

# Software Development

## Lab1: Introduction to programming

### Topics

1. How to Compile and Run a Java program
2. “Hello World!” demo
3. How to Debug a Java program
4. Our first Java programs

Today we use the following tools/software:

- Notepad++
- Command Prompt

We will compile and run the Java programs at the **Command Prompt**, that is we type the commands at the Command Prompt. In order to open the Command Prompt follow either the steps described at A. or B.:

- **A.** click on the *Windows Start Menu* → *All Programs* → *Accessories* → *Command Prompt*

or

- **B.** click on the *Windows Start Menu* → *Run...* → *in the new window type cmd and then press OK*

## 1 How to Compile and Run a Java program

1. How to Compile a Java program
  - (a) A java program is compiled using the Java programming language compiler **javac**  

```
javac <ProgramName>.java
```

e.g. at the Command Prompt we will type `javac FirstProgram.java`

- (b) In order to compile a Java program we have to be located in the folder which contains the program. Last time we created a *folder* called **swd** in your student drive. (How to create a folder: to create a folder you have to be positioned at the location where you would like to create that folder, then *right-click a blank area at that location*, then click **New**, and then click **Folder**; now type the name of the new folder (e.g. swd in our example), and then press **Enter**.)
- (c) At the Command Prompt we use the command **cd** (i.e. change directory) to modify the current location to point to the *swd* folder. **Note** that the current directory might be in a different disk drive than your student drive. In such a case, we have first to change to the correct drive. [Figure 1](#) shows an example where we are located on **C:** drive. Now, let's assume that we created the *swd* folder on the *W:* drive. In order to change to the *W:* drive we have to type at the Command Prompt **W:** and then press Enter. **Note** If your student drive it's labeled with another letter you have to type that letter (e.g. *H:*). [Figure 2](#) and [Figure 3](#) show an example of how to change the current location to point to *W:*.
- (d) We assume that you created the swd folder directly in your student drive and you saved the program *FirstProgram.java* in the swd folder.
- (e) At the command prompt we can use the command **dir** to display to content of a directory/folder. Type at the command prompt the command **dir** and press Enter; you should see the folder **swd**. [Figure 4](#) shows an example of listing the content of the current directory.
- (f) We saved the *FirstProgram.java* file in the folder *swd*. In order to compile the program we have to be located in the *swd* folder. At the command prompt type **cd swd** and then press Enter. Now the current folder is *swd* as shown in [Figure 5](#). Just to double check that you have saved the file in the *swd* folder you can use again the command **dir** to display the content of that folder. You should see there the file *FirstProgram.java* as seen in the [Figure 6](#).
- (g) We can now proceed to compile the Java program. At the com-

mand prompt type `javac FirstProgram.java` and then press Enter (see [Figure 7](#)). Note: if you get a message saying that: *“javac” is not recognized as an internal or external command...* please see [section 4](#) which shows how to identify which javac command to use. Please note that you have Java installed on your machine, but the Windows environment variable PATH does not point to the location where the Java is installed on your computer, and that’s why the *javac* command is not recognized by the Command Prompt.

- (h) The Java compiler has compiled our program and generated a new file, *FirstProgram.class* in this instance, which contains the bytecode corresponding to the Java program. We can use again the `dir` command to see the new file as depicted in the [Figure 8](#).
- (i) Now we can run the java program by using the `java` command. Please note that java executes the code contained in the compiled class (i.e. the .class file) and not the .java file! **Therefore, each time you modify your program you have to save the .java file, compile the .java file, and run the program!**

```
java <ProgramName>
```

- (j) At the command prompt type `java FirstProgram` and then press Enter. What do you observe? You should see the same result as shown in [Figure 9](#).

