Java Basics

CS 99 – Summer 2000

Michael Clarkson

Lecture 2

Administration

- Lab 1 in progress
  - Due tomorrow, at beginning of lab
  - Submit on a floppy
- Lab 2 posted today
- Put a check by your name on the attendance sheet – add your name if it isn't there
- This is the last day to enroll in the class!
- Still need questionnaire from at least 8 people

Agenda

- Variables
- Assignment
- Expressions
- Methods

Variables

- Named storage location in memory with an associated type
- Declaration
- Types
- Names
- Literals
- Scope

Declaring Variables

- Syntax:

  `type name [= init] [, name = init]…;`
- Examples:

```
int y;
int x = y;
double pi = 3.14;
String hi = "Hi!";
int a = 1, b, c = 2;
```

Types

- Every value in a program has a type
- Every variable, since it holds values, also has a type
- Java has some built-in types call *intrinsic* types, a.k.a. primitive types
- Programmers can also create their own types using *classes*

Intrinsic Types

- Integers
  - Numbers that are whole valued and signed
  - e.g., 5, -1000, 42, 0
  - Java types `byte, short, int, long`
- Floating point numbers
  - Numbers that have a decimal component
  - e.g., 3.14, 1.78, .9944, -1.69, 1.0, 0.0
  - Java types `float, double`
- We'll usually use `int` and `double`

Intrinsic Types [2]

- Characters
  - The symbols in a character set, such as letters, numerals, punctuation, etc.
  - e.g., 'a', 'b', 'c', 'X', 'Y', 'Z', '1', '%'
  - Java type `char`
- Booleans
  - Values that are either true or false
  - true, false
  - Java type `boolean`

The String type

- `String` is an example of a user-defined type
- Strings are sequences of characters
- e.g., "Hello, world!", "1 + 1 = 2"

Naming Variables

- Follow Style Guide
- First character in name must be a letter
- Remaining characters can be letters, numbers, or the underscore "_" (e.g., `cs99_2000su`)
- Can be (practically) as long a name as you want

Literals

- Variables are placeholders for values in a program
- Literals are actual values written directly in a program:

```
int x = 5;
double y = x + 2;
String s = "5 + 2 = " + y;
```

- Literals above: 5, 2, "5 + 2 = "

Scope

- Scope is the lifetime of a variable
- Variables are live from the statement where they are declared to the end of the block that statement is in
- You *cannot* use a variable if it is not live (in scope)
- Implication: variables *must* be declared before using them

Assignment Statement

- Syntax:

  `variable = value`
- Examples:

```
x = 5;
y = x;
z = x + y;
d = round(b) – 1;
```

A Special Assignment

- What does this mean:

  `x = x + 1`
- Take the value of x+1 and store it in x
- So if x equaled 1 before executing the statement, it would equal 2 afterwards:

```
// x = 1
x = x + 1
// x = 2
```

Default Values

- What would this output?

```
int x;
System.out.println(x);
```

- Answer: every variable is initialized to a default value, if you don't provide one
  - Numeric types (`int`, `double`): `0`
  - Boolean: `false`
  - Strings: `""` (the empty string, or the null string)

Expressions

- Values combined by operators
- Has a value, and therefore a type

Operators

- Operators allow values to be combined
- Categories of operators
  - Arithmetic
  - Relational
  - Logical
  - (Bitwise)
- Unary, binary, ternary

Arithmetic Operators

`+`	Addition
`-`	Subtraction
`*`	Multiplication
`/`	Division
`%`	Modulus
`++`	Increment
`--`	Decrement
`+=`	Addition assignment (also `-=`, `*=`, `/=`, `%=`)

Arithmetic Operators [2]

- Operands are numeric types
- Resulting value is a numeric type
- Unary minus
- Division and Modulus
- Assignment Operators
- Increment and Decrement

Relational Operators

==	Equal to
!=	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

Relational Operators [2]

- For equality operators:
  - Operands must be of the same type
- For ordering operators:
  - Operands must be of numeric type
- For both:
  - Resulting value is a boolean
- Common errors:
  - Equality operators don't work on strings
  - Using the assignment operator instead of the equality operator

Logical Operators

&&	AND
||	OR
!	NOT
&=, |=	AND assignment, OR assignment

Operands and resulting values are boolean

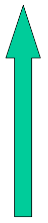
Assignment Operator

- Assignment statement acts as an operator
- Resulting value is the value from the RHS of the assignment
- e.g., value of `x = 2` is 2
- So we can write:

  `x = y = 2;`
- Final values of x and y?

Order of Operations

- Precedence
- Associativity



( )			
++	--	!	
*	/	%	
+	-		
>	>=	<	<=
==	!=		
&&			
||			
=	*op=*		

Methods

- Transfer of control
- Return types and values
- Parameters and arguments
- Walkthrough of a method call

Transfer of Control

```
class MethodExample {
   static void method1() {
        System.out.println("1");
   }
   static void method2() {
        System.out.println("2");
        method3();
   }
   public static void main(String[] args) {
        method3();
        method2();
        method1();
   }
   static void method3() {
        System.out.println("3");
   }
}
```

What is the output from this code?

`return` statement

- The `return` statement can occur anywhere in the body of a method
- Its syntax is:
  `return` *`[expression]`*`;`
- Examples:
  - `return;`
  - `return 5;`
  - `return x;`
  - `return x * y / 2;`

`return` statement [2]

- `return` means "stop executing this method and return to where it was called"
- If the method has a return type, the expression after return is evaluated, and the value is substituted for the method call

Return Types

- Methods can have return types and values
- So method calls can be used as values in expressions
- `void` means "this method has no return type"
- The type of the method and the type of the return must match!

Return Type Example

```
public static void main(String[] args) {
        int x = 1;
        x = x + foo();
        System.out.println(x * bar());
}
static int foo() {
   return 5;
}
static int bar() {
   return 4/2;
}
```

What is the output from this code?

Parameters & Arguments

- Methods can be declared with parameters:

```
static double average(double n1, double n2,
                      double n3)
```

- When you write a call to such a method, you provide arguments:

```
double avg;
…
avg = average(x, 10/7, Math.sqrt(2));
```

Matching Params. & Args.

- Parameters in a method are assigned the values of the arguments in the method call in the order they occur
- So in the previous slide:
  - `n1 = x`
  - `n2 = 10/7`
  - `n3 = √2`

Walkthrough of Call

- See online slideset with walkthrough of what happens during a method call