

Java Enterprise Application Development

*Lecture 2
Variables, Operators,
Control Flow Statements,
and Arrays*

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Getting Started with Java Programming

- Step 1: download and install the latest JDK
 - <https://www.oracle.com/java/technologies/downloads/>
- Step 2: download and install an IDE
 - **IntelliJ IDEA (recommended)**
 - Visual Studio Code (considerable)
 - Eclipse
- Step 3: Go!
 - A *Hello World* example

Variables

- Four kinds of variables
 - Instance Variables (Non-Static Fields), Class Variables (Static Fields), Local Variables, Parameters
- Naming
 - Case-sensitive, beginning with a letter, \$, or _
 - Subsequent characters may be letters, digits, \$, _
 - Must not be a keyword or reserved word
 - If the name consists of only one word, spell that word in all lowercase letters; if it consists of more than one word, capitalize the first letter of each subsequent word
 - If your variable stores a constant value, capitalize every letter and separate subsequent words with the underscore character

Primitive Data Types

- Java is **statically-typed**: variables first declared, then used
- 8 primitive data types
 - byte, short, int, long
 - float, double
 - boolean
 - char
- Special support for character strings
 - String, **immutable**

Default Values

- Default will be zero or null

Data Type	Default Value (for fields)
byte	0
short	0
int	0
long	0L
float	0.0f
double	0.0d
char	'\u0000'
String (or any object)	null
boolean	false

Literals

- A literal is the source code representation of a fixed value
- Integer Literals
 - An integer literal is of type long if it ends with the letter L or l; otherwise it is of type int
 - Decimal, Hexadecimal (0x~), Binary (0b~)
- Floating-Point Literals
 - A floating-point literal is of type float if it ends with the letter F or f; otherwise its type is double
 - Can also be expressed using E or e (for scientific notation)
- Character and String Literals

Operator Precedence

Operators	Precedence
postfix	expr++ expr--
unary	++expr --expr +expr -expr ~ !
multiplicative	* / %
additive	+ -
shift	<< >> >>>
relational	< > <= >= instanceof
equality	== !=
bitwise AND	&
bitwise exclusive OR	^
bitwise inclusive OR	
logical AND	&&
logical OR	
ternary	? :
assignment	= += -= *= /= %= &= ^= = <<= >>= >>>=

Assignment, Arithmetic, and Unary

- Simple Assignment Operator: =
- Arithmetic Operators: +, -, *, /, %
 - You may combine the arithmetic operators with the simple assignment operator to create compound assignments
 - The + operator can also be used for concatenating two strings together
- Unary Operators: +, -, ++, --, !

Equality, Relational, and Conditional

- Equality and Relational Operators: `==`, `!=`, `>`, `>=`, `<`, `<=`
- Conditional Operators: `&&`, `||`
 - Short-circuiting: the second operand is evaluated only if needed
- Ternary operator: `a ? b : c`
- **Type Comparison Operator: `instanceof`**
 - Test if an object is an instance of a class, an instance of a subclass, or an instance of a class that implements a particular interface

Bitwise and Bit Shift

- Unary bitwise complement operator "`~`" inverts a bit pattern
- Signed left shift operator "`<<`" shifts a bit pattern to the left, and the signed right shift operator "`>>`" shifts a bit pattern to the right
- Bitwise `&` operator performs a bitwise AND operation
- Bitwise `^` operator performs a bitwise exclusive OR operation
- The bitwise `|` operator performs a bitwise inclusive OR operation

The "Hello World!" Application

- Source code and bytecode
- General structure
- The main method
- Source code comments (3 kinds)
 - **Javadoc**: specific for Java

Expressions, Statements, and Blocks

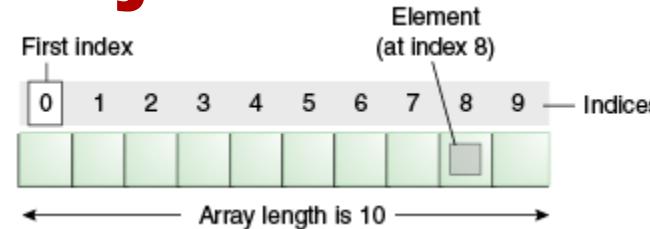
- Expression: made up of variables, operators, and method invocations, that evaluates to a single value
- Statement: a complete unit of execution
 - Expression statements
 - Assignment expressions
 - Any use of `++` or `--`
 - Method invocations
 - Object creation expressions
 - Declaration statements
 - Control flow statements
- Block: a group of zero or more statements between balanced braces

Control Flow Statements

- The if-then Statement
- The if-then-else Statement
- The switch Statement
 - Working with byte, short, char, int, enumerated types, String, and a few special classes that wrap certain primitive types
- The while and do-while Statements
- The for Statement
- **Branching Statements:** break, continue, return

Arrays

- **Array: a container object**



- Declaring a variable to refer to an array
 - `int[] anArray;`
- Creating, initializing, and accessing an array
 - `anArray = new int[10];`
- Length of array: `arrayRefVar.length`
- Shortcut syntax to create and initialize an array
 - `int[] anArray = {100, 200, 300, 400, 500, 600, 700, 800};`
- **The enhanced for statement: recommended**

Duplicating Arrays

- Whenever you need to duplicate an array
 - Using the assignment (=) statement?
- Correct way: using `arraycopy` utility!
 - `public static void arraycopy(Object src, int srcPos, Object dest, int destPos, int length)`
- Related issue: passing arrays to methods
 - Sample code and explanation
 - Java is “**passing by value**”

Array Manipulations

- Methods for performing array manipulations by the `java.util.Arrays` class
 - `arraycopy`, `copyOfRange`
 - `equals`
 - `binarySearch`
 - `fill`
 - `sort`, `parallelSort` (demonstration of performance difference)
 - Many more (for your private study)

Multidimensional Arrays

- Declaration and creation

```
int[][] myNumbers = new int[4][6];
```

```
int[][] myNumbers = { {1, 2, 3, 4}, {5, 6, 7, 8} };
```

- In Java, a multidimensional array is an array **whose components are themselves arrays**

- Rows are allowed to vary in length: **ragged array**

```
int[][] myNumbers = { {1, 2, 3, 4}, {5, 6, 7}, {8, 9} };
```

- Initialization issue

```
int[][] myNumbers = new int[3][];
```

ArrayList

- Declaration and initialization
- add, remove
- get, set
- size, clear, isEmpty
- contains, indexOf