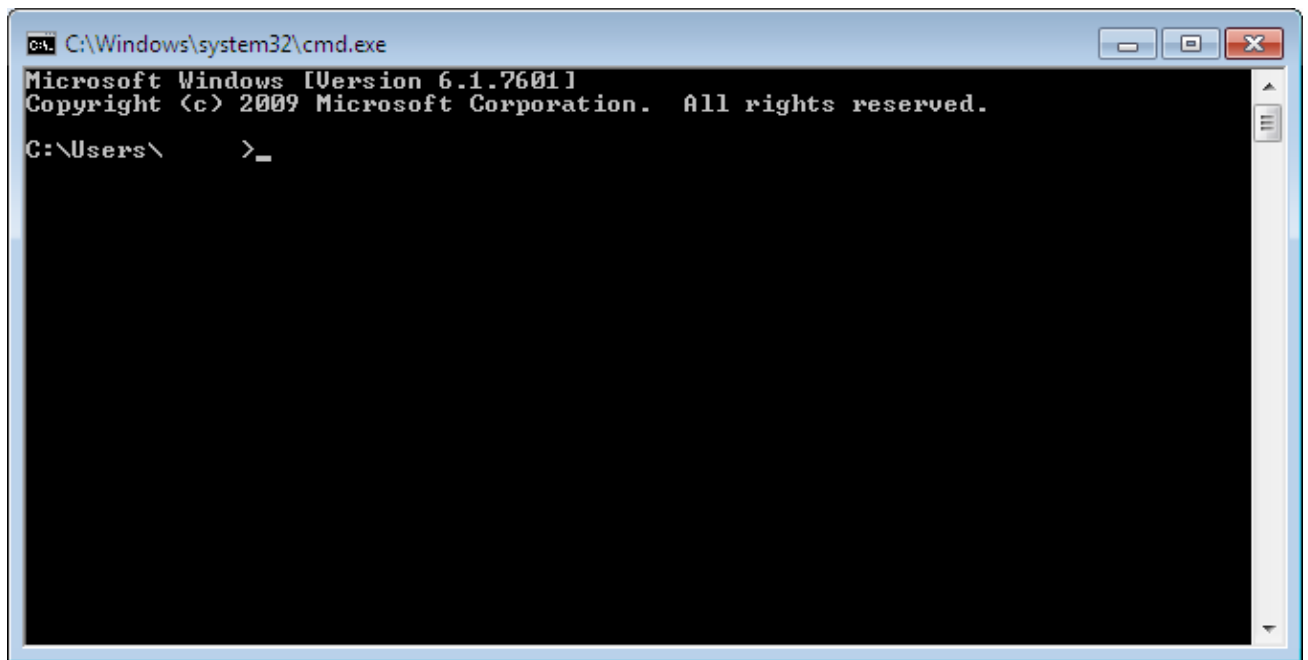


Figure 1: How to Compile and Run a Java Program

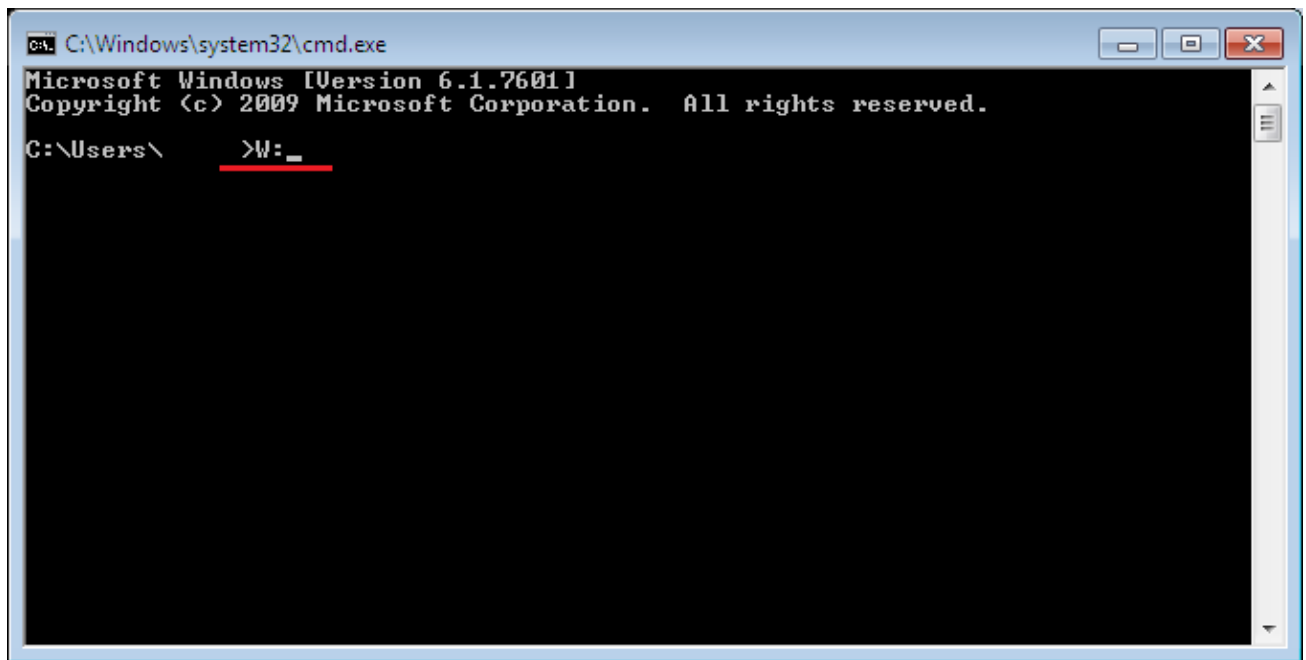


Figure 2: How to Compile and Run a Java Program

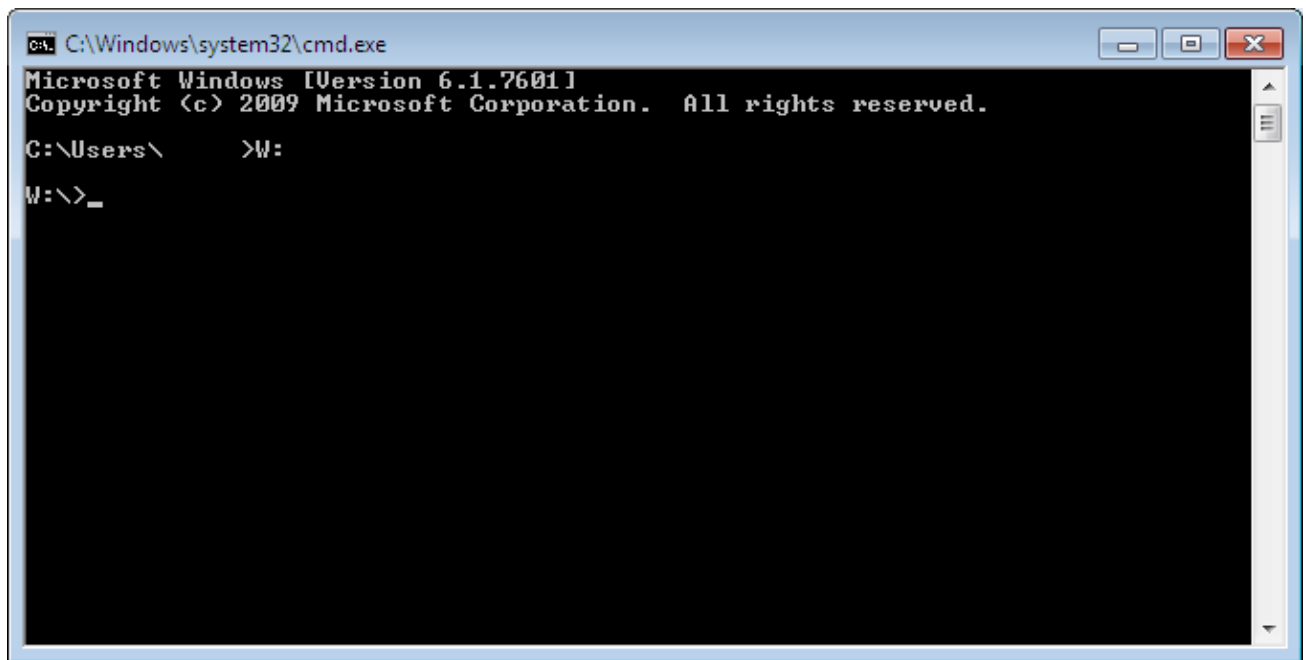
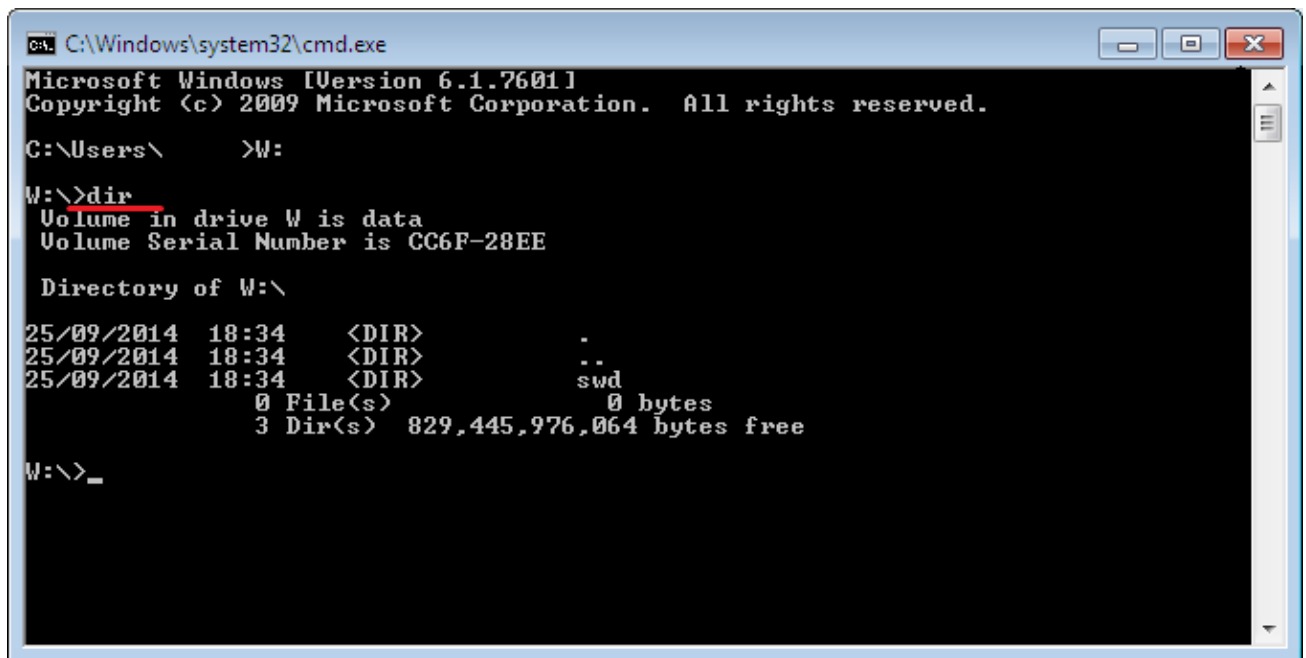


Figure 3: How to Compile and Run a Java Program



A screenshot of a Windows Command Prompt window. The title bar shows the path 'C:\Windows\system32\cmd.exe'. The window contains the following text:

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\      >W:

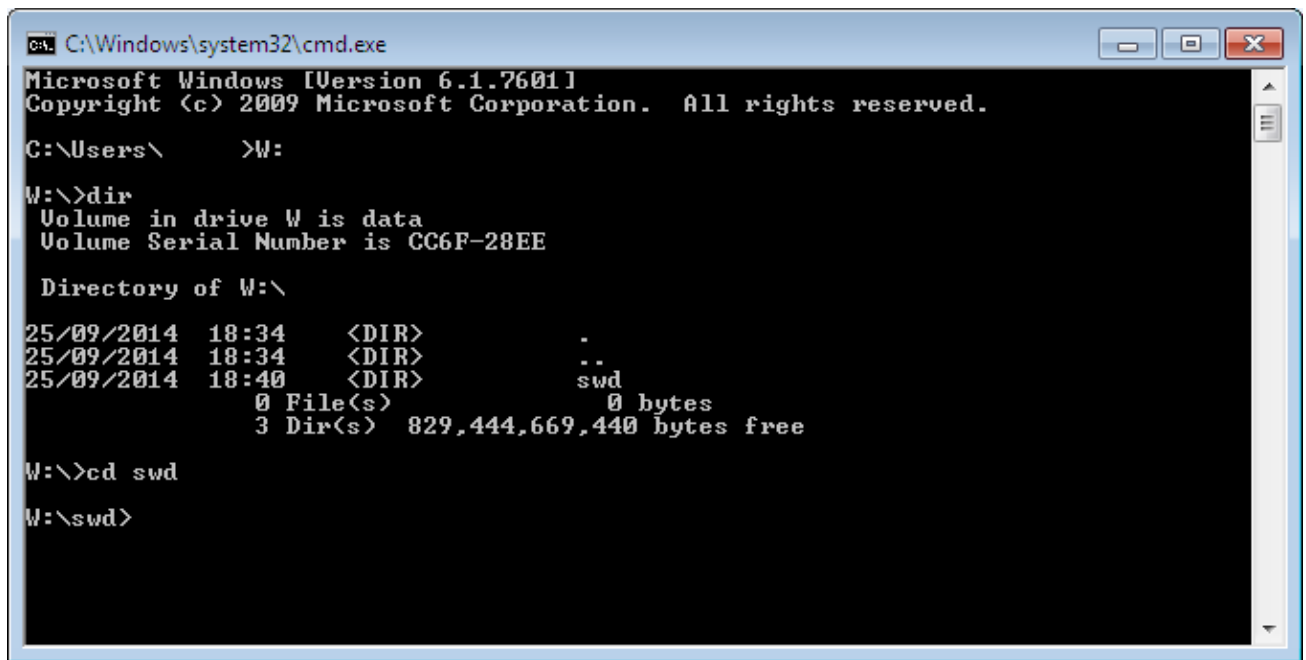
W:\>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\

25/09/2014  18:34    <DIR>          .
25/09/2014  18:34    <DIR>          ..
25/09/2014  18:34    <DIR>          swd
               0 File(s)              0 bytes
               3 Dir(s)  829,445,976,064 bytes free

W:\>_
```

Figure 4: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\>W:

W:\>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

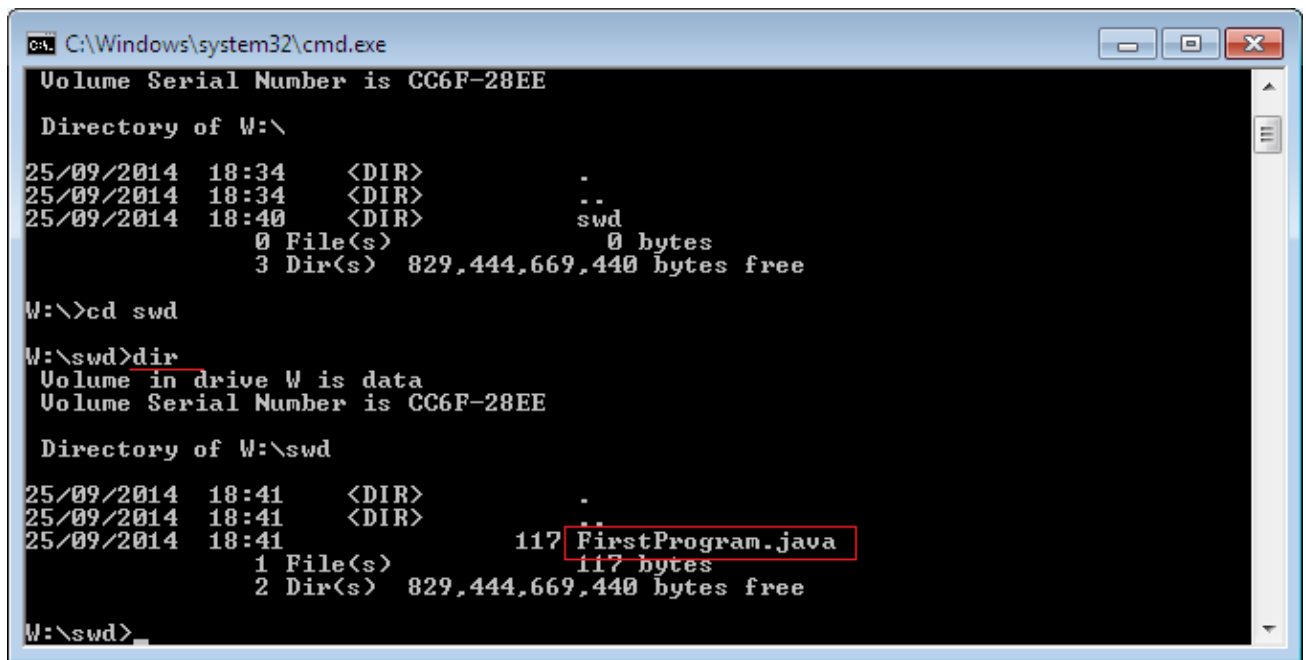
Directory of W:\

25/09/2014  18:34    <DIR>          .
25/09/2014  18:34    <DIR>          ..
25/09/2014  18:40    <DIR>          swd
               0 File(s)              0 bytes
               3 Dir(s)  829,444,669,440 bytes free

W:\>cd swd
W:\swd>
```

