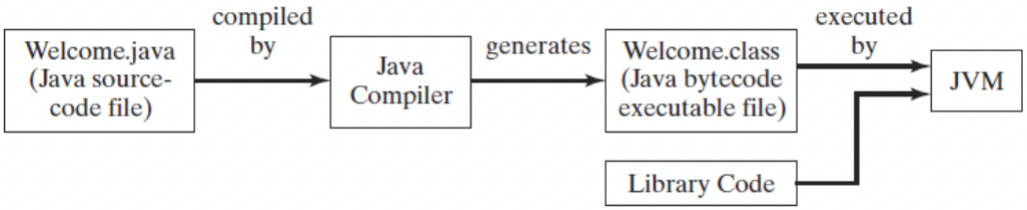
Lecture 2 - Introduction to Java

- What is Java?
  - An object-oriented language invented by James Gosling in 1994 at Sun Microsystems
  - Write once, run anywhere (WORA)
  - Widely-used in industry
  - Used to develop software running on:
    * Desktop Computers * Servers * Mobile devices
- Java Programs
  1. Writing the source code using a text editor
  2. Translating the source code into Java bytecode using a compiler
     - Bytecode is similar to machine instructions but is architecture neutral and can run on any platform that has a Java Virtual Machine (JVM)
  3. Executing the bytecode
     - The JVM is an interpreter: it translates bytecode into the target machine language code one at a time rather than the whole program as a single unit
     - Each step is executed immediately after it is translated



- Integrated Development Environment
  - A system comprising several tools that facilitate software development and testing
  - Popular IDEs:
    * Eclipse * NetBeans * IntelliJ
- Data Types
  - Eight primitive types
    * byte, char, short, int, long, float, double, boolean
  - Objects
    * Defined using **classes**
    * Java provides wrapper classes to use primitive types as objects (e.g. Integer, Double, etc)
- Numeric Primitive Types

Name	*Range*	*Storage Size*
byte	-2^7 to $2^7 - 1$ (-128 to 127)	8-bit signed
short	-2^{15} to $2^{15} - 1$ (-32768 to 32767)	16-bit signed
int	-2^{31} to $2^{31} - 1$ (-2147483648 to 2147483647)	32-bit signed
long	-2^{63} to $2^{63} - 1$ (i.e., -9223372036854775808 to 9223372036854775807)	64-bit signed
float	Negative range: $-3.4028235\text{E}+38$ to $-1.4\text{E}-45$ Positive range: $1.4\text{E}-45$ to $3.4028235\text{E}+38$	32-bit IEEE 754
double	Negative range: $-1.7976931348623137\text{E}+38$ to $-4.9\text{E}-324$ Positive range: $4.9\text{E}-324$ to $1.7976931348623137\text{E}+38$	64-bit IEEE 754

- Classes
  - A typical Java class includes the following:
    - Data fields to represent the state of an object
    - Methods to represent the behavior of an object. Each method has:
      - A return type (**void** if nothing is returned)
      - Zero or more arguments
    - Special type of methods, known as constructors, that perform initialization actions. A constructor:
      - Has no return type (not even **void**)
      - Has zero or more arguments
      - Should have the same name as the class
      - Is invoked using the **new** operator
  - Instantiation is creating an object (or an instance of a class)
- The *main* method
  - The main method is the entry point where the program begins execution
  - Should have the following form:

```
public static void main(String [] args) {
        //write your code here
}
```

- Default values
  - The default value of a data field is:
    - ***null*** for a reference type
    - **0** for a numeric type
    - **false** for a boolean type
    - **'\u0000'** for a char type
  - Java assigns no default value to a local variable inside a method
- Scope
  - The scope of fields and methods is the entire class
  - The scope of a local variable starts from its declaration until the end of the block that contains it
- Differences between Variables of Primitive Types and Reference Types
  - Every variable represents a memory location that holds a value
  - For a variable of a primitive type, the value is of the primitive type
  - For a variable of a reference type, the value is a reference to where an object is located (i.e. a pointer)
  - When you assign one variable to another:
    - For a variable of a primitive type, the real value of one variable is assigned to the other variable
    - For a variable of a reference type, the reference of one variable is assigned to the other variable.
- The *this* reference
  - The **this** *keyword* is the name of a reference that an object can use to refer to itself
  - It can be used to reference the object's instance members
- The *static* modifier
  - Static fields/methods can be accessed from a reference variable or from their class name
  - Non-static (or instance) fields/methods can only be accessed from a reference variable

- Arrays
  - An array is a data structure that represents a collection of the same types of data
  - Once an array is created, its size is fixed
    - e.g. **int [] A = new int[10];**
  - The size of an array A can be found using **A.length**
  - When an array is created, its elements are assigned the default value
  - Array elements could be initialized individually
    - e.g. **A[0] = 5;**
  - Array initializer (combines declaration, creation, and initialization)
    - e.g. **double[] myList = 1.9, 2.9, 3.4, 3.5;**
- Two-dimensional Arrays
  - The syntax for declaring a two-dimensional array is:
    - **elementType [][] arrayRefVar;** (e.g. **int[][] matrix;**)
  - For a two-dimensional array A, **A.length** returns the number of rows
  - Two-dimensional array examples: