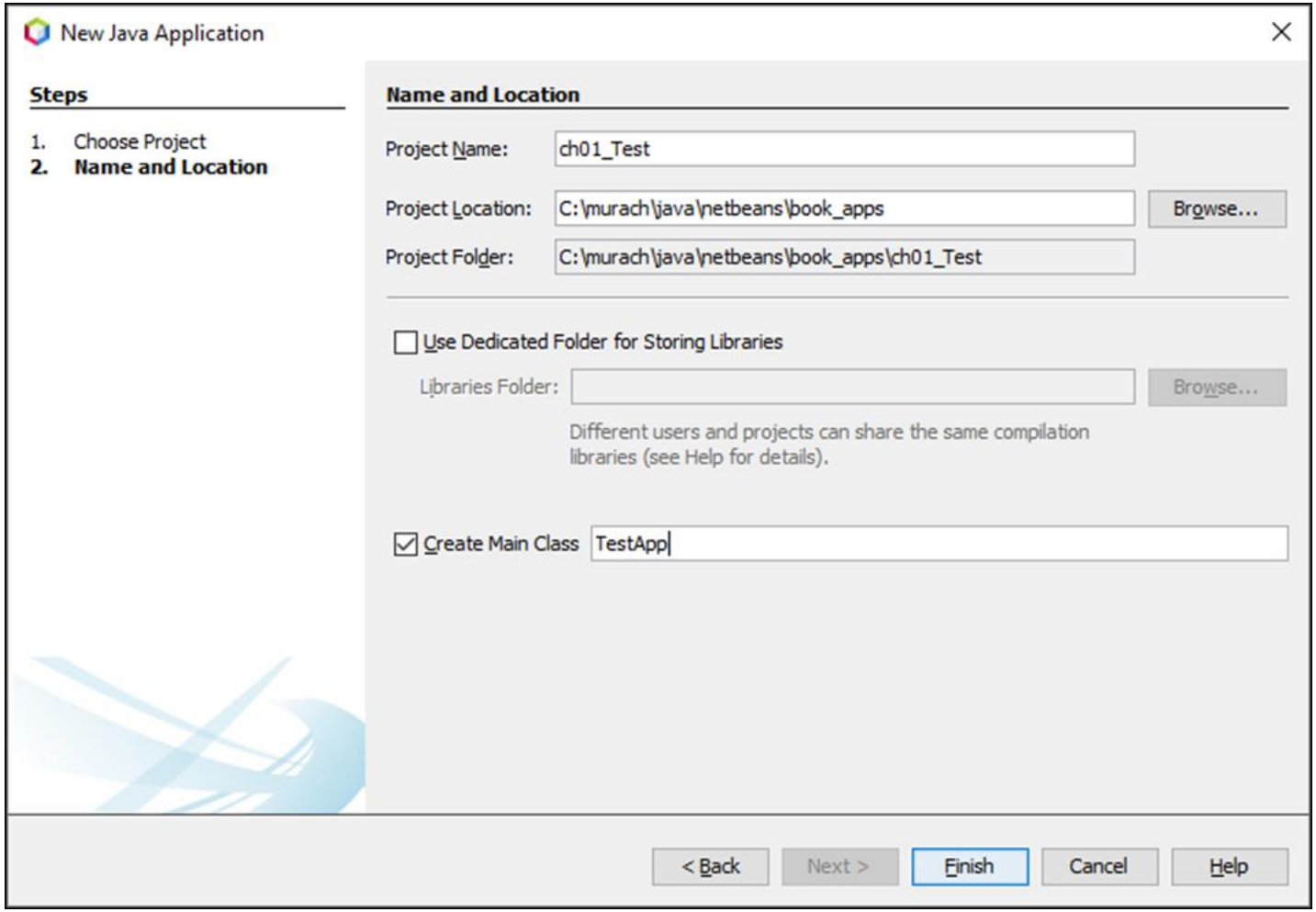
How to work with the Output window

- When you run an application that prints data to the console, NetBeans displays that data in the Output window.
- If an application requests input from the console, the Output window pauses to accept the input. Then, you can click in the Output window, type the input, and press the Enter key.
- The Output window also displays other information such as messages or errors that occur when the application is compiled or run.