Figure 5: How to Compile and Run a Java Program





```
C:\Windows\system32\cmd.exe
Volume Serial Number is CC6F-28EE

Directory of W:\

25/09/2014  18:34    <DIR>          .
25/09/2014  18:34    <DIR>          ..
25/09/2014  18:40    <DIR>          swd
               0 File(s)                0 bytes
               3 Dir(s)  829,444,669,440 bytes free

W:\>cd swd

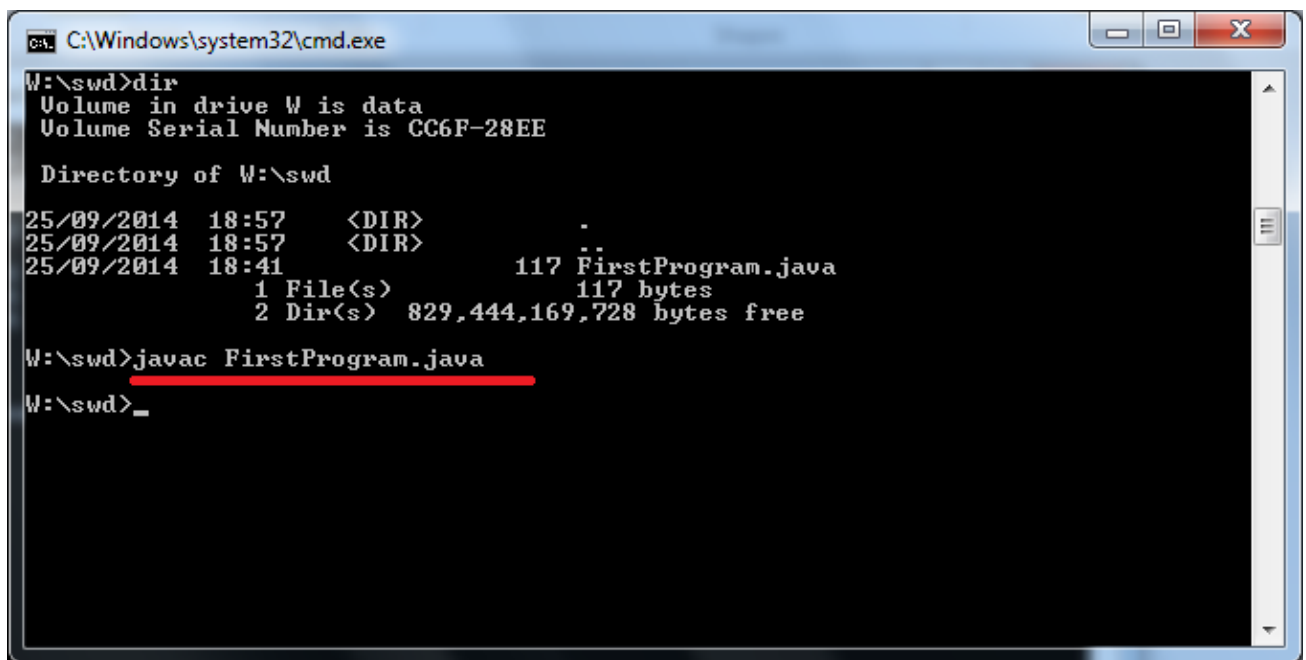
W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd

25/09/2014  18:41    <DIR>          .
25/09/2014  18:41    <DIR>          ..
25/09/2014  18:41                117 FirstProgram.java
               1 File(s)             117 bytes
               2 Dir(s)  829,444,669,440 bytes free

W:\swd>
```

Figure 6: How to Compile and Run a Java Program



The image shows a Windows command prompt window titled "C:\Windows\system32\cmd.exe". The prompt is at "W:\swd>". The user has entered the command "dir", which has produced the following output:

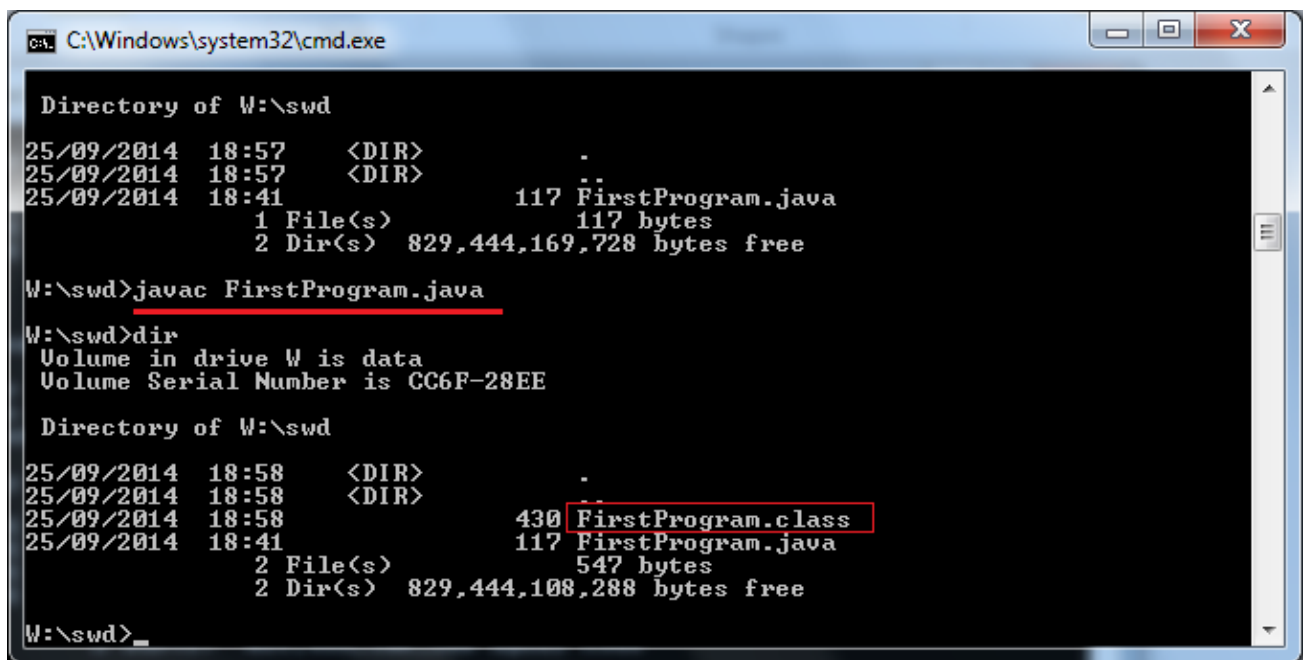
```
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd

25/09/2014  18:57    <DIR>          .
25/09/2014  18:57    <DIR>          ..
25/09/2014  18:41                117 FirstProgram.java
               1 File(s)                117 bytes
               2 Dir(s)  829,444,169,728 bytes free
```

The user then enters the command "javac FirstProgram.java". The command is underlined with a red line. The prompt returns to "W:\swd>".

Figure 7: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe

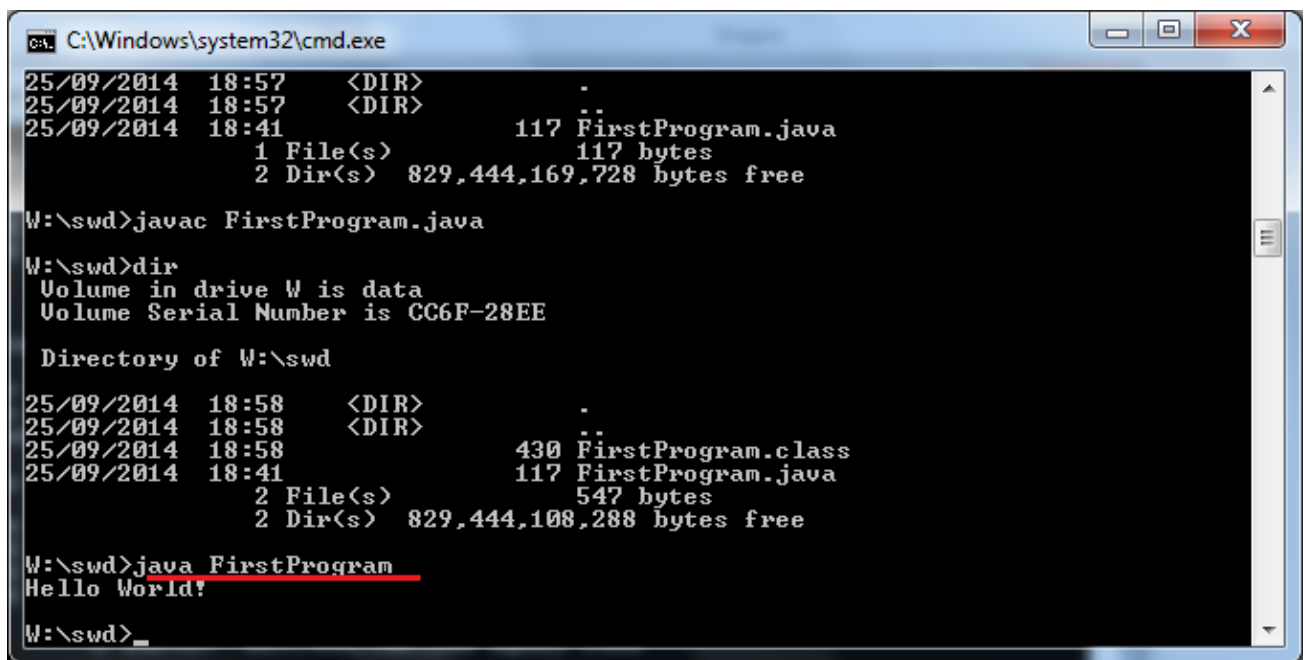
Directory of W:\swd
25/09/2014  18:57    <DIR>          .
25/09/2014  18:57    <DIR>          ..
25/09/2014  18:41                117 FirstProgram.java
               1 File(s)                117 bytes
               2 Dir(s)  829,444,169,728 bytes free

W:\swd>javac FirstProgram.java
W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd
25/09/2014  18:58    <DIR>          .
25/09/2014  18:58    <DIR>          ..
25/09/2014  18:58                430 FirstProgram.class
25/09/2014  18:41                117 FirstProgram.java
               2 File(s)                547 bytes
               2 Dir(s)  829,444,108,288 bytes free

W:\swd>
```

Figure 8: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe
25/09/2014 18:57 <DIR> .
25/09/2014 18:57 <DIR> ..
25/09/2014 18:41      117 FirstProgram.java
                1 File(s)      117 bytes
                2 Dir(s)  829,444,169,728 bytes free

W:\swd>javac FirstProgram.java

W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd

25/09/2014 18:58 <DIR> .
25/09/2014 18:58 <DIR> ..
25/09/2014 18:58      430 FirstProgram.class
25/09/2014 18:41      117 FirstProgram.java
                2 File(s)      547 bytes
                2 Dir(s)  829,444,108,288 bytes free

W:\swd>java FirstProgram
Hello World!

W:\swd>_
```

Figure 9: How to Compile and Run a Java Program

## 2 How to Debug a Java program

Using the demo on how to debug a Java program shown during class debug the programs from the Debug folder. Download the files from the Debug folder, compile them, try to solve the issues, compile them again, and run the programs.

