Object-Oriented Programming with Java

Assoc. Prof. Dr. Marenglen Biba

(C) 2010 Pearson Education, Inc. All rights reserved.

General Info

- Course: Object-Oriented Programming with Java
- Instructor : Assoc. Prof. Dr. Marenglen Biba
 Office : Faculty building 2nd floor
- Office Hours
- Phone
- E-mail
- Course page

- : by appointment
- : ext. 346
- : marenglenbiba@unyt.edu.al
- http://www.marenglenbiba.net/foundprog-java/
- Course Location and Time: LAB3, Thu. 17.30–21.30

Course Description

- This course introduces object-oriented programming.
- This course introduces Java language and architecture.
- Students will learn how to program in Java and use some of its most important APIs.
- Special importance will be assigned to the Object– Oriented nature of Java and its use of polymorphism.

Course Outcomes

At the end of the course the student will be able to:

- use Java programming language in object-oriented program design
- understand the Java architecture and use the Java APIs
- understand and use inheritance and polymorphism as implemented in Java
- understand and use the exception handling mechanism of Java
- perform standard input-output operations

Required Readings

- Java: How to Program. 9th ed. by Deitel & Deitel, (required)
- Thinking in Java. 4th ed. by Bruce Eckel, Pearson Education. (recommended)

Course Content

- Introduction
- Classes and Objects
- Control Statements
- Arrays and Enumerations
- Inheritance
- Polymorphism
- Collections
- Standard I/O

Grading Policy

Exam (Theory + Lab) 100%

Technology Expectations

- Internet use is necessary since students should regularly check the course home page
- Continued and regular use of e-mail is expected
 - In all your communications please use:
 - Foundation course: Student Name Surname
 - In all you communications regarding assignments
 - Foundation Assignment Number: Student Name Surname
- Students must keep copies of all assignments and projects sent by e-mail.



Contacts

How do you contact me?

- Email
- In some urgent cases by phone

How do I contact you?

- Email
- In some urgent cases by phone
- I do not have your emails yet!
 - Very soon you will have a UNYT e-mail account

Before we start: Oracle Academy

- Sun Microsystems has become part of Oracle
- UNYT Computer Science Department is an Oracle Academy.

Lesson 1 Introduction

(C) 2010 Pearson Education, Inc. All rights reserved.

Outline

Theory Session

- Introduction to Java
- Machine Languages, Assembly Languages and High-Level Languages
- Java Class Libraries
- Typical Java Development Environment

Lab Session

- Configuration of environment variables for Java programmes
- Development with text editor and compilation with javac
- Execution with the java command
- Development of Java programs in Netbeans

Introduction

- The core of the course emphasizes achieving program clarity through the proven techniques of object-oriented programming.
- We will follow a live-code approach Java features presented in complete working Java programs.
- Java is one of today's most popular languages for developing software.

Structured and OO Programming

- Over the years, many programmers learned structured programming.
- You'll learn structured programming and objectoriented programming — the key programming methodology used by programmers today.
- You'll create and work with many software objects.
 Their internal structure is often built using structured-programming techniques.

Java Editions

- This course is based on Java Standard Edition (Java SE)
 - The current version is JDK 13
 - <u>http://www.oracle.com/technetwork/java/javase/downloads/index.</u> <u>html</u>
- Java Enterprise Edition (Java EE)
 - geared toward developing large-scale, distributed networking applications and web-based applications.

JAVA: A general view



Full description of APIs

http://download.oracle.com/javase/8/docs/technotes/guides/index.html#jre-jdk

Machine Languages, Assembly Languages and High-Level Languages

- Programmers write instructions in various programming languages, some directly understandable by computers and others requiring intermediate translation steps.
- Three general language types:
 - Machine languages
 - Assembly languages
 - High-level languages

Wish you were here!



Machine Languages, Assembly Languages and High-Level Languages (Cont.)

- Compiling a high-level language program into machine language can take a considerable amount of computer time.
- Interpreter programs execute high-level language programs directly, although slower than compiled programs run.
- Java uses a clever mixture of compilation and interpretation to run programs.

