Basic Java Syntax

COMP 401, Spring 2014

Lecture 2

1/14/2014

Comments

- Single line comments:

```
// This is a comment.
```

- Multiple line comments:

```
/*
All of these lines.
Are commented.
*/
```

A Word About Types

Value Types

- Integers
- Real numbers
- Booleans
- Character

Reference Types

- String
- Array
- Objects typed by their class
- Classes themselves

Values types are defined entirely by their value.

Reference types are structures in memory.

- Address in memory uniquely identifies them.
  - The “value” of a variable that holds a reference type is this address.

Value Types

- Integers
  - `byte, short, int, long`
  - Difference is in size (1, 2, 4, or 8 bytes)
  - No “unsigned” version
  - Decimal (*255*), hexidecimal (*0xff*), and binary (*0b11111111*) literal formats
- Real Numbers
  - `float, double`
  - Difference is in precision.
- Characters
  - `char`
  - Characters in Java are 16-bit Unicode values
  - Literals use single-quote: *‘c’*
  - Non-printable escape sequence: ‘\u####’ where # is hex digit.
    - Example: ‘\u00F1’ for ñ
- Logical
  - `boolean`
  - Literals are *true* and *false*

Packages, classes, and methods, oh my!

- A package is a collection of classes.
  - Defined by a "package" statement at the beginning of a source code file.
    - Example:

```
package lec02.ex01;
```

    - All classes defined in the file belong to that package.
- A class is a collection of functions (for now).
  - Defined by "class" keyword followed by a block of code delimited by curly braces.
  - Example:

```
class {
    /* Class definition. */
}
```

- A method is just another name for a function or procedure and is a sequence of Java statements.
  - Defined within a class.
  - Syntax: a method header or signature followed by a block of code delimited by curly braces.

Method Signature

- Almost everything you need to know about a method is in its *signature*.
  - 5 parts to a method signature
    - Access modifier
      - `public`, `private`, `protected`, or default (i.e., not specified)
    - Method type
      - `static` or default (i.e., not specified)
      - The keyword static indicates that this is a "class method".
      - If the keyword static is not present, then this is an "instance method".
    - Return type
      - The type of value returned by the method as a result.
      - If there is no result, then this is indicated by the keyword `void`.
    - Method name
      - Must start with a letter, $, or _
      - Can contain letters, numbers, $, or _
    - Parameter list
      - In parenthesis, comma-separated list of parameter variables.
        - » If the method has no parameters, then just: ()
      - Each parameter variable name is preceded by a type declaration.

Method Signature Examples

```
public static void main(String[] args)

int foo (int a, MyType b, double c)

protected static void bar()

static String toUpperCase(String s)

static private Secret my_secret()
```

Until we know a little more…

- All of the methods in my examples today are going to be public class methods.

Inside a method

- The body of a method is a sequence of *statements.*
- A statement ends in a semi-colon
  - Types of statements:
    - Variable declaration
    - Assignment
    - Conditional
    - Loop
    - Method call
    - Return statement
- Blocks
  - Zero or more statements enclosed in curly braces { }
  - Allowed anywhere a single statement is allowed.
    - And vice versa

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Variable declaration

- Syntax:

```
type name;
type name1, name2, name3;
type name = value;
```

- A variable is valid within the block of statements where the declaration occurs.
  - This is known as the *scope* of the variable.
  - The declaration must occur before the variable is used.
- Method parameter names are treated as if they were variables declared within the method body.

Variable Names

- Variable names *should* start with a letter and can contain letters, digits, $, or _
  - Can not start with digit
  - Can not contain whitespace or punctuation other than $ or _
    - In general, use of punctuation in variable names is discouraged.
  - Case sensitive
  - Can not be a keyword
- Legal:
  - foo, bar, a_variable, var123
- Legal but not considered good:
  - var_with_$, _badness
- Illegal:
  - 1var, while, break, this has whitespace

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Assignment

- Syntax:

  ```
  variable = expression;
  ```

- Note: single equals for assignment.
- Left hand side must be some sort of variable that can be assigned.
- Expression must produce a value that matches the type of the variable.

Expressions

- A sequence of symbols that can be evaluated to produce a value.
  - Can be used wherever a value is expected.
- Types of expressions:
  - Literal values: 123
  - Variable names: a_variable
  - Public class/object fields: Math.PI
  - Value as a result of a method call: foo()
  - Expressions combined by operators: 4+3*2

Operators

- Unary: +, -, !, ++, --
- Arithmetic: +, -, /, *, %
- Relational: ==, !=, >, >=, <, <=
- Boolean: &&, ||
- Ternary: ?:
  - *expression ? if_true : if_false*
- Bitwise: ~, <<, >>, >>>, &, |, ^
- Be aware of precedence
  - Can be controlled by explicitly grouping with ()
- Be aware of context
  - Some operators do different things depending on the types of the values they are applied to.

