

Lecture 1

Introduction to Computers, Programs, and Java

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General Guidelines

- Attentive attendance in classes is mandatory.
- Distracting others in class is violating others rights to be attentive. So food, laptop or cell phones are not allowed during class time. However, you may drink water, soft drinks, and/or coffee at your convenience.
- **No make-up exams** will take place for missed quizzes and mid-term. If you miss a quiz, you will get zero for that.
- Assignments are due at the beginning of the lecture sessions at the deadline. There will be a penalty of **20% for delay submission under 24 hours** and **50% penalty for delay under 48 hours**. Any **more delay** will result in **100% penalty** for that submission. It is your responsibility to submit the assignments in time.
- **Final exam** will be **comprehensive**.
- Any means of unauthorized assistance in preparing materials which a student submits as original work is deemed to be cheating and constitutes grounds for disciplinary action. Serious instances may be referred to the Disciplinary Committee in the Office of the Vice Chancellor.

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Course Introduction

• Tentative Marks Distribution

Homework	15%
Quizzes	15%
Midterm 1	15%
Midterm 2	20%
Final Exam (Comprehensive)	35%

• Text Book:

1. "Introduction to Java programming", Y. Daniel Liang, 10th Edition, Pearson.
2. "Java: The complete reference", Herbert Schildt

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Important Dates

- Midterm 1: **26.02.2018 (Monday)**
- Midterm 2: **28.03.2018 (Monday)**
- Final: To be announced by the department

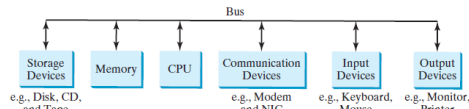
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Computer and its components



- A computer is an electronic device that stores and processes data.



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Computer and its components

- Central Processing Unit (CPU):
 - Computer's brain
 - Has two components:
 - Control unit: controls and coordinates the actions of the other components.
 - Arithmetic/logic unit: performs numeric operations (addition, subtraction, multiplication, division) and logical operations (comparisons).
- Bits and Bytes:
 - Setting a sequence of switches on or off.
 - Switch 'On': value is 1
 - Switch 'Off': value is 0
 - 0s and 1s are digits in the binary number system and are called bits (binary digits)
 - Minimum storage unit in a computer is byte
 - A byte is composed of eight bits.

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Computer and its components

- Memory:
 - Consists of an ordered sequence of bytes for storing programs as well as data that the program is working with.
 - Every byte has unique address.
 - The bytes in the memory can be accessed in any order.
 - A.k.a. random-access memory (RAM): volatile

- Storage Devices:

- Programs and data are permanently stored.
- Three main types:
 - Magnetic Disk Drives
 - Optical Disk Drives:
 - USB Flash Drives

Memory address	Memory content	
.	.	.
.	.	.
.	.	.
2000	01000011	Encoding for character 'C'
2001	01110010	Encoding for character 'r'
2002	01100101	Encoding for character 'e'
2003	01110111	Encoding for character 'w'
2004	00000011	Encoding for number 3
.	.	.

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Computer and its components

- Input and Output Devices:



- Communication Devices:



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Programming Languages

- Machine Language
 - Computer's native language
 - Differs among different types of computers
 - Set of built-in primitive instructions, in the form of binary code
 - For example, to add two numbers, the instruction in binary code could be like this:


```
1101101010011010
```
 - Difficult to read and modify
- Assembly Language
 - Uses a short descriptive word, known as a mnemonic, to represent each of the machine-language instructions
 - For example, to add the numbers 2 and 3 and get the result, an instruction in assembly code would be like this:


```
add 2, 3, result
```

Programming Languages

- Assembly Language (contd.)
 - Assembler: used to translate assembly-language program into machine code

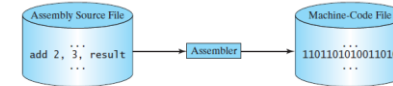
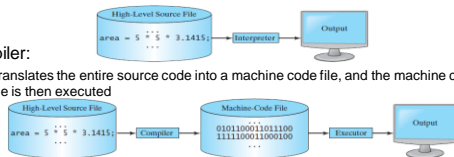


FIGURE 1.3 An assembler translates assembly-language instructions into machine code.

- An instruction in assembly language corresponds to an instruction in machine code.
- Writing in assembly requires one to know how the CPU works
- Referred to as low-level language
- Machine dependent

Programming Languages

- High-level Language:
 - Platform independent
 - English like
 - Easy to learn and use
 - A program written in high-level language is called a source program or source code
 - A source program must be translated into machine code for execution by:
 - Interpreter:
 - Reads one statement from the source code, translates it to the machine code or virtual machine code, and then executes it right away
 - Compiler:
 - Translates the entire source code into a machine code file, and the machine code file is then executed