The first dialog box for creating a new project



The second dialog box for creating a new project



Eclipse with a Java project

eclipse - ch01_FutureValueConsole/src/FutureValueApp.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Package Explorer

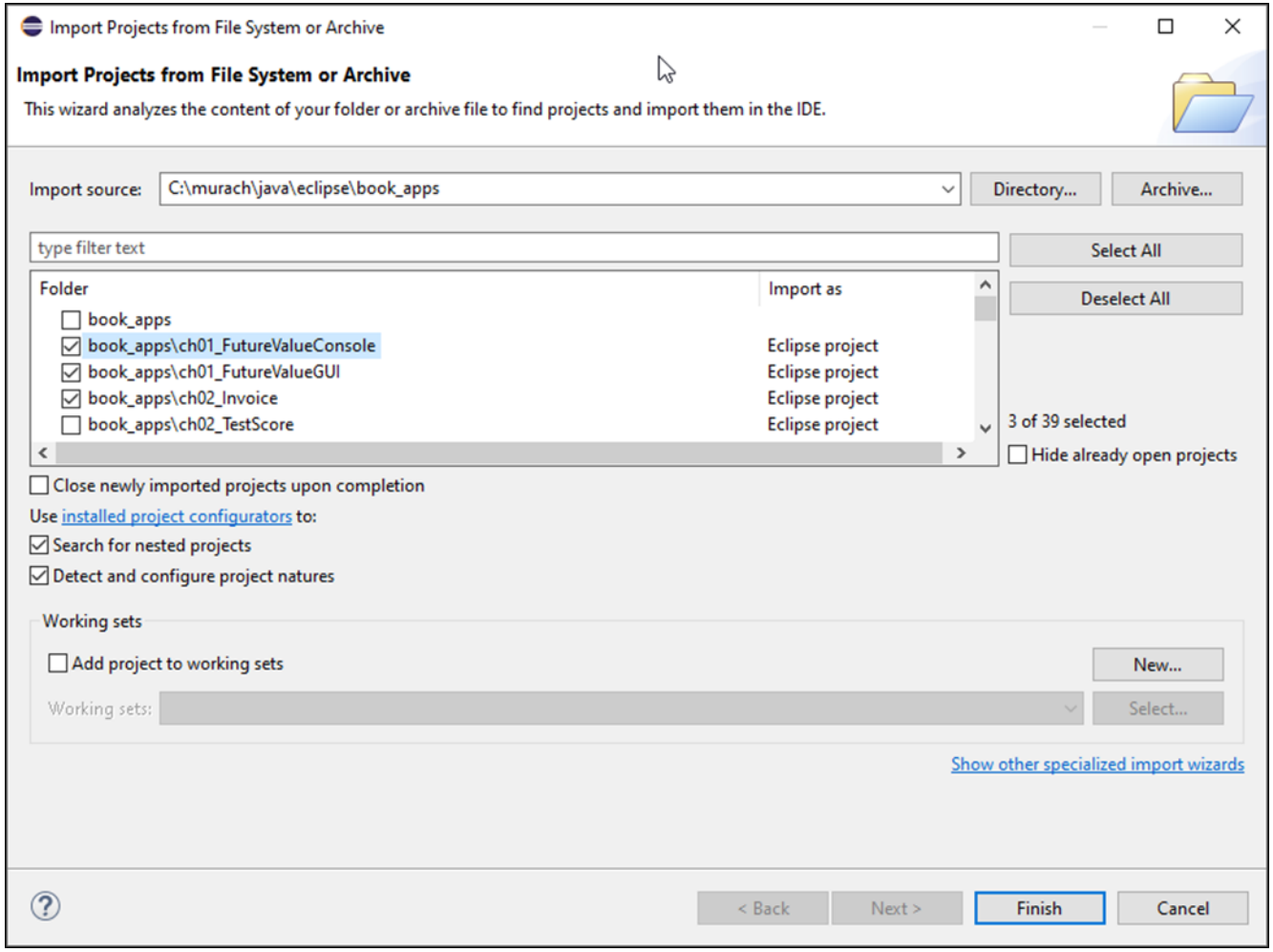
- ch01_FutureValueConsole
  - src
    - (default package)
      - FutureValueApp.java
  - JRE System Library [JavaSE-16]

