



CMSC 131

Object-Oriented Programming I

Precedence, Short Circuiting, Casting,
Static Methods

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This material is based on material provided by Ben Bederson, Bonnie Dorr,
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Overview

- ▶ Precedence
- ▶ Short Circuiting
- ▶ Casting
- ▶ Static Methods

Precedence

- ▶ Explains how to evaluate expressions
 - What is value of $1 - 2 + 3 * 4$?
 - **Precedence rules** answer this question
 - Higher-precedence operators evaluated first
 - Example from math: “Please, Excuse my Dear Aunt Sally” or PEMDAS
 - Multiple and divide (higher precedence) before you add and subtract (lower precedence)
- ▶ Java follows “Aunt Sally’s Rules” ... but what about other operators?

Java Precedence Rules

- ▶ parentheses: ()
- ▶ unary ops: +x -x ++x --x x++ x-- !x
- ▶ multiply/divide: * / %
- ▶ add/subtract: + -
- ▶ comparisons: < > <= >=
- ▶ equality: == !=
- ▶ logical and: & &
- ▶ logical or: | |
- ▶ assignments: = += *= /= %= (these are right to left associative)

Higher precedence on top

Examples

▶ $x * y + -z$

Same as $(x * y) + (-z)$

▶ $(x \leq y \ \&\& \ y \leq z \ || \ w > z)$

Same as $((x \leq y) \ \&\& \ (y \leq z)) \ || \ (w > z)$

▶ What is value of $1 - 2 + 3 * 4$?

$$= 1 - 2 + 3 * 4$$

$$= 1 - 2 + (3 * 4)$$

$$= (1 - 2) + 12$$

$$= -1 + 12$$

$$= 11$$

Should You Rely on Precedence?

- ▶ No!
- ▶ The only ones people can remember are
 - “Please Excuse My Dear Aunt Sally” (PEMDAS)
 - And maybe unary and increment/decrement operators

- ▶ Bad:

```
if (2 * x++ < 5 * z + 3 && -w != x / 2)
```

- ▶ Better:

```
if ((2 * x++ < 5 * z + 3) && (-w != x / 2))
```

- ▶ Best:

```
if (((2 * x++) < (5 * z + 3)) && (-w != (x / 2)))
```

Strive for Readable Code

► Alternative #1

```
if ((temp >98 && temp <=100) || (systolic <=120 && diastolic < 80)..
```

► Alternative #2

```
boolean tempIsOK = (.....)
```

```
boolean BPIsOK = (....)
```

```
if (tempIsOK || BPIsOK)....
```

Short-circuiting Example

- ▶ As soon as Java knows an answer → it quits evaluating the expression

- ▶ What does Java print?

```
int x = 0, y = 1;  
if ((y > 1) && (++x == 0)) {  
    --y;  
}  
System.out.println(x);  
=> 0
```

- ▶ Why?

- $y > 1$ is false
- The result of `&&` will be false, regardless of second expression
- Java therefore does not evaluate second expression of `&&`

- ▶ This treatment of `&&`, `||` is called **short-circuiting**

- Subexpressions evaluated from left to right
- Evaluation stops when value of over-all expression is determined

- ▶ **Example:** ShortCircuiting.java

Examples

- ▶ What does Java print?

```
int x = 0, y = 1;
if ((y >= 1) && (++x == 0)) {
    --y;
}
System.out.println(x);
1
```

- ▶ What does Java print?

```
int x = 0, y = 1;
if ( ((y > 1) && (++x == 0))
    ||
    ((y == 1) && (x++ == 0)) ) {
    --y;
}
System.out.println(x);
System.out.println(y);
```

- ▶ 1
0

Examples (cont.)

- ▶ What does Java print?

```
int x = 0, y = 0;
```

```
while (x++ <= 4) {
```

```
    y += x;
```

```
}
```

```
System.out.println (y);
```

```
=> 15
```

Programming with Side-Effects

Generally

- ▶ Side effects in conditions are hard to understand
- ▶ Good programming practice
 - Conditions should be side-effect-free
 - Side effects should be in “stand-alone statements”
- ▶ Major Goal → Strive to create the most readable and maintainable code.

Primitive Types and their Hierarchy

- ▶ double
- ▶ float
- ▶ long
- ▶ int
- ▶ short
- ▶ byte

```
int x = 7.2;  
double y = 6;
```

- ▶ Changing to something else Further Up this list is acceptable
 - called “**Widening Conversion**”
- ▶ Changing to Something else Further Down this list is not acceptable
 - called “**Narrowing Conversion**”
- ▶ **Explicit casting** needed for when you want to go lower in the list

Type Casting - implicit

Which of the following are legal?

▶ `int x = 3.5;`

Illegal: 3.5 is not an `int`

▶ `float x = 3;`

Legal: 3 is an `int`, which is also a `float`

▶ `long i = 3;`

Legal: 3 is an `int`, which is also a `long`

▶ `byte x = 155;`

Illegal: 155 is too big to be a `byte` (> 127)

▶ `double d = 3.14159F;`

Legal: 3.14159F is a `float`, which is also a `double`

Mixed Expressions with Explicit Type Casting

- ▶ What is result of
`float x = 3 / 4;`
 - x assigned value 0.0F
 - Why?
 - 3, 4 are ints
 - So integer / operation is used, yielding 0, before upcasting is performed
- ▶ To get floating point result, use explicit casting
`float x = (float) 3 / (float) 4;`
 - Assigns x the value 0.75F
- ▶ Can also do following
`float x = (float) 3 / 4;`
 - Why?
 - `(float) 3` returns a value type float (3.0F)
 - 4 is an int
 - In this case, Java compiler uses widening conversion on “lower” type (here, int) to obtain values in same type before computing operation
- ▶ Or:
`float x = 3.0f / 4;`

main method

```
public static void main(String args[]) {  
    // statements here  
}
```

- ▶ All projects and examples have defined this method
- ▶ No explicit call needed
- ▶ Parts of