## 3 Our first Java programs

### Problem 1.

Write, compile and test a program that displays vertically the text "Hello John!".

```
H
e
l
l
o

J
o
h
n
!
```

### Problem 2.

Write, compile and test a program that displays the following pattern on screen:

```
  *
 * *
* * *
 * *
  *
```

Save the program as Diamond.java

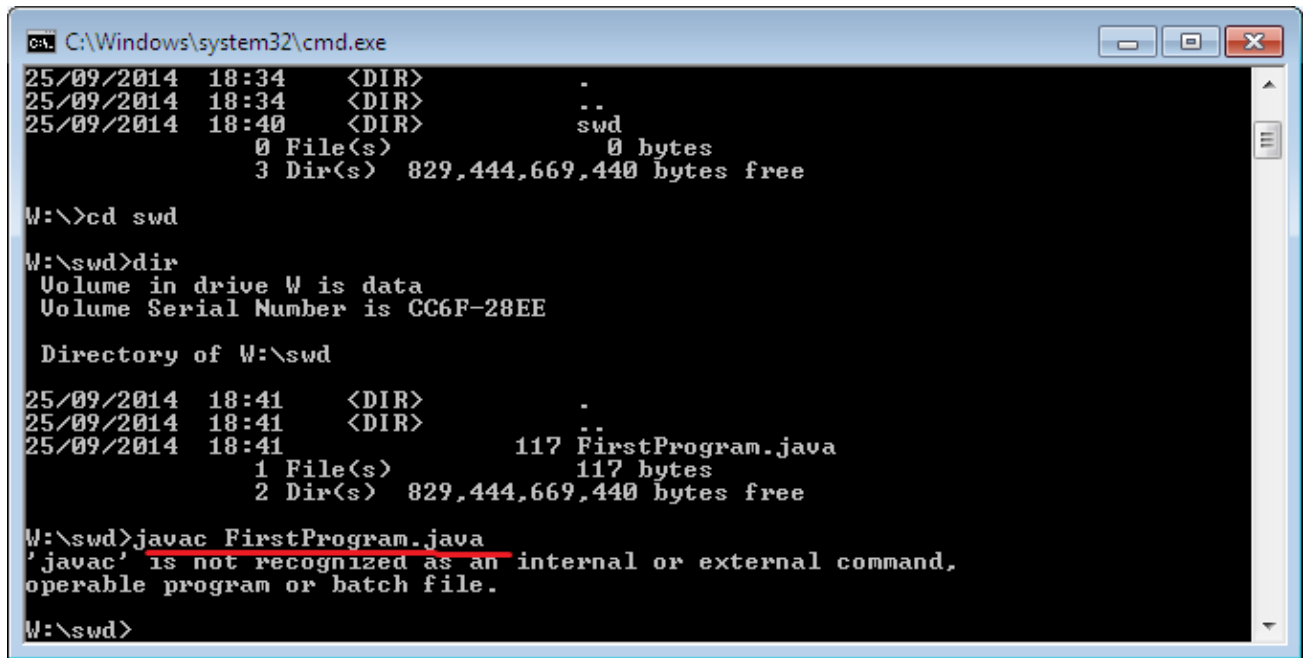
**Problem 3.**

Write, compile and test a program that uses the command window to display the following statement about comments:

”Program comments are nonexecuting statements you add to a file for the purpose of documentation”

Also include the same statement in two different comments in the class; each comment should use a different method of including comments in a java class.

Save the program as Comments.java



```
C:\Windows\system32\cmd.exe
25/09/2014 18:34 <DIR> .
25/09/2014 18:34 <DIR> ..
25/09/2014 18:40 <DIR> swd
0 File(s) 0 bytes
3 Dir(s) 829,444,669,440 bytes free

W:\>cd swd

W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd
25/09/2014 18:41 <DIR> .
25/09/2014 18:41 <DIR> ..
25/09/2014 18:41 117 FirstProgram.java
1 File(s) 117 bytes
2 Dir(s) 829,444,669,440 bytes free

W:\swd>javac FirstProgram.java
'javac' is not recognized as an internal or external command,
operable program or batch file.

W:\swd>
```

Figure 10: How to Compile and Run a Java Program

#### 4 How to compile a java program when you get the message: "javac" is not recognized as an internal or external command...

##### Resources

- Microsoft Command-line reference <http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/ntcmds.msp?mfr=true>