Java Class Libraries

- > Java programs consist of pieces called classes.
- Classes include methods that perform tasks and return information when the tasks complete.
- Java class libraries
 - Rich collections of existing classes
 - Also known as the Java APIs (Application Programming Interfaces)
- Two aspects to learning the Java "world."
 - The Java language itself
 - The classes in the extensive Java class libraries
- Download the Java API documentation
 - http://www.oracle.com/technetwork/java/javase/documentati on/index.html

Avoid reinventing the wheel!



Software Engineering Observation 1.1

Use a building-block approach to creating your programs. Avoid reinventing the wheel—use existing pieces wherever possible. This software reuse is a key benefit of object-oriented programming.

The existing pieces are available Java classes that have been developed before and you can use them for your own programs.

 Java program development and execution cycle (illustrated in Fig. 1.1).

- Java programs normally go through five phases
 - edit
 - compile
 - load
 - verify
 - execute



Fig. 1.1 | Typical Java development environment. (Part 1 of 2.)



Fig. 1.1 | Typical Java development environment. (Part 2 of 2.)

- We discuss these phases in the context of the Java SE Development Kit 13 (JDK13) from.
- Download the most up-to-date JDK and its documentation from:
 - http://www.oracle.com/technetwork/java/javase/downloads/in dex-jsp-138363.html
 - Carefully follow the installation instructions for the JDK provided in the Before You Begin section of the book to ensure that you set up your computer properly to compile and execute Java programs.
- Java Center at:
 - http://www.oracle.com/technetwork/java/javase/overview/in dex.html

- Phase 1 consists of editing a file with an editor program (normally known simply as an editor).
 - Type a Java program (source code) using the editor
 - Make any necessary corrections
 - Save the program
 - A file name ending with the .java extension indicates that the file contains Java source code.
 - Linux editors: vi and emacs.
 - Windows editors: Notepad, EditPlus
 (www.editplus.com), TextPad (www.textpad.com)
 and jEdit (www.jedit.org).

- Integrated development environments (IDEs)
 - Provide tools that support the software-development process, including editors for writing and editing programs and debuggers for locating logic errors — errors that cause programs to execute incorrectly.
- Popular IDEs
 - Eclipse (www.eclipse.org)
 - NetBeans (<u>www.netbeans.org</u>)
 - Oracle JDeveloper
 - JBuilder (www.codegear.com)
 - JCreator (www.jcreator.com)
 - BlueJ (www.blueJ.org)
 - jGRASP(www.jgrasp.org)

Phase 2

Use the command javac (the Java compiler) to compile a program. For example, to compile a program called Welcome.java, you'd type javac Welcome.java

 If the program compiles, the compiler produces a .class file called Welcome.class that contains the compiled version of the program.

- Java compiler translates Java source code into bytecodes that represent the tasks to execute.
- Bytecodes are executed by the Java Virtual Machine (JVM) a part of the JDK and the foundation of the Java platform.
- JRE
 - You can download this from the same page of JDK
- Virtual machine (VM) a software application that simulates a computer
 - Hides the underlying operating system and hardware from the programs that interact with it.
- If the same VM is implemented on many computer platforms, applications that it executes can be used on all those platforms.

JRE and JDK

Sun Microsystems

 provides two principal software products in the Java[™] Platform, Standard Edition (Java[™] SE) family:

Java SE Runtime Environment (JRE)

- The JRE provides the libraries, Java virtual machine, and other components necessary for you to *run* applications written in the Java programming language.
- This runtime environment can be redistributed with applications to make them free-standing.

Java SE Development Kit (JDK)

 The JDK includes the JRE plus command-line development tools such as compilers and debuggers that are necessary or useful for *developing* applets and applications.

JVM - Java Virtual Machine

- The Java virtual machine is an abstract computing machine that has an instruction set and manipulates memory at run time.
- The Java virtual machine is ported to different platforms to provide hardware- and operating system-independence.

- Bytecodes are platform independent
 - They do not depend on a particular hardware platform.
- Bytecodes are portable
 - The same bytecodes can execute on any platform containing a JVM that understands the version of Java in which the bytecodes were compiled.
- The JVM is invoked by the java command. For example, to execute a Java application called Welcome, you'd type the command java Welcome

- Phase 3
 - The JVM places the program in memory to execute it
 - This is known as loading.
 - Class loader takes the .class files containing the program's bytecodes and transfers them to primary memory.
 - Also loads any of the .class files provided by Java that your program uses.
 - The .class files can be loaded from a disk on your system or over a network.

- Phase 4
 - As the classes are loaded, the bytecode verifier examines their bytecodes
 - Ensures that they are valid and do not violate Java's security restrictions.
 - Java enforces strong security to make sure that Java programs arriving over the network do not damage your files or your system (as computer viruses and worms might).

- > Phase 5
 - The JVM executes the program's bytecodes.
 - JVM typically uses a combination of interpretation and justin-time (JIT) compilation.
 - Analyzes the bytecodes as they are interpreted, searching for hot spots — parts of the bytecodes that execute frequently.
 - A just-in-time (JIT) compiler (the Java HotSpot compiler) translates the bytecodes into the underlying computer's machine language.
 - When the JVM encounters these compiled parts again, the faster machine-language code executes.

Laboratory Session

- For your home development environment you need:
 - JDK
 - http://www.oracle.com/technetwork/java/javase/dow nloads/index.html
 - Netbeans
 - https://netbeans.org/downloads/

Test-Driving a Java Application

- Checking your setup. Read the *Before You Begin section of the book to confirm that you've set up Java properly on your computer.*
- Download Java at:
 - http://www.oracle.com/technetwork/java/javase/downloads/index.html
- Writing a simple Java Program.
 - Welcome
 - Perform simple operations
 - Print to the console
- Compiling the program
 - Javac command or
 - Netbeans
- Executing
 - The java command or
 - Run in Netbeans

First Program in Java

public class Operator {

public static void main(String args[]) {

Saving the program

- Save the program
 - A file name ending with the .java extension indicates that the file contains Java source code.

Compiling using the command prompt: setting environmental variables



| 🔾 🖂 🛛 🖓 🕨 Control Panel 🕨 A | All Control Panel Items 🕨 System | 1 | ✓ 4 Search Control Pail | nel P |
|---|---|--|-------------------------|-------|
| Control Panel Home Control Panel Home Control Panel Home Control Panel Home Remote Settings System protection Control Panel Home Advanced system settings | View basic information Windows edition Windows 7 Professional Copyright © 2009 Microso Get more features with a n | about your computer ft Corporation. All rights reserved. ew edition of Windows 7 | | |
| | System Manufacturer: Rating: Processor: Installed memory (RAM): System type: Pen and Touch: | Dell 511 Your Windows Experience Index needs to be refress Intel(R) Core(TM) i3-2120 CPU @ 3.30GHz 3.30 GHz 4.00 GB (3.90 GB usable) 64-bit Operating System No Pen or Touch Input is available for this Display | hed | Dæll |
| See also Action Center Windows Update Performance Information and Tools | Dell support Phone number: Support hours: Website: Computer name, domain, and | 1-800-624-9896 (XPS 1-800-232-8544) In the United States, 24 hours a day, 7 days a week Online support | | |

| ys | stem Properties |
|----|---|
| (| Computer Name Hardware Advanced System Protection Remote |
| | You must be logged on as an Administrator to make most of these changes. |
| | Visual effects, processor scheduling, memory usage, and virtual memory |
| | Settings |
| | User Profiles Desktop settings related to your logon |
| | S <u>e</u> ttings |
| | Startup and Recovery System startup, system failure, and debugging information |
| | Settings |
| | Environment Variables |
| | OK Cancel Apply |

| Variable | Value |
|---|--|
| TEMP | %USERPROFILE%\AppData\Local\Temp |
| TMP | %USERPROFILE%\AppData\Local\Temp |
| | |
| vstem variables | <u>N</u> ew <u>E</u> dit <u>D</u> elete |
| ystem variables Variable | New Edit Delete |
| vstem variables Variable OS | New Edit Delete value ^ Windows_NT |
| vstem variables Variable OS Path | New Edit Delete Value Windows_NT C:\Windows\system32;C:\Windows;C:\ |
| ystem variables Variable OS Path PATHEXT PROCESSOR_/ | New Edit Delete S Value Windows_NT C:\Windows\system32;C:\Windows;C:\ .COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS; A AMD64 |

Locate Java SDK. Look for JDK folder/bin

| | | | | | X | | |
|-----------------------|---------------------------------------|------------------|-------------|----------|----------|--|--|
| C:\Program | C:\Program Files\Java\jdk1.7.0_07\bin | | | | | | |
| Organize 🔻 Include in | library ▼ Share with ▼ New folder | | | · · | 0 | | |
| ☆ Favorites | Name | Date modified | Туре | Size | <u>^</u> | | |
| 📃 Desktop | appletviewer | 12/10/2012 10:54 | Application | 15 KB | | | |
| Downloads | apt | 12/10/2012 10:54 | Application | 15 KB | | | |
| Recent Places | extcheck | 12/10/2012 10:54 | Application | 15 KB | E | | |
| | 🔲 idlj | 12/10/2012 10:54 | Application | 15 KB | | | |
| 🥽 Libraries | 📧 jabswitch | 12/10/2012 10:54 | Application | 54 KB | | | |
| Documents | 📰 jar | 12/10/2012 10:54 | Application | 15 KB | | | |
| J Music | 💷 jarsigner | 12/10/2012 10:54 | Application | 15 KB | | | |
| Pictures | 🍰 java | 12/10/2012 10:54 | Application | 185 KB | | | |
| 📑 Videos | 💷 javac | 12/10/2012 10:54 | Application | 15 KB | | | |
| | 💷 javadoc | 12/10/2012 10:54 | Application | 15 KB | | | |
| 🖳 Computer | 💷 javafxpackager | 12/10/2012 10:54 | Application | 78 KB | | | |
| 🏭 Local Disk (C:) | 💷 javah | 12/10/2012 10:54 | Application | 15 KB | | | |
| 🚗 HP v210w (D:) | 💷 javap | 12/10/2012 10:54 | Application | 15 KB | | | |
| 👝 System Reserved (G: | 🗾 java-rmi | 12/10/2012 10:54 | Application | 15 KB | | | |
| | 🕌 javaw | 12/10/2012 10:54 | Application | 185 KB | | | |
| 📬 Network | 🕌 javaws | 12/10/2012 10:54 | Application | 283 KB | | | |
| | 💷 jcmd | 12/10/2012 10:54 | Application | 15 KB | - | | |
| 50 1000 | | 10/00/0010 10 54 | A P P | 4.F. 1/D | Ť | | |
| 50 items | | | | | | | |

Compiling using the command prompt

• Set the environment variable in Windows. This is done only

| once. | Syste | m Properties | | - | - | | XX) |
|--------------------------|--------------|--------------|------------|-------------|----------------------|--------------|----------|
| | Cor | mputer Name | Hardware | Advanced | System Protection | Remote | |
| | Er | vironment Va | ariables | | | 23 | |
| | | Edit System | n Variable | | | X | <u>ח</u> |
| | | Variable n | ame: | Path | | | |
| | | Variable v | alue: | LO\;C:\Prog | gram Files\Java\jdk: | 1.7.0_07\bin | |
| | | | | | ОК | Cancel | |
| | | System varia | bles | | | | |
| | \mathbb{H} | Variable | ١ | /alue | | * | |
| | | NUMBER_C |)F_P 4 | 1 | | | |
| | | OS | 1 | Windows_NT | | | |
| | | Path | (| COM, EVE, P | ystem32;C:\Windov | vs;C:\ | |
| ŕ | | FAILEN | | COMPLEXE | AT,.CHD,.VD3,.VDL | ., | |
| The jdk/bin path. | | | | New | Edit | Delete | |
| Put "·" after every path | | | | | | | |
| | 100 | | | | ОК | Cancel | |
| | | | | | | | |

Open a command prompt

| _ | | | |
|----------|-------------------------|----------------------|-------------------|
| S | Skype • | | Programs (1) |
| γ | GNOMON | Biba | Cmd |
| | Getting Started | Documents | |
| | Calculator | Pictures | |
| | Connect to a Projector | Music | |
| | Notepad • | Computer | |
| | Sticky Notes | Control Panel | |
| <u></u> | Paint | Devices and Printers | |
| | Snipping Tool | Default Programs | |
| E | FileZilla | Help and Support | |
| • | All Programs | | See more results |
| Sec | arch programs and files | Shut down | cmd × Shut down ► |
| | | | |
| ? | | l 💿 🔮 | 🔗 🥝 🔚 🖸 🚳 🧔 🍯 |

Change directory to the .java file

Computer ► Local Disk (C:) ► DISK D ► UNYT ► COURSES ► JAVA ► JAVA FALL 2012 ► LESSON1 ►



