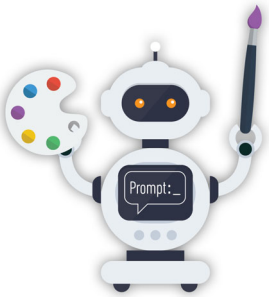

Before You Begin

Please read this section to understand our conventions and set up your computer to compile and run our example programs. If there are changes to the instructions presented here, we'll post updates on the book's webpage at

```
https://deitel.com/jhtp12
```

Font and Naming Conventions

We use fonts to distinguish application elements and Java code elements from regular text:

- We use a **bold font** for on-screen application elements, such as "the **File** menu."
- We use a `fixed-width font` for commands and Java code elements, as in

```
System.out.println("Welcome to Java!");
```

Getting the Code Examples

Java How to Program: An Objects-Natural Approach, 12/e's examples are available for download from our GitHub repository at

```
https://github.com/pdeitel/JavaHowToProgram12e
```

If you're not familiar with GitHub, press (or select) the green "<> **Code**" button, then select **Download ZIP** from the drop-down menu that appears. This will save

```
JavaHowToProgram12e-main.zip
```

in your user account's `Downloads` folder. Next, extract the ZIP file's contents:

- On macOS, double-click the file to extract its contents, then navigate into the `JavaHowToProgram12e-main` folder and drag the `examples` folder to your `Documents` folder.
- On Windows, double-click the file, navigate into the `JavaHowToProgram12e-main` folder, then drag the `examples` folder to your `Documents` folder.

Various instructions and code examples throughout the book assume the examples are in a folder named `examples` in your user account's `Documents` folder, structured as follows:

```
Documents
   examples
      ch01
      ch02
      ch03
      ...
```

If you place the `examples` folder elsewhere or rename it, you must update our instructions and code accordingly.

Java Development Kit (JDK)

We developed this book's examples using the Java 23 version of the Java Development Kit (JDK), which contains the command `javac` for compiling Java programs, the command `java` for running Java programs, and more. We discuss compiling and running Java programs in Chapter 1's "Test-Driving the JDK" section.

We used the free, open-source OpenJDK version of the JDK from:

```
https://adoptium.net/temurin/releases/
```

This site—managed by the Eclipse Foundation[1]—provides downloads for many operating systems and hardware platforms. Below, we discuss getting the OpenJDK for Windows and macOS.

Windows Users

Go to

```
https://adoptium.net/temurin/releases/
```

then select the following options:

- Under **Operating System**, select **Windows**.
- Under **Architecture**, select **x64**.
- Under **Package Type**, select **JDK**.
- Under **Version**, select **23** (or higher to use a newer version).

Next, press (or select) the `.msi` installer button to download the OpenJDK installer. When the download completes, double-click the installer file in your user account's `Downloads` folder. The installer's filename will be similar to:

```
OpenJDK23U-jdk_x64_windows_hotspot_23.0.2_7.msi
```

In the installed dialog:

1. Press (or select) **Next** to move to the **End-User License Agreement** step. You must accept the license agreement to install the software. Once you've read the agreement, select "I accept the terms in the License Agreement," then press (or select) **Next** to move to the **Installation Scope** step.
2. Choose whether to install the JDK just for you or for anyone using your computer, then press (or select) **Next** to move to the **Custom Setup** step.
3. By default, the installer selects the first three options (**Modify PATH variable**, **Associate .jar** and **Set or override JAVA_HOME variable**). We recommend keeping the default settings and installation location. Press (or select) **Next**, then click **Install**.
4. In the **User Account Control** dialog, press (or select) **Yes** to allow the installer to make changes to your system and install the JDK.
5. When the installer completes, press (or select) **Finish**.

1. "About the Eclipse Foundation." Accessed February 12, 2025. `https://eclipse.org/org/`.

To ensure that Java is installed correctly, enter **Terminal** in your Windows taskbar's **Search** field then select **Terminal** in the search results. This opens a **Windows PowerShell** window. In this window, enter the command

```
java --version
```

and press (or select) *Enter* or *Return* to execute it. The command's output should be similar to the following:

```
openjdk 23.0.2 2025-01-21
OpenJDK Runtime Environment Temurin-23.0.2+7 (build 23.0.2+7)
OpenJDK 64-Bit Server VM Temurin-23.0.2+7 (build 23.0.2+7, mixed mode, sharing)
```

MacOS Users

Go to

```
https://adoptium.net/temurin/releases/
```

then choose the following options:

- Under **Operating System**, select **macOS**.
- Under **Architecture**, for Macs with Apple silicon (M-series processors), select **aarch64**; otherwise, select **x64** for Intel-processor Macs.
- Under **Package Type**, select **JDK**.
- Under **Version**, select **23** (or higher to use a newer version).