FutureValueApp.java

```
1  import java.util.Scanner;
2  import java.text.NumberFormat;
3
4  public class FutureValueApp {
5
6      @SuppressWarnings("resource")
7      public static void main(String[] args) {
8          System.out.println("Welcome to the Future Value Calculator\n");
9
10         Scanner sc = new Scanner(System.in);   // create object to scan input
11         String choice = "y";
12         while (choice.equals("y")) {
13             // get the input from the user
14             System.out.print("Enter monthly investment:   ");
15             String input = sc.nextLine();
16             double monthlyInvestment = Double.parseDouble(input);
17
18             System.out.print("Enter yearly interest rate: ");
19             input = sc.nextLine();
20             double interestRate = Double.parseDouble(input);
21
22             System.out.print("Enter number of years:      ");
23             input = sc.nextLine();
24             int years = Integer.parseInt(input);
25
```

Writable | Smart Insert | 1 : 1 : 0

The dialog box for opening a project in Eclipse



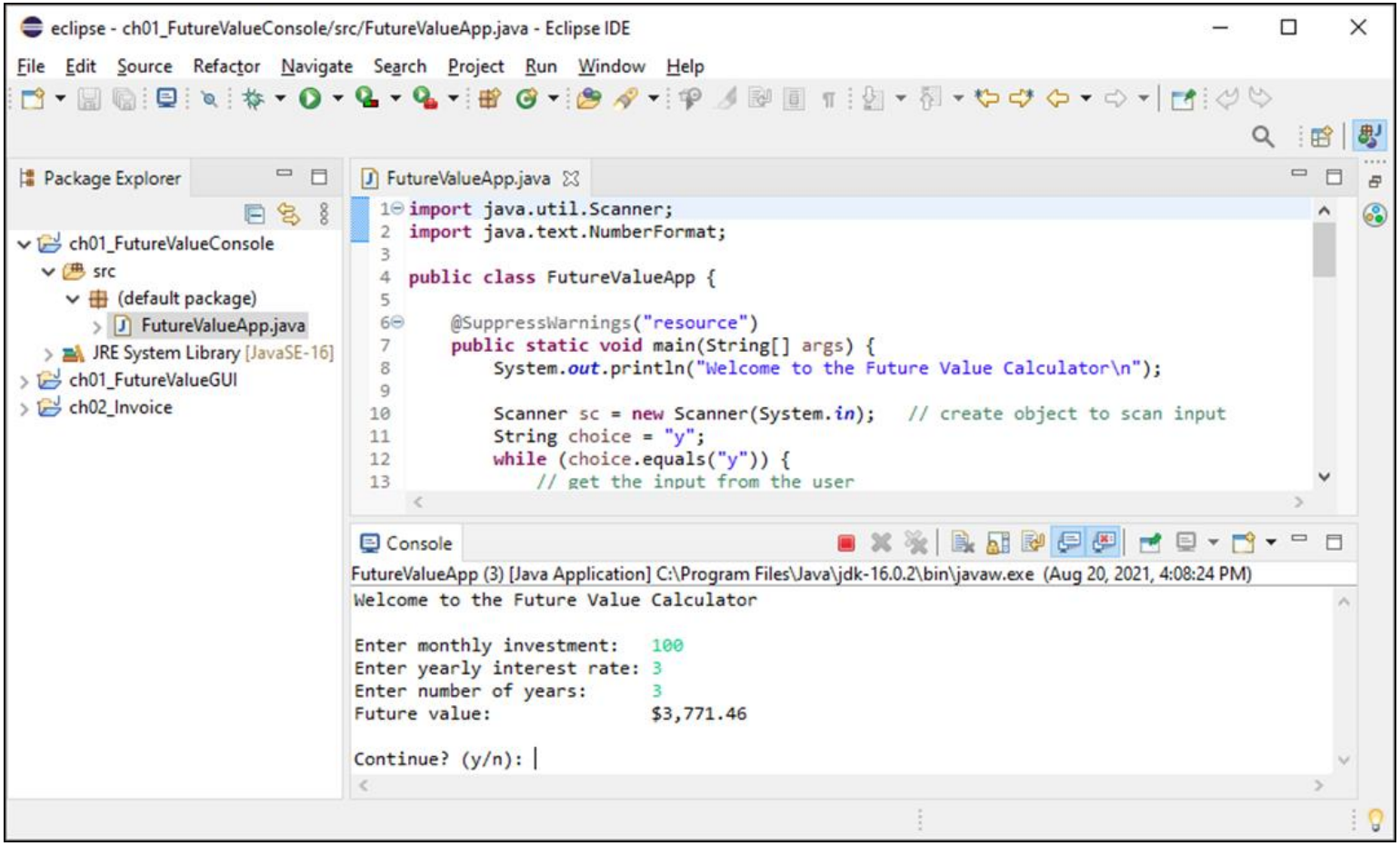
How to open and close a project in Eclipse