Compile with javac command

Share with 💌 New folder in library 🔻 Date modified Size Name Type MyFirstProject 11/10/2012 16:20 File folder MyProject 88 11/10/2012 18:08 File folder SecondProject File folder 11/10/2012 18:08 Lesson1 Microsoft PowerP... 15/10/2012 11:02 9.654 KB Operator.class CLASS File 15/10/2012 11:05 1 KB Operator.java 11/10/2010 11:08 JAVA File 1 KB 23 C:\Windows\system32\cmd.exe Microsoft Windows [Version 6.1.7600] ٠ Copyright (c) 2009 Microsoft Corporation. All rights reserved. Ξ C:\Users\Biba>cd C:\DISK D\UNYT\COURSES\JAVA\JAVA FALL 2012\LESSON1 C:\DISK D\UNYT\COURSES\JAVA\JAVA FALL 2012\LESSON1>javac Operator.java C:\DISK D\UNYT\COURSES\JAVA\JAVA FALL 2012\LESSON1> i: 111 ۰.

.class file generated

Run the program with the java command

| ibrary ▼ Share with ▼ New folder | | | | | |
|--|------------------|-------------|----------|----|--|
| Name | Date modified | Туре | Size | | |
| 鷆 MyFirstProject | 11/10/2012 16:20 | File folder | | | |
| 퉬 MyProject | 11/10/2012 18:08 | File folder | | | |
| 퉬 SecondProject | File folder | | | | |
| Microsoft PowerP | | | 9,654 KB | | |
| Operator.class | 15/10/2012 11:05 | CLASS File | 1 KB | | |
| Operator.java | 11/10/2010 11:08 | JAVA File | 1 KB | | |
| C:\Users\Biba>cd C:\DISK D\UNYT\COURSES\JAVA\JAVA FALL 2012\LESSON1 C:\DISK D\UNYT\COURSES\JAVA\JAVA FALL 2012\LESSON1>java Operator.java C:\DISK D\UNYT\COURSES\JAVA\JAVA FALL 2012\LESSON1>java Operator ************************************ | | | | | |
| | | | • | з÷ | |

Compiling using Netbeans

| NetBeans IDE 7.0.1 | | | | | | |
|--|--------------------------------------|---|---|--|--|--|
| File Edit Yiew Navigate Source Refactor Run Debug Profile Team Tools Window Help | | | | | | |
| 👚 🞦 블 🌗 🏓 🧭 < default confi | 📸 🚰 🔚 🌗 🥥 🥐 🛛 Infig> 🕑 🍟 🎉 🕨 🏗 - 🕐 - | | | | | |
| Proj 4 × Files Services | Start Page 🗙 | | | | | |
| ⊞ 🆢 MyProject | | NetBeans IDE | | | | |
| | Learn & Discover | My NetBeans | What's New | | | |
| | Recent Projects | Install Plugins | Activate Features | | | |
| | 威仰 FoodSafety | Add support for other languages and technologies by installing plugins from the NetBeans Update Center. | NetBeans turns on functionality as you Start creating and opening projects and will just activate the features you need, your experience quicker and cleaner. Alternatively, you can activate features manually. | | | |
| | ORACLE | Show On Startup | | | | |
| | | | | | | |
| : MyProject - Navigator 40 × | | | | | | |
| | | | | | | |
| | | | | | | |
| | Tasks | | | | | |
| ar 10 a 411. | | | | | | |

New Project

| ile | Edit | View | Navigate | Source | Refactor | Run | Debug | Profile | Team | Tools | Window |
|----------|-------|----------|------------|------------|----------|------------|---------|--------------------|------------|--------|------------|
| P | New | Projec | t | Ctrl+Shift | +N a | ult conf | ia> | v | <u>n</u> n | | i - |
| P | New | File | | Ctrl+N | | | | | | | |
| <u>p</u> | Oper | n Proje | ct | Ctrl+Shift | ;+0 | _ | Start P | ^o age x | | | |
| _ | Oper | n Rece | nt Project | | • | | | | | | |
| | Close | e Proje | ct | | | | | | | | |
| | Oper | n File | | | | | | | | - | |
| | Oper | n Rece | nt File | | • | | | | | earn | & Disco |
| | Proje | ect Gro | чр | | • | | | | | | |
| | Proje | ect Pro | perties | | | | | Rec | ent Pi | roject | s |
| | Impo | ort Proj | iect | | • | | | | | - | |
| | Save |) | | Ctrl+S | | | | plip F | oodSaf | ety | |
| | Save | As | | | | | | | | | |
| 4 | Save | All | | Ctrl+Shift | +S | | | | | | |
| | Page | e Setup |) | | | | | | | | |
| | Print | | | Ctrl+Alt+ | Shift+P | | | | | | |
| | Print | to HTI | ML | | | | | OP | | | |
| | Exit | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| МуР | rojec | t - Na | vigator | | | € × | | | | | |