Assignment and Unary Operators

- Most numeric operators have an “assignment” form.
  - Easy syntax for applying the operator to a variable and assigning the result back to the same variable.
  - Examples:
    - a += 3 // Equivalent to a = a + 3
    - b *= 4 // Equivalent to b = b * 4
- Unary operators ++ and –
  - Used with integer typed variables to increment and decrement.
  - Usually used as a statement unto itself:
    - a++; // Equivalent to a = a + 1;
    - b--; // Equivalent to b = b – 1;

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Conditional Execution: if-else if-else

```
if (expression) {
  block
} else if (expression) {
  block
} else {
  block
}
```

if example

```
if (score > 90) {
  System.out.println(“You got an A!”);
} else if (score > 80) {
  System.out.println(“You got a B.”);
} else if (score > 70) {
  System.out.println(“You got a C?”);
} else if (score > 60) {
  System.out.println(“You got a D :-(“);
} else {
  System.out.println(“You failed”);
}
```

Conditional Execution: switch

```
switch (expression) {
case value:
  statements
  break;
case value:
  statements
  break;
...
default:
  statements
}
```

- Works with basic value data types
- Works with String as of Java 7
- Execution starts at first matching case value
  - or default if provided and no case matches
- Continues until break statement or end of switch.

Switch Example

```
switch (c) {
  case 'a':
  case 'e':
  case 'i':
  case 'o':
  case 'u':
   System.out.println("Vowel");
   break;
  default:
   System.out.println("Consonant");
}
```

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Loops: while

```
while (expression) {
  block
}

do {
  block
} while (expression);
```

while example

```
int sum = 0;
int n = 1;
while (n < 11) {
  sum += n;
  n++;
}
System.out.println(“The sum of 1 to 10 is: “ + sum);
```

Loops: for

```
for (init; test; update) {
  block
}
```

for example

```
int sum = 0;
for(int n=1; n<11; n++) {
  sum += n;
}
System.out.println("The sum of 1 to 10 is: " + sum);
```

- Note that variable *n* is declared as part of init expression in for loop.
  - This is a common programming idiom if loop variable is only needed for the loop.
  - Scope of variable is limited to the loop block.

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Calling Methods

- Calling a class method:
  `ClassName.methodName(`*`parameter values`*`);`
- Calling an instance method:
  `objectReference.methodName(`*`parameter values`*`);`
- Above *parameter values* is a comma separated list of values.
  - A value can be also be an expression that results in a value.
  - Must match in number and type according to method's signature.
- A method call that returns a value can be part of an expression.
  - int max_times_min = max(a, b, c) * min(a, b, c);

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Return

- Syntax:

  `return` *`expression;`*

- Ends execution of a method and returns the value of the expression as the result of the method.
  - Must match type declared in method signature.
  - If method return type is “void”, then simply:

    `return;`

Java Execution Model

- Your program is always executing within the context of some method.
  - Starts off in the "main" class method defined in whatever class you told the program to start with.
  - Execution context includes:
    - Variable names that are in scope.
    - Parameter names.
- When you call a method:
  - Current context is saved.
  - A new context is created.
    - Method parameter names are mapped to values provided when method was called.
    - As method executes, declared variables become part of this new context.
- When a method returns:
  - Current context is destroyed.
  - Context where method call occurred is restored.
- This is why recursion works.

Strings

- String class
  - Sequence of chars
- Some common methods:
  - length()
  - charAt(*int idx)*
  - concat(*String otherString*)
    - Can also use "+"
  - equals(*Object obj*)
    - Be careful about using "=="
  - substring(*int start, int end*)
  - trim()
- Strings are immutable
  - Operations that change/alter a string are really giving you a new one.

```
a = "A String ";
a.length();
```
9
```
a.charAt(3);
```
't'
```
a.concat("am I");
```
"A String am I"
```
a + "am I";
```
Same as above
```
a.equals("B string");
```
false
```
a.substring(2,5);
```
"Stri"
```
a.trim();
```
"A String"

Arrays

- Container for a **fixed** number of values with the same type.
- Zero based indexing.
- Variables for arrays declared by using [] after type.
  - Type of the variable is Array
  - Type of each entry is specified by type name before []
- Empty arrays can be created with *new* keyword.
  - Size must be provided.
  - What do I mean by "empty"?
- Literal array syntax can be used to create array from literal values (or expressions).

```
int[] iarray;
   Declared, but not created.
iarray = new int[10];
   Now it's created, but
   uninitialized.
len = iarray.length;
   Length available as public
   field. Note, not a method.
iarray[0] = 3;
   0th item set
iarray[-1];
   Illegal index
iarray[10];
   Index out of bounds
int[] iarray = {1,2,(2+1)};
   Declared and items
   initialized all in one.
```