- To open a project, select File→Open Projects from File System. In the dialog box, click the Directory button, navigate to the folder that contains the projects you want to import, select the projects, and click Finish.
- To close a project and remove it from the Package Explorer, right-click on the project in the Package Explorer window and select Delete. Then, make sure the "Delete project contents on disk" checkbox is unchecked and select OK.

Note for macOS

- To enable right-clicking with macOS, you can edit the system preferences for the mouse. Or, if you prefer, you can control-click instead of right-clicking.

Eclipse with three open projects and a Console window



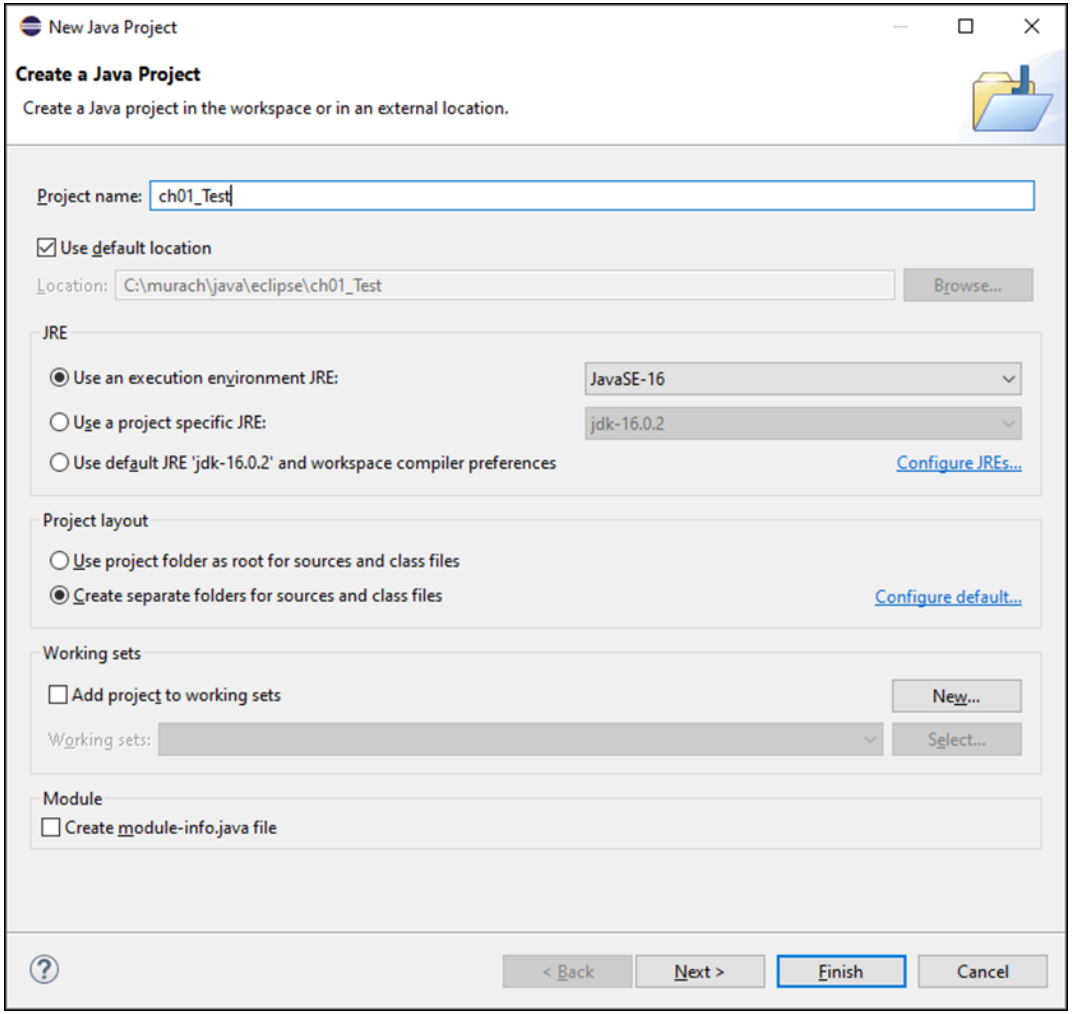
How to compile and run a project with Eclipse