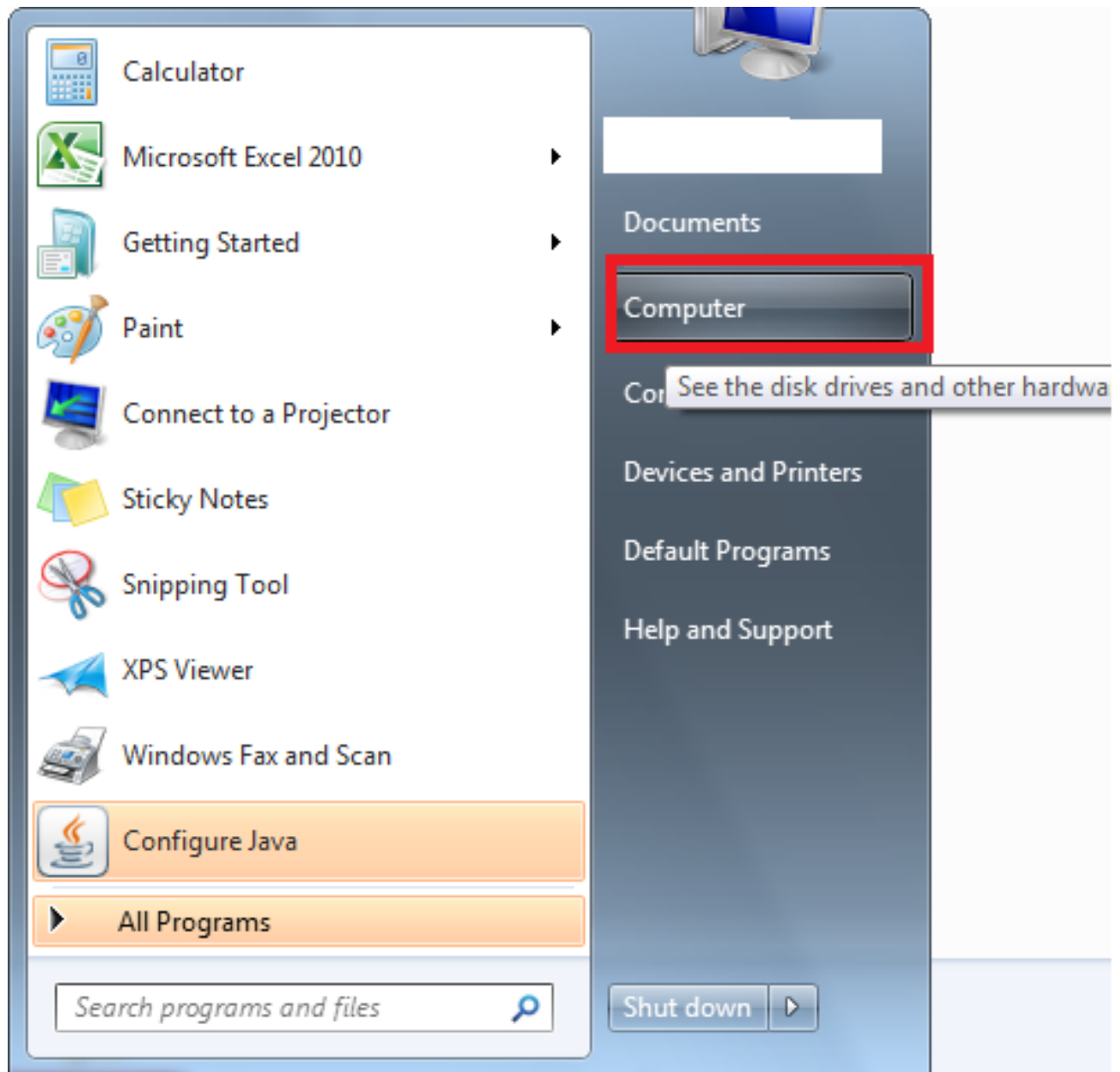


Figure 11: How to find the JDK installed on your machine



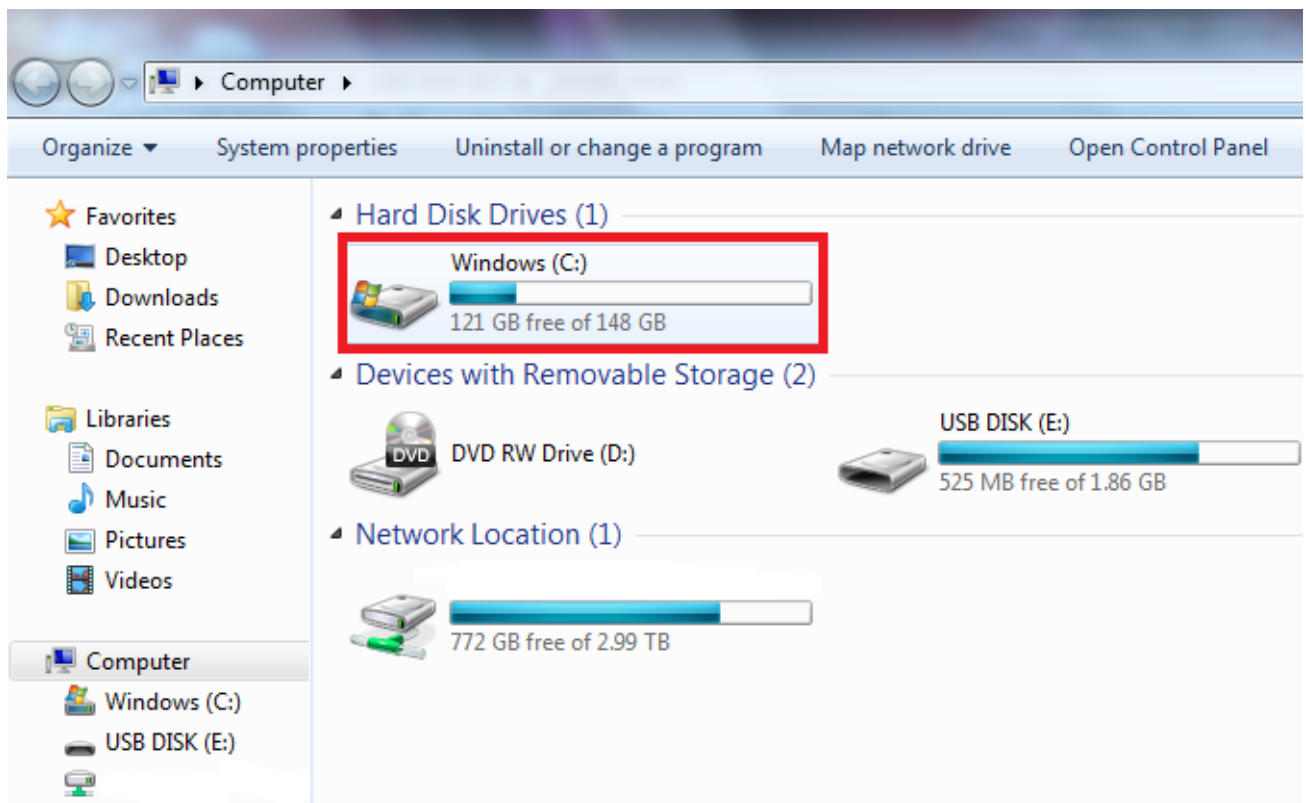


Figure 12: How to find the JDK installed on your machine

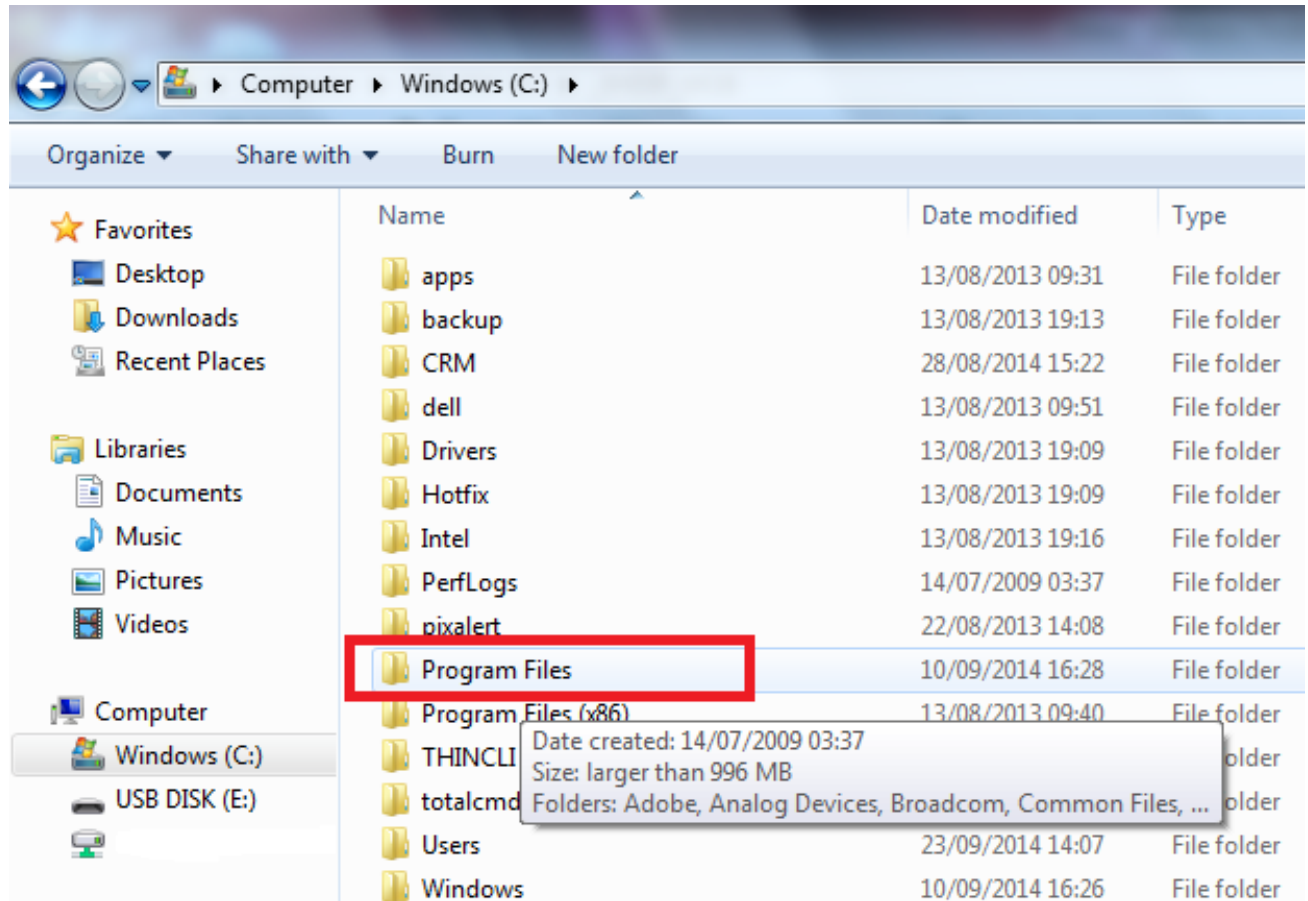


Figure 13: How to find the JDK installed on your machine

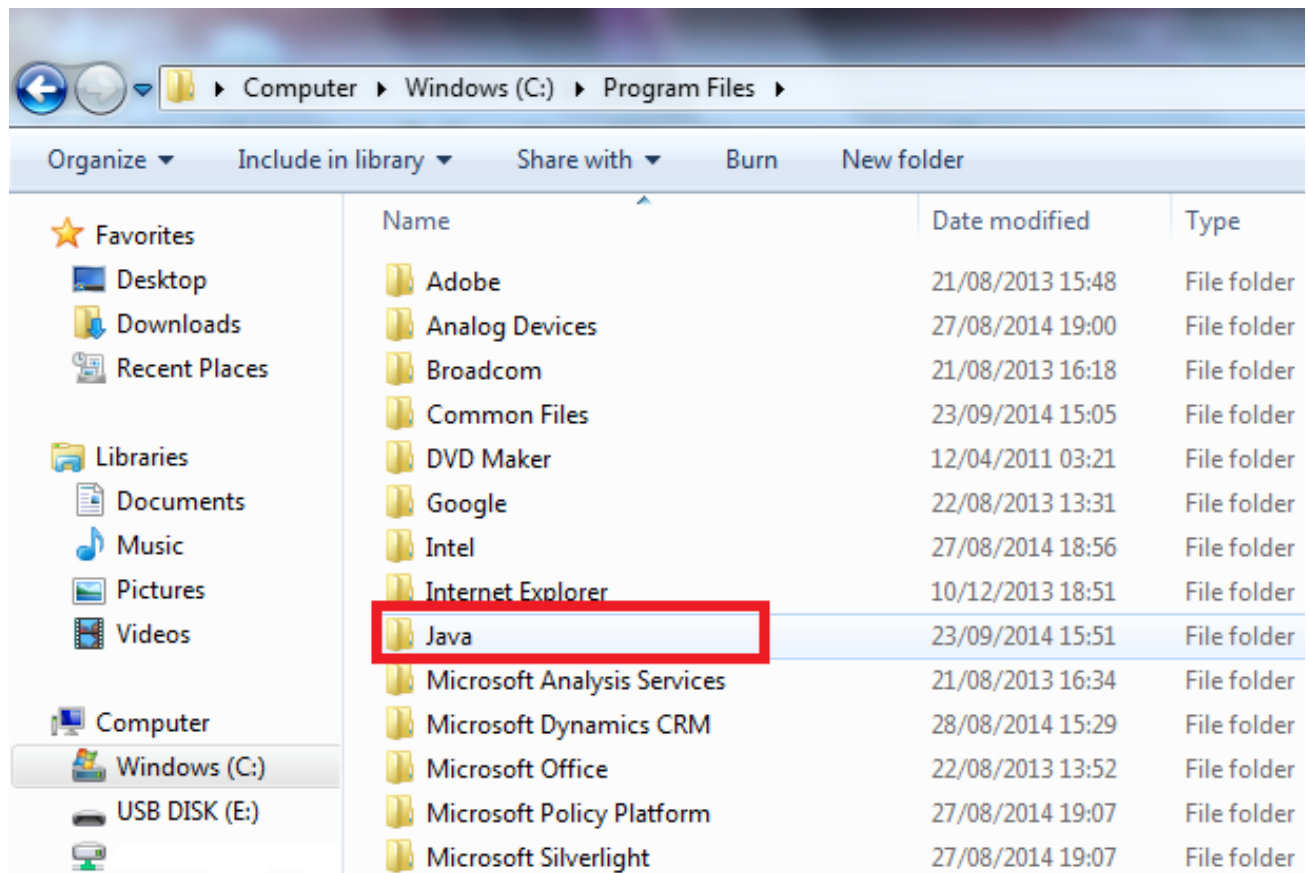


