CIT 103 & CIT 104

Object Oriented Programming

By

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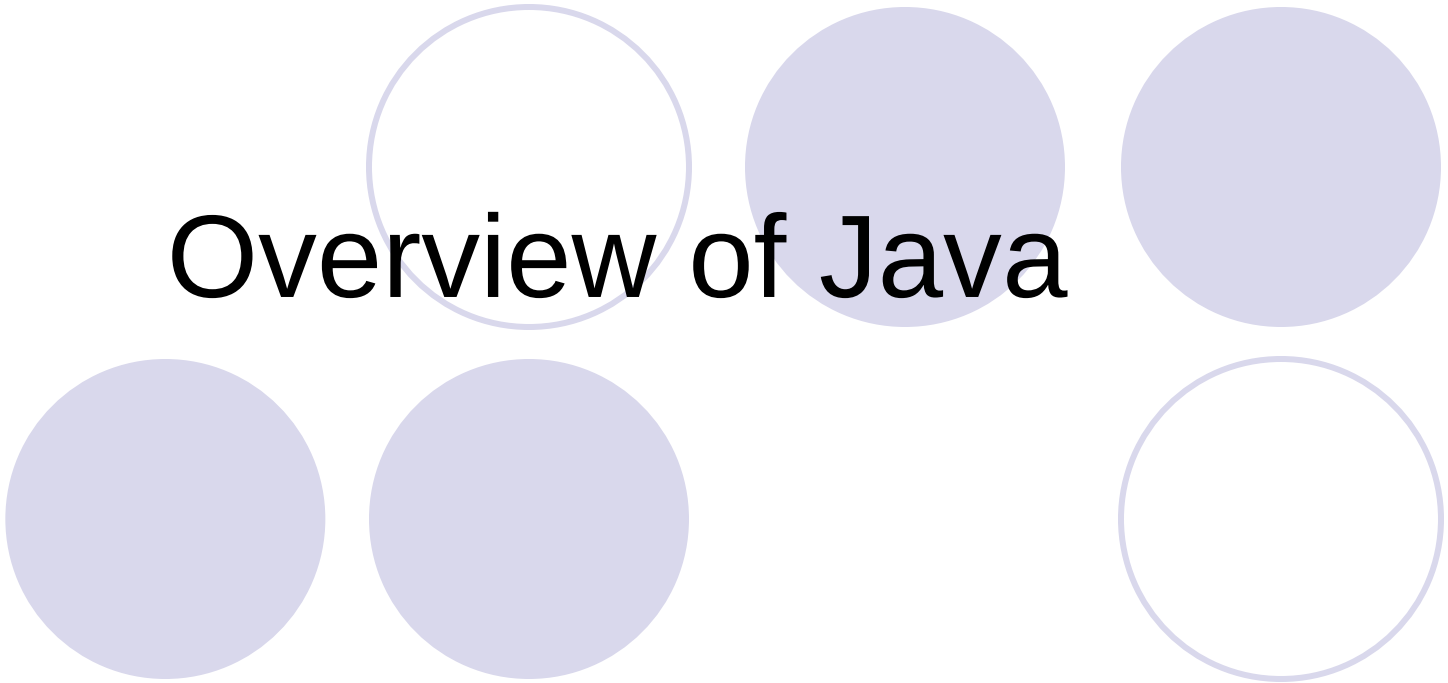
Overview of Java



What is Java?

- Developed by Sun Microsystems (James Gosling)
- A general-purpose object-oriented language
- Based on C/C++
- Designed for easy Web/Internet applications
- Widespread acceptance

Java Features (1)

- **Simple**
  - fixes some clumsy features of C++
  - no pointers
  - automatic garbage collection
  - rich pre-defined class library http://java.sun.com/j2se/1.4.2/docs/api/
- **Object oriented**
  - focus on the data (objects) and methods manipulating the data
  - all functions are associated with objects
  - almost all data types are objects (files, strings, etc.)
  - potentially better code organization and reuse

Java Features (2)

- **Interpreted**
  - java compiler generate **bytecodes**, not native machine code
  - the compiled byte-codes are **platform-independent**
  - java bytecodes are translated on the fly to machine readable instructions in runtime (Java Virtual Machine)
- **Portable**
  - same application runs on all platforms
  - the sizes of the primitive data types are always the same
  - the libraries define portable interfaces