Operating Systems

- OS manages and controls a computer's activities
- Major tasks:
 - Controlling and monitoring system activities
 - Allocating and assigning system resources
 - Scheduling operations
 - Multiprogramming:
 - Allows multiple programs to run simultaneously by sharing the same CPU
 - Example: it enables to use a word processor to edit a file at the same time as your web browser is downloading a file.
 - Multithreading:
 - Allows a single program to execute multiple tasks at the same time.
 - Example: A word-processing program allows users to simultaneously edit text and save it to a disk
 - Multiprocessing:
 - Uses two or more processors together to perform subtasks concurrently and then combine solutions of the subtasks to obtain solution for the entire task

Introduction to Java

- Java is a powerful and versatile programming language for developing software running on mobile devices, desktop computers, and servers.
- Java was developed by a team led by James Gosling at Sun Microsystems.
- Sun Microsystems was purchased by Oracle in 2010.
- Java is *simple, object oriented, distributed, interpreted, robust, secure, architecture neutral, portable, high performance, multithreaded, and dynamic*.

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Introduction to Java

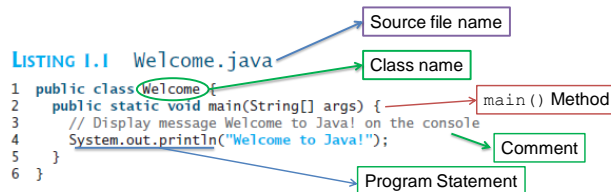
- The *Java language specification* is a technical definition of the Java programming language's syntax and semantics.
- The *application program interface (API)*, also known as *library*, contains predefined classes and interfaces for developing Java programs.
- Java is a full-fledged and powerful language that can be used in many ways. It comes in three editions:
 - *Java Standard Edition (Java SE)* to develop client-side applications. The applications can run standalone or as applets running from a Web browser.
 - *Java Enterprise Edition (Java EE)* to develop server-side applications, such as Java servlets, JavaServer Pages (JSP), and JavaServer Faces (JSF).
 - *Java Micro Edition (Java ME)* to develop applications for mobile devices, such as cell phones.

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A simple Java program



Output:

Welcome to Java!

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A simple Java program

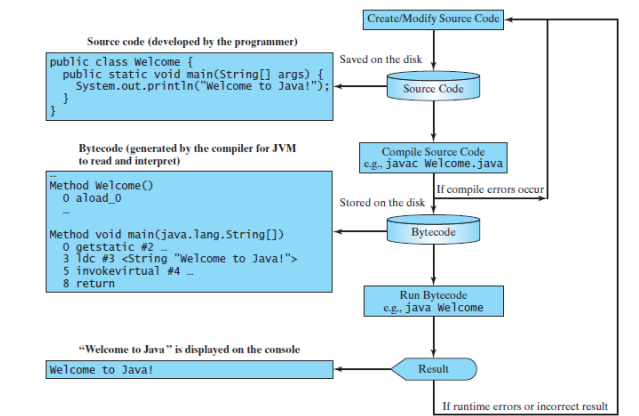


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Creating, Compiling, and Executing a Java Program



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Programming Errors

Three types:

1. Syntax Errors
2. Runtime Errors
3. Logic Errors

• Syntax Errors:

- Detected by the compiler
- A.k.a. compile errors
- Result from errors in code construction, such as
 - Mistyping a keyword,
 - Omitting some necessary punctuation, or
 - Using an opening brace without a corresponding closing brace

LISTING 1.4 ShowSyntaxErrors.java

```

1 public class ShowSyntaxErrors {
2     public static main(String[] args) {
3         System.out.println("Welcome to Java");
4     }
5 }
    
```

- Error 1: missing the keyword void
- Error 2: Missing closing quotation mark

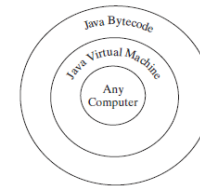
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Creating, Compiling, and Executing a Java Program

- The java language is a high-level language.
- Java bytecode is a low-level language.
- The bytecode is similar to machine instruction but is architecture neutral and can run on any platform that has a Java Virtual Machine (JVM).
- The virtual machine is a program that interprets Java bytecode



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Programming Errors

• Runtime Errors:

- Errors that cause a program to terminate abnormally
- Occur while a program is running if the environment detects an operation that is impossible to carry out.
- Example 1:
 - Input mistakes typically cause runtime errors.
 - An input error occurs when the program is waiting for the user to enter a value, but the user enters a value that the program cannot handle.
- Example 2:
 - Division by zero.

LISTING 1.5 ShowRuntimeErrors.java

```

1 public class ShowRuntimeErrors {
2     public static void main(String[] args) {
3         System.out.println(1 / 0);
4     }
5 }
    
```

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Programming Errors

- Logic Errors:
 - Occur when a program does not perform the way it was intended to.
 - Example: Converting Celsius to Fahrenheit

LISTING 1.6 ShowLogicErrors.java

```
1 public class ShowLogicErrors {  
2     public static void main(String[] args) {  
3         System.out.println("Celsius 35 is Fahrenheit degree ");  
4         System.out.println((9 / 5) * 35 + 32);  
5     }  
6 }
```

```
Celsius 35 is Fahrenheit degree  
67
```

- Expected result: 95.0
- Program output: 67