Figure 14: How to find the JDK installed on your machine

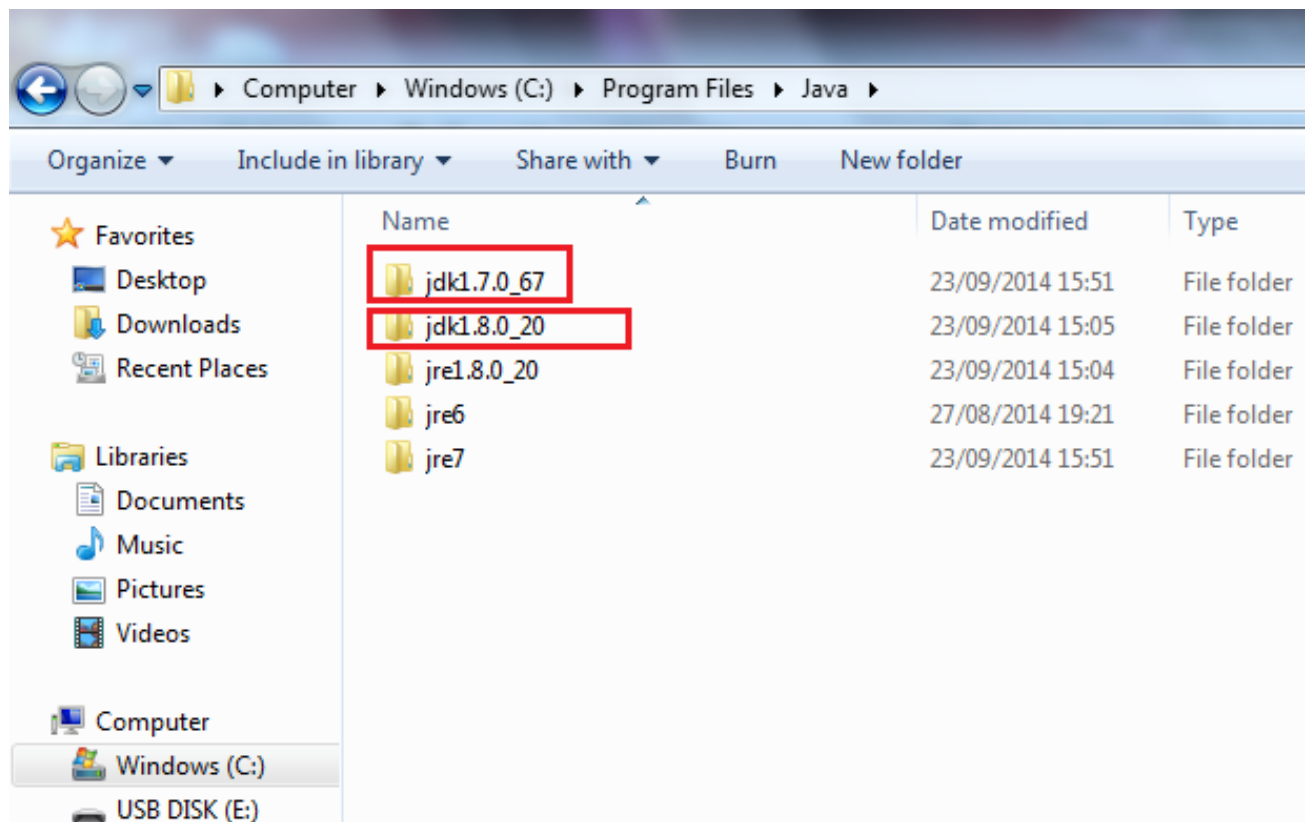


Figure 15: How to find the JDK installed on your machine

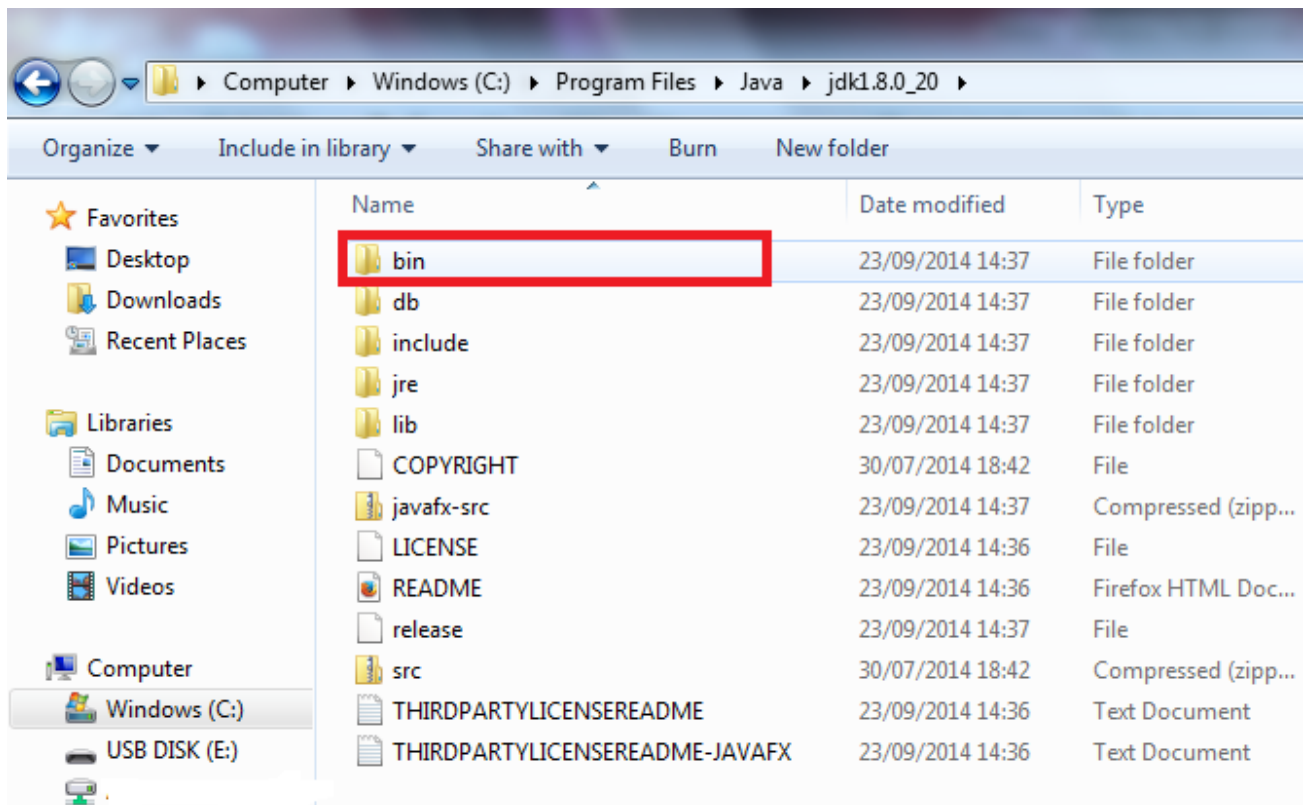


Figure 16: How to find the JDK installed on your machine

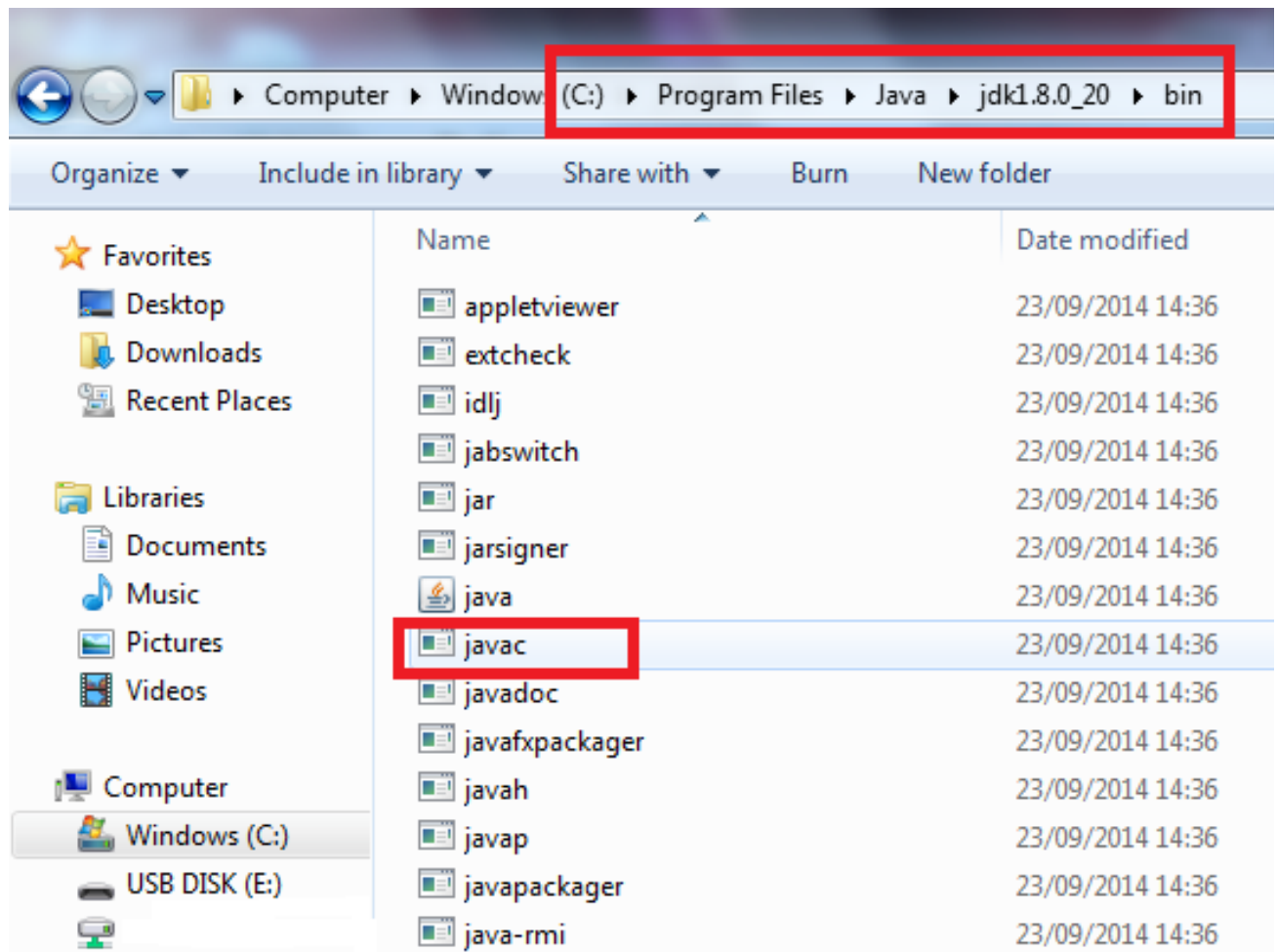
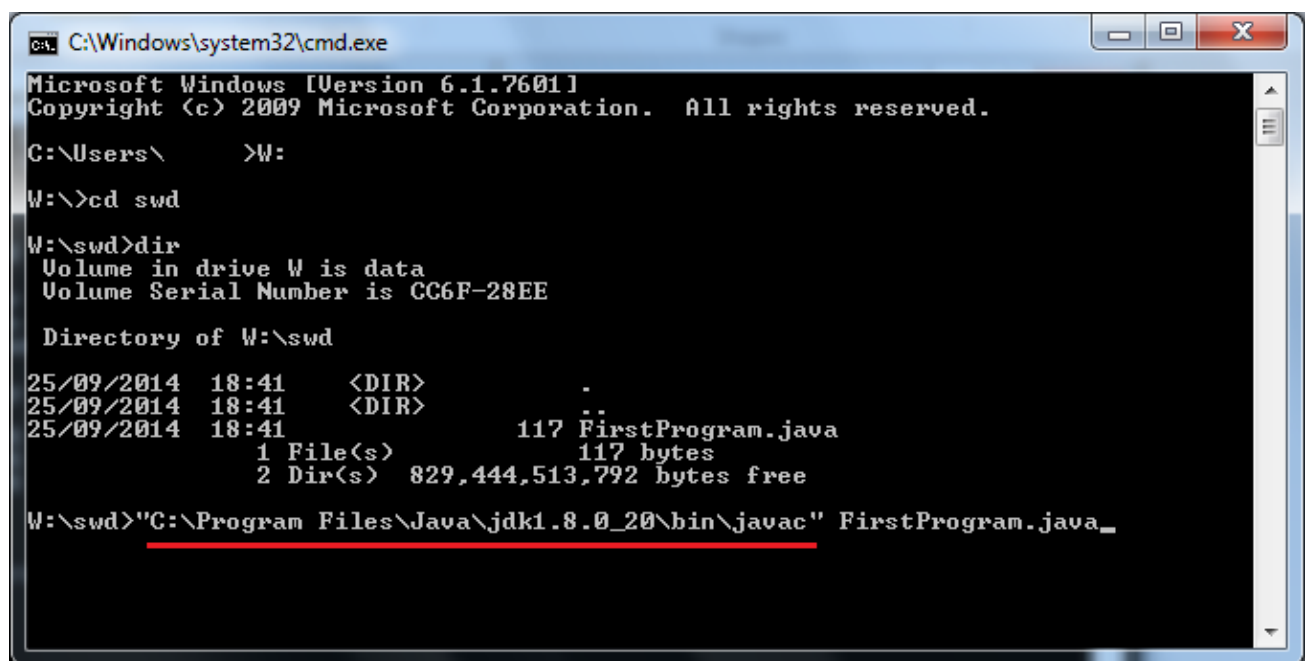


Figure 17: How to find the JDK installed on your machine



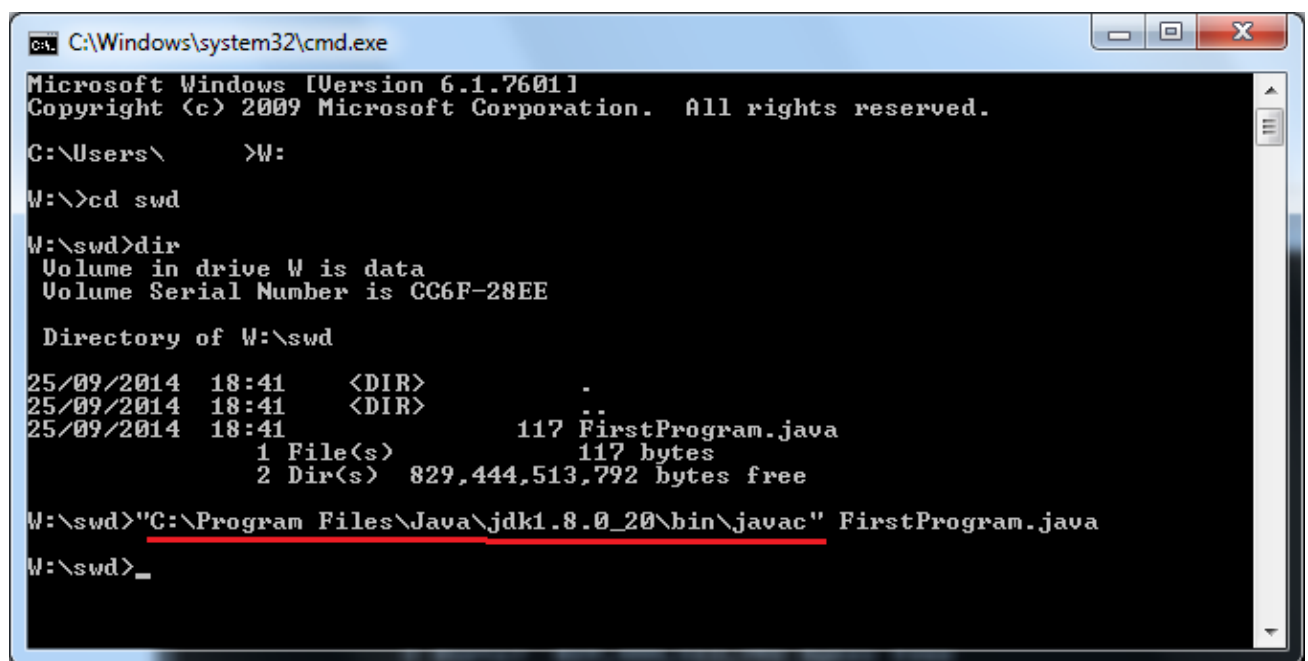
```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\ >W:
W:\>cd swd
W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd
25/09/2014 18:41 <DIR> .
25/09/2014 18:41 <DIR> ..
25/09/2014 18:41 117 FirstProgram.java
                  1 File(s) 117 bytes
                  2 Dir(s) 829,444,513,792 bytes free

W:\swd>"C:\Program Files\Java\jdk1.8.0_20\bin\javac" FirstProgram.java_
```

Figure 18: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

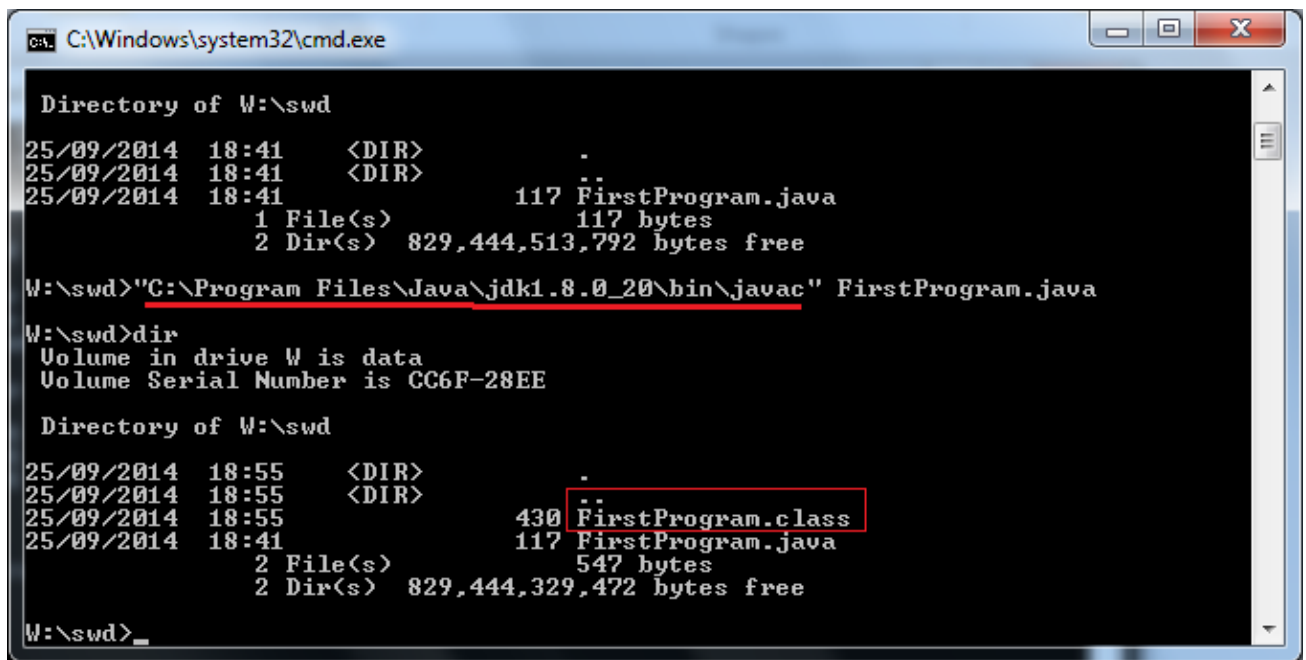
C:\Users\ >W:
W:\>cd swd
W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd
25/09/2014 18:41 <DIR> .
25/09/2014 18:41 <DIR> ..
25/09/2014 18:41 117 FirstProgram.java
                  1 File(s) 117 bytes
                  2 Dir(s) 829,444,513,792 bytes free

W:\swd>"C:\Program Files\Java\jdk1.8.0_20\bin\javac" FirstProgram.java
W:\swd>_
```

Figure 19: How to Compile and Run a Java Program





The screenshot shows a Windows command prompt window titled "C:\Windows\system32\cmd.exe". The user is in the directory "W:\swd". The first command is "dir", which lists the contents of the directory. The output shows a directory listing for "W:\swd" with the following details:

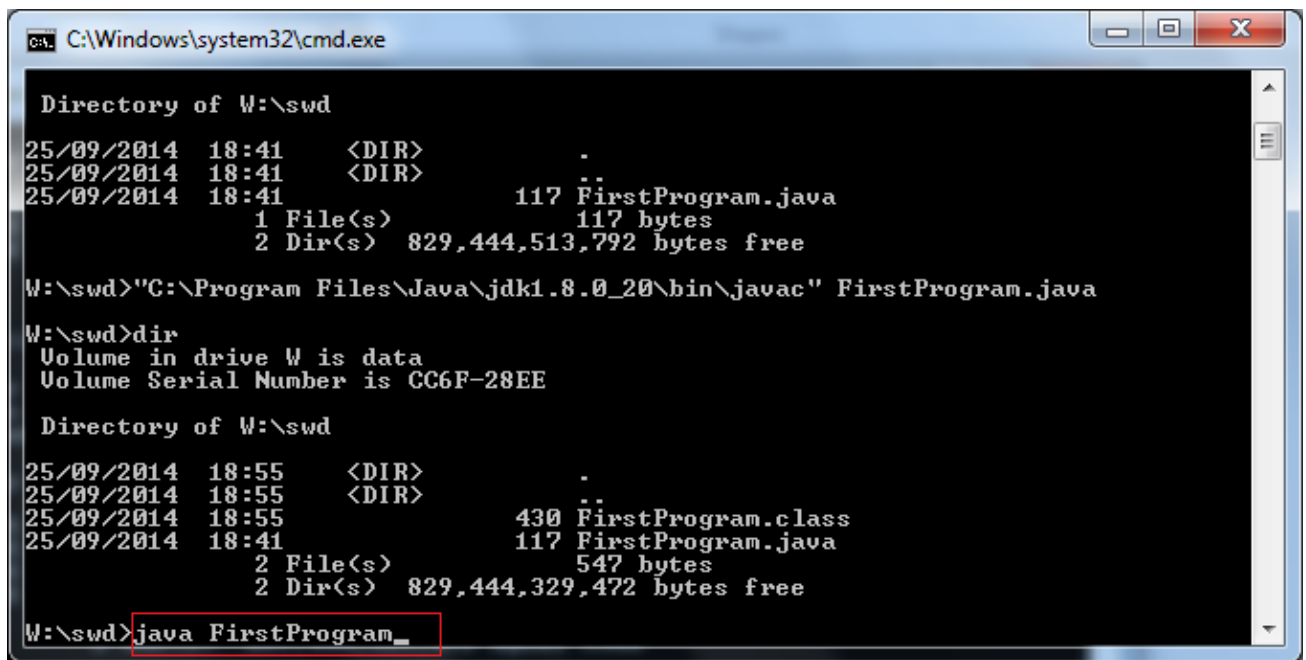
Date	Time	Type	Name	Size
25/09/2014	18:41	<DIR>	.	
25/09/2014	18:41	<DIR>	..	
25/09/2014	18:41	File(s)	FirstProgram.java	117 bytes
				2 Dir(s) 829,444,513,792 bytes free

The user then enters the command "C:\Program Files\Java\jdk1.8.0\_20\bin\javac" FirstProgram.java". The prompt changes to "W:\swd>". The user then enters "dir", and the output shows the directory listing after compilation:

Date	Time	Type	Name	Size
25/09/2014	18:55	<DIR>	.	
25/09/2014	18:55	<DIR>	..	
25/09/2014	18:55	File(s)	FirstProgram.class	430 bytes
25/09/2014	18:41	File(s)	FirstProgram.java	117 bytes
				2 Dir(s) 829,444,329,472 bytes free

The prompt is now "W:\swd>".

Figure 20: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe

Directory of W:\swd
25/09/2014  18:41    <DIR>          .
25/09/2014  18:41    <DIR>          ..
25/09/2014  18:41                117 FirstProgram.java
                1 File(s)                117 bytes
                2 Dir(s)  829,444,513,792 bytes free

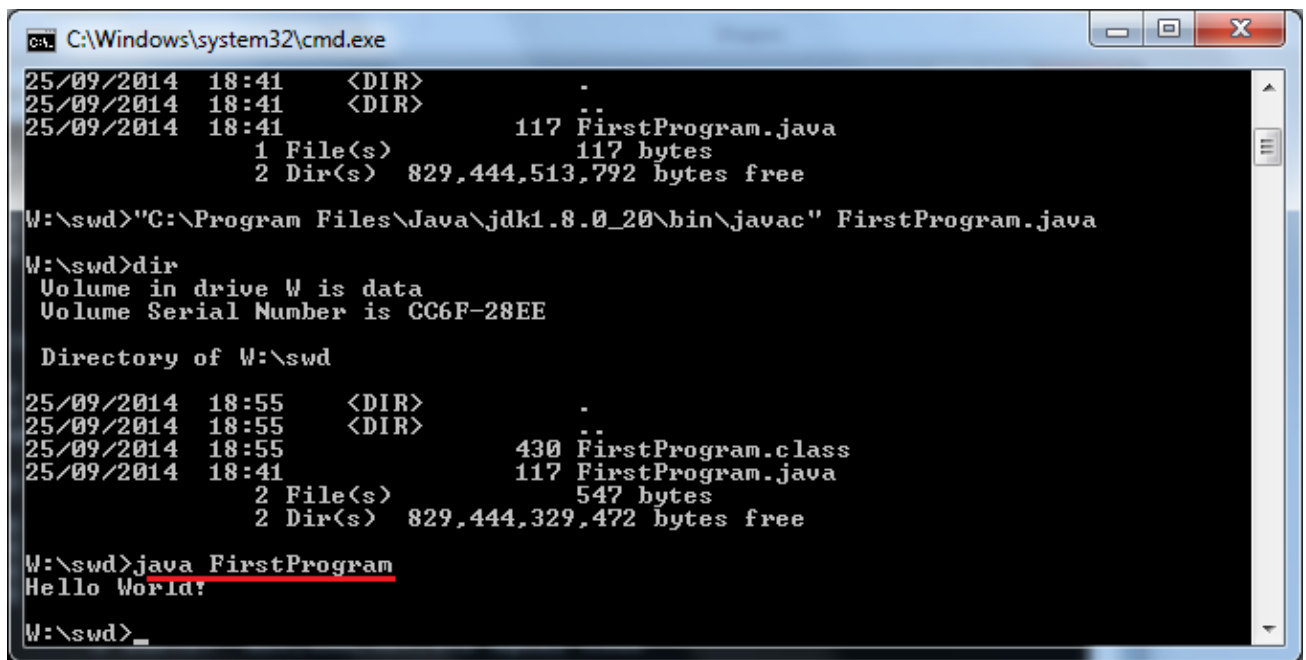
W:\swd>"C:\Program Files\Java\jdk1.8.0_20\bin\javac" FirstProgram.java

W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd
25/09/2014  18:55    <DIR>          .
25/09/2014  18:55    <DIR>          ..
25/09/2014  18:55                430 FirstProgram.class
25/09/2014  18:41                117 FirstProgram.java
                2 File(s)                547 bytes
                2 Dir(s)  829,444,329,472 bytes free

W:\swd>java FirstProgram_
```