- If you open multiple projects, they all appear in the Package Explorer. To select a project, click on it in the Package Explorer.
- To run the selected project, click the Run button in the toolbar. When you run a project, Eclipse automatically compiles it.
- To delete all compiled files for a project and compile the project again, select the project in the Package Explorer. Then, select Project→Clean.

How to work with the Console window

- When you run an application that prints data to the console, the Console window displays that data.
- If an application requests input from the console, the Console window pauses to accept the input. Then, you can click in the Console window, type the input, and press the Enter key.
- The Console window can also display error messages when you run an application.

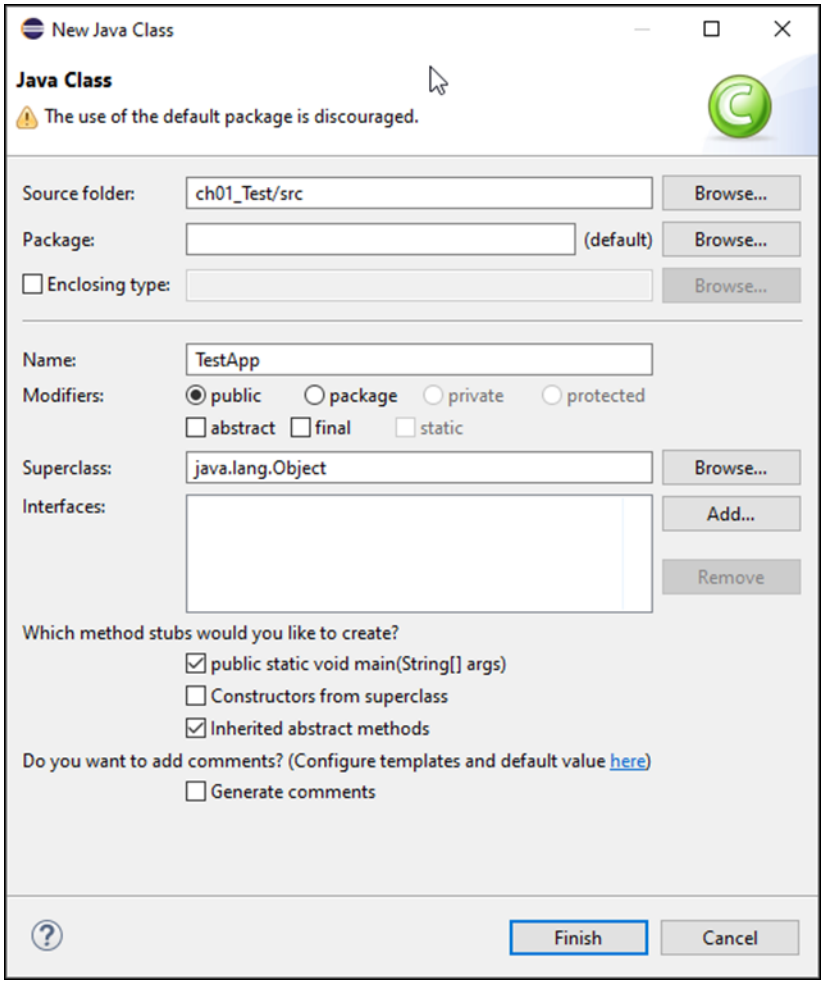
The dialog box for creating a new project



How to create a new project

1. Select File→New→Java Project.
2. Enter a name for the project.
3. Uncheck from the “Create module-info.java file” checkbox.
4. Click Finish.

The dialog box for creating a new class



How to create a new class

1. In the Package Explorer, right-click on the project and select New→Class.
2. In the Package text box, delete the name for the package.
3. In the Name text box, enter the name of the class.
4. Select the first checkbox that adds a main() method to the class.
5. Click Finish.