Type of Project

| 🗊 New Project | | |
|---------------------------------|---|--|
| Steps 1. Choose Project 2 | Categories: Image: Imag | Projects: Java Application Java Class Library Java Project with Existing Sources Java Free-Form Project |
| | Description: Creates a new Java SE application in a in the project. Standard projects use an ID your project. | standard IDE project. You can also generate a main class E-generated Ant build script to build, run, and debug |
| | < <u>B</u> ack | Next > Einish Cancel Help |

Project Name and Location

| IN I | ew Java Application | | | X |
|-----------------|---------------------------------------|-------------------|---|--------|
| Ste | ps | Name and Local | tion | |
| 1. 2. | Choose Project Name and Location | Project Name: | MyFirstProject | |
| | | Project Location: | \COURSES\JAVA\JAVA FALL 2011\SLIDES\LESSON1\MyFirstProject | Browse |
| | | Project Folder: | 'A\JAVA FALL 2011\SLIDES\LESSON1\MyFirstProject\MyFirstProject | |
| | | Use Dedicated | l Folder for Storing Libraries | |
| | | Libraries Folde | r: | Browse |
| | | | Different users and projects can share the same compilation libraries (see Help for details). | |
| | | Create Main C | lass myfirstproject.MyFirstProject | |
| | | 🔽 Set as Main Pr | oject | |
| - | · · · · · · · · · · · · · · · · · · · | | | |
| | | | < Back Next > Finish Cancel | Help |

Project created



Create a new class



Create a new class

| 🗊 New Java Class | | |
|---|-----------------------|---|
| Steps | Name and L | ocation |
| Choose File Type Name and Location | Class <u>N</u> ame: | Operator |
| | Project: | MyFirstProject |
| | Location: | Source Packages |
| | Pac <u>k</u> age: | |
| | <u>⊂</u> reated File: | AVA\JAVA FALL 2011\SLIDES\LESSON1\MyFirstProject\MyFirstProject\src\Operator.java |
| | | |
| | | |
| | | |
| | | |
| | | |
| | (t) Warning: | It is highly recommended that you do NOT place Java classes in the default package. |
| a 1962. On | | |
| | | < <u>B</u> ack Next > <u>Finish</u> Cancel <u>H</u> elp |

Write the code



Write the code: start with main



Write the code

Run the program



Console output

| 7.0.1 | |
|---|--|
| f <u>a</u> ctor <u>R</u> un | <u>D</u> ebug <u>P</u> rofile Tea <u>m</u> <u>T</u> ools <u>W</u> indow <u>H</u> elp |
| <default config=""> 💽 🏠 🏷 🏗 - 🕀 -</default> | |
| vices | Start Page 🗴 🎪 Operator.java 🗴 |
| | [[] [] - [] - [] - [] - [] - [] - [] - |
| | <pre>1</pre> |
| <0 × 0) | 24 |
| ~ | 25 |
| | Output - MyFirstProject (run) |
| | 😥 run: |
| | Welgene this is more first wearen in Torre |
| | Welcome, this is your first program in Java The result is: 63 |
| | 227 *********************************** |
| | BUILD SUCCESSFUL (total time: 2 seconds) |
| - | |
| | |
| | |
| | |
| | |
| | |

output

Exercise 2

public class CircleAreaCalculator{

```
public static void main( String args[ ] ) {
```

System.out.println("Welcome, this is your second program in Java");

int radius = 10;

```
double area = Math.PI * radius * radius;
```

```
System.out.print("The area of the circle is: ");
```

System.out.println(area);

Exercise 3: Simple object-oriented program

Modeling Automobiles with class Auto and creating different objects

Readings

- ▶ JavaTM How to Program, 9/e
 - Chapter 1

End of class