Figure 21: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe
25/09/2014 18:41 <DIR> .
25/09/2014 18:41 <DIR> ..
25/09/2014 18:41      117 FirstProgram.java
                1 File(s)      117 bytes
                2 Dir(s)  829,444,513,792 bytes free

W:\swd>"C:\Program Files\Java\jdk1.8.0_20\bin\javac" FirstProgram.java

W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

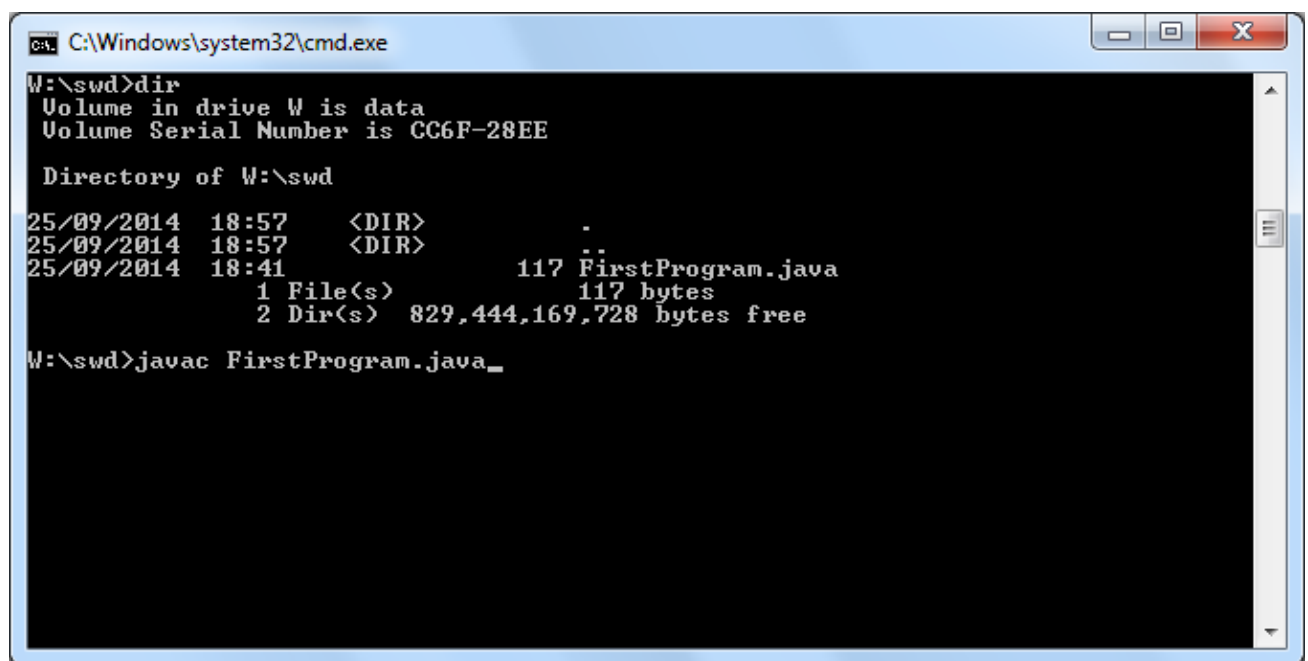
Directory of W:\swd

25/09/2014 18:55 <DIR> .
25/09/2014 18:55 <DIR> ..
25/09/2014 18:55    430 FirstProgram.class
25/09/2014 18:41    117 FirstProgram.java
                2 File(s)      547 bytes
                2 Dir(s)  829,444,329,472 bytes free

W:\swd>java FirstProgram
Hello World!

W:\swd>_
```

Figure 22: How to Compile and Run a Java Program



A screenshot of a Windows command prompt window titled "C:\Windows\system32\cmd.exe". The window has a blue title bar and standard Windows window controls (minimize, maximize, close) on the right. The command prompt shows the following text:

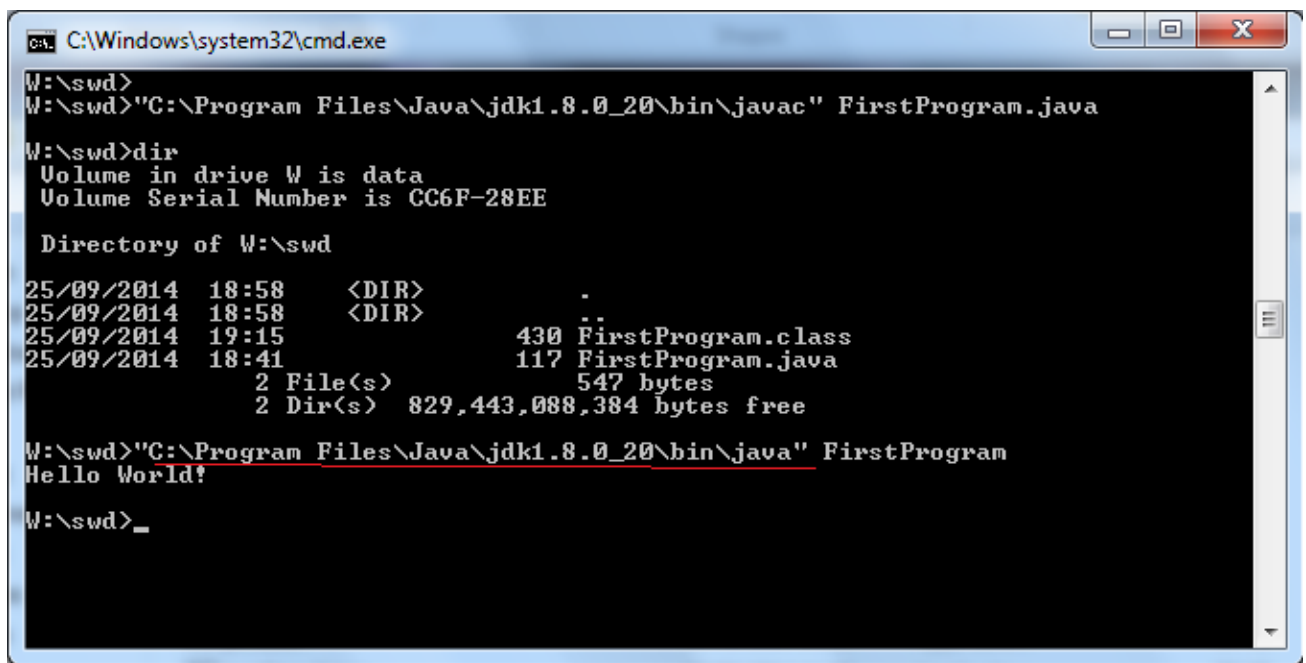
```
W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd

25/09/2014  18:57    <DIR>          .
25/09/2014  18:57    <DIR>          ..
25/09/2014  18:41                117 FirstProgram.java
                1 File(s)                117 bytes
                2 Dir(s)  829,444,169,728 bytes free

W:\swd>javac FirstProgram.java_
```

Figure 23: How to Compile and Run a Java Program



```
C:\Windows\system32\cmd.exe
W:\swd>
W:\swd>"C:\Program Files\Java\jdk1.8.0_20\bin\javac" FirstProgram.java
W:\swd>dir
Volume in drive W is data
Volume Serial Number is CC6F-28EE

Directory of W:\swd
25/09/2014  18:58      <DIR>          .
25/09/2014  18:58      <DIR>          ..
25/09/2014  19:15                430 FirstProgram.class
25/09/2014  18:41                117 FirstProgram.java
                2 File(s)              547 bytes
                2 Dir(s)  829,443,088,384 bytes free

W:\swd>"C:\Program Files\Java\jdk1.8.0_20\bin\java" FirstProgram
Hello World!
W:\swd>_
```

Figure 24: How to Compile and Run a Java Program