Java Features (3)

- **Reliable**
  - extensive **compile-time and runtime error checking**
  - **no pointers** but real arrays. **Memory corruptions or unauthorized memory accesses are impossible**
  - **automatic garbage collection** tracks objects usage over time
- **Secure**
  - usage in networked environments requires more security
  - **memory allocation model** is a major defense
  - access restrictions are forced (private, public)

Java Features (4)

- **Multithreaded**
  - multiple concurrent threads of executions can run simultaneously
  - utilizes a sophisticated set of synchronization primitives (based on monitors and condition variables paradigm) to achieve this
- **Dynamic**
  - java is designed to adapt to evolving environment
  - libraries can freely add new methods and instance variables without any effect on their clients
  - interfaces promote flexibility and reusability in code by specifying a set of methods an object can perform, but leaves open how these methods should be implemented
  - can check the class type in runtime

Java Disadvantages

- **Slower than compiled language such as C**
  - an experiment in 1999 showed that Java was 3 or 4 times slower than C or C++

    title of the article: "Comparing Java vs. C/C++ Efficiency Issues to Interpersonal Issues" (Lutz Prechelt)
  - adequate for all but the most time-intensive programs

Environment Setup

- Sun Solaris OS JDK 1.4 (latest: J2SE 5.0)
- See the provided manual.

Install Java™ 2 Platform on your machine

- Can be installed on different platforms:
  - Unix/Linux
  - Windows
  - Mac OS
- Follow the on-line instructions:

  http://java.sun.com/docs/books/tutorial/getStarted/cupojava/index.html

Getting Started: (1)

(1) Create the source file:

- open a text editor, type in the code which defines a class (*HelloWorldApp*) and then save it in a file (*HelloWorldApp.java*)
- file and class name are case sensitive and must be matched exactly (except the `.java` part)

Example Code: HelloWorldApp.java

```
/**
 * The HelloWorldApp class implements an application
 * that displays "Hello World!" to the standard output
*/
public class HelloWorldApp {
  public static void main(String[] args) {
    // Display "Hello World!"
    System.out.println("Hello World!");
  }
}
```

★ Java is CASE SENSITIVE!

Getting Started: (2)

(2) Compile the program:

- compile HelloWorldApp.java by using the following command:

```
javac HelloWorldApp.java
```

it generates a file named HelloWorldApp.class

☹ **'javac' is not recognized as an internal or external command, operable program or hatch file.**

javac: Command not found

if you see one of these errors, you have two choices:

1) specify the full path in which the `javac` program locates every time. For example:

```
C:\j2sdk1.4.2_09\bin\javac HelloWorldApp.java
```

2) set the PATH environment variable (see manual)

```
C:\Program Files\Java\jdk1.7.0\bin
```

Getting Started: (3)

(3) Run the program:

- run the code through:

```
java HelloWorldApp
```

- Note that the command is `java`, not `javac`, and you refer to `HelloWorldApp`, not `HelloWorldApp.java` or `HelloWorldApp.class`

☹ **`Exception in thread "main" java.lang.NoClassDefFoundError: HelloWorldApp`**

if you see this error, you may need to set the environment variable CLASSPATH.

Language basics (1)

- Data types
  - 8 primitive types:
    - boolean, byte, short, int, long, float, double, char
  - Class types, either provided by Java, or made by programmers
    - String, Integer, Array, Frame, Object, Person, Animal, …
  - Array types
- Variables
  - *dataType identifier [= Expression]:*
  - Example variable declarations and initializations:

```
int x;     x=5;
boolean b = true;
Frame win = new Frame();
String x = “how are you?”;
```

```
int[] intArray;
intArray = new int[2];
intArray[0] = 12;
intArray[1] = 6;
Person pArray = new Person[10];
```

Language basics (2)

- Flow of control
  - if, if-else, if-else if
  - switch
  - for, while, do-while
  - break
  - continue

Supplemental reading

- ***Getting Started***

  http://java.sun.com/docs/books/tutorial/getStarted/index.html

- ***Nuts and bolts of the Java Language***

  http://java.sun.com/docs/books/tutorial/java/nutsandbolts/index.html

- ***Compiling and Running a Simple Program***

  http://developer.java.sun.com/developer/onlineTraining/Programming/BasicJava1/compile.html