Next, press (or select) the `.pkg` installer button to download the OpenJDK installer. When the download completes, double-click the installer file in your user account's `Downloads` folder. The installer's filename for M-processor Macs will be similar to:

```
OpenJDK23U-jdk_aarch64_mac_hotspot_23.0.2_7.pkg
```

and for Intel-processor Macs will be similar to:

```
OpenJDK23U-jdk_x64_mac_hotspot_23.0.2_7.pkg
```

In the installer dialog:

1. Press (or select) **Continue** to move to the **Software License Agreement** step. You must accept the license agreement to install the software. Once you've read the agreement, press (or select) **Continue**, then press (or select) **Agree** to accept the license terms and proceed to the **Standard Install on "Macintosh HD"** step.
2. Press (or select) **Install** to perform the installation. If you are asked for your system password, enter it and press (or select) **Install Software**.
3. When the installation is complete, press (or select) **Close** in the dialog.

To ensure that Java is installed correctly, in your **Finder**, select the **Go** menu's **Utilities** option, then open **Terminal.app**. In the **Terminal** window, type the command

```
java --version
```

and press (or select) *Enter* or *Return* to execute it. The command's output should be similar to the following:

```
openjdk 23.0.2 2025-01-21
OpenJDK Runtime Environment Temurin-23.0.2+7 (build 23.0.2+7)
OpenJDK 64-Bit Server VM Temurin-23.0.2+7 (build 23.0.2+7, mixed mode, sharing)
```

Java Release Cadence

Java follows a six-month release cadence that began with Java 9 in 2017. New versions are released every March and September, enabling faster delivery of new language and library features. Every two years, a release is designated as a Long-Term Support (LTS) version. These are geared toward enterprises requiring stability and extended support. Non-LTS releases have shorter support cycles, encouraging early adoption of innovations. The latest LTS version is Java 21. The next will be Java 25 (September 2025).

Java Integrated Development Environments (IDEs)

There are many Java integrated development environments (IDEs)—software applications that combine essential tools for software development, such as a code editor, compiler, debugger and other tools to help you build applications. The steps for using each differ, so we use the JDK's command-line tools for most examples. In Chapter 1, we provide a JDK test-drive. On the book's webpage

`https://deitel.com/jhtp12`

we provide the following IDE test-drives:

- JetBrains' IntelliJ IDEA Community Edition,
- the Eclipse Foundation's Eclipse IDE for Java Developers, and
- Microsoft's Visual Studio Code cross-platform code editor—this tool has plugins for Java development.

These IDEs have the most significant market shares in the Java development community. Each is available for Windows, macOS and Linux. **Before installing any of the tools we discuss below, install the OpenJDK as described in the previous section.**

IntelliJ IDEA Community Edition

The recommended way to install the IntelliJ IDEA Community Edition IDE is via the JetBrains **Toolbox** app, which you can download from:

`https://jetbrains.com/toolbox-app/`

The site will recognize your operating system and provide a **Download** button for the appropriate installer. Press (or select) **Download**. When the download completes, double-click the installer file in your `Downloads` folder and follow the on-screen prompts to install the **Toolbox** app. Next, press (or select) the **Toolbox** app icon to open its window:

- macOS users will find the **Toolbox** app icon  at the top-right of the screen.
- Windows users will find the **Toolbox** app icon  in the task tray at the bottom-right of the screen. You may need to press (or select) the small upward-pointing arrow to see all the task tray icons.

In the **Toolbox** window, scroll to **IntelliJ IDEA Community Edition** and press (or select) its **Install** button.

Eclipse IDE for Java Developers

The Eclipse Foundation provides step-by-step Eclipse IDE installation instructions at

```
https://eclipse.org/downloads/packages/installer
```

In Step 3, choose the **Eclipse IDE for Java Developers**, then follow the remaining instructions to complete the installation.

Visual Studio Code

Microsoft provides step-by-step Visual Studio Code download and install instructions for Windows users at:

```
https://code.visualstudio.com/docs/setup/windows
```

and for macOS users at:

```
https://code.visualstudio.com/docs/setup/mac
```

After installing Visual Studio Code, follow Microsoft's step-by-step instructions for getting started with Java at:

```
https://code.visualstudio.com/docs/java/java-tutorial
```

JavaFX Software Development Kit (SDK)

In Chapters 15–17, you'll build graphical user interface (GUI), graphics and multimedia apps using JavaFX, which must be installed separately from the JDK. JavaFX is developed in parallel with the JDK by a consortium of companies and individuals, including Oracle, which oversees Java's development. A new JavaFX version is released in parallel with each new Java version.

Download the JavaFX SDK

To work with JavaFX, you must first install the JavaFX Software Development Kit (SDK), which is available from:

```
https://gluonhq.com/products/javafx/
```

In the **Downloads** section, choose the following options:

1. Under **JavaFX version**, select the version that matches your JDK version (JavaFX 23.0.2 at the time of this writing).
2. Under **Operating System**, select your operating system.
3. Under **Architecture**, Apple silicon (M-series processor) Mac users should select **aarch64**, and Intel-processor Mac users and Windows users should select **x64**.
4. Under **Package Type**, select **SDK**.

Next, press (or select) the **Download** button to download the SDK for your platform. This places a ZIP file in your `Downloads` folder with a name similar to

```
openjfx-23.0.2_OS-architecture_bin-sdk.zip
```

where *OS* is your operating system and *architecture* is the architecture you selected.

Extract the JavaFX SDK from the ZIP File

Next, extract the ZIP file's contents:

- On macOS, double-click the file to extract its contents. This creates a folder in your `Downloads` folder named `javafx-sdk-23.0.2` (the version number will depend on the precise version you downloaded).
- On Windows, double-click the file, then drag the `javafx-sdk-23.0.2` folder to your `Downloads` folder (the version number will depend on the precise version you downloaded).

To complete the installation, you must set the `PATH_TO_FX` environment variable, as discussed below for Windows and macOS.

Configuring the `PATH_TO_FX` Environment Variable on Windows

Perform the following steps:

1. Enter `environment` in the taskbar's **Search** field.
2. In the search results, select **Edit the system environment variables**.
3. In the **System Properties** dialog, press (or select) the **Environment Variables** button.
4. Under **User variables**, click **New…**.
5. Enter the **Variable name** `PATH_TO_FX`. Then, for the **Variable value**, enter the following, replacing *User* with your user account's folder name and, if necessary, replacing `23.0.2` with your JavaFX version:

   ```
   C:\Users\User\Downloads\javafx-sdk-23.0.2\lib
   ```

6. Press (or select) **OK** to save the environment variable.
7. Press (or select) **OK** in the **System Properties** dialog to close it.

If you have any open Command Prompt or PowerShell windows, you'll need to close and reopen them for the environment variable to take effect.

Configuring the `PATH_TO_FX` Environment Variable on macOS

Perform the following steps:

1. In your **Finder**, select the **Go** menu's **Utilities** option, then open **Terminal.app**.
2. Next, determine your shell executing the command

   ```
   echo $SHELL
   ```

3. If Step 2 displayed `"/bin/zsh"`, execute

   ```
   open -e ~/.zshrc
   ```

   Otherwise, execute

   ```
   open -e ~/.bash_profile
   ```

4. Add the following line to the end of the file, replacing *User* with your user account's folder name and, if necessary, replacing `23.0.2` with the JavaFX version you downloaded:

   ```
   export PATH_TO_FX="/Users/User/Downloads/javafx-sdk-23.0.2/lib"
   ```

   then save and close the file.

Scene Builder

In our JavaFX examples, you'll use the free Scene Builder tool to create graphical user interfaces (GUIs) using drag-and-drop techniques. To download the Scene Builder installer, press (or select) the **Download Now** button at:

```
https://gluonhq.com/labs/scene-builder/
```

Next, press (or select) the **Download** button for your platform. When the download completes, double-click the installer, then follow the on-screen prompts to install Scene Builder.

Generative AIs

As mentioned in the Preface section "Integrated Generative AI," you'll leveraging generative AI (genAI) as you work your way through *Java How to Program: An Objects Natural Approach, 12/e*. At Deitel & Associates, Inc., we use many genAIs, including the following four genAI chatbots:

- OpenAI ChatGPT (`https://chatgpt.com`)
- Google Gemini (`https://gemini.google.com/app`)
- Anthropic Claude (`https://claude.ai`)
- Perplexity (`https://perplexity.ai`)

Registering for Accounts

You can use ChatGPT and Perplexity for free without registering. Google requires you to sign into your Google account to use Gemini's free version. For Claude, you must provide an email address to use the free version, then they'll send you a login link. ChatGPT and Perplexity will remember your past chats only if you register for a free account.

Paid vs. Free Tiers

We use these chatbots' paid versions, but each offers a powerful free tier. However, the free versions are more limited. They generally

- allow fewer queries in a given time period,
- allow shorter queries,
- allow fewer (or disallow) file uploads,
- have slower response times and
- limit or prevent access to their most up-to-date and powerful capabilities.

Using the GenAI Chatbots

We'll suggest hundreds of genAI prompts throughout this book, so you'll use genAI chatbots extensively. When you visit each chatbot, its webpage will provide a box in which you can enter a prompt and submit it to the chatbot. ChatGPT and Gemini also allow you to speak a prompt. To get a sense of each chatbot's capabilities, submit prompts like:

What are your capabilities?
What are the differences between your free and paid tiers?

When you submit a prompt, the chatbot will formulate and present its response. And as a reminder: **Always verify the information genAI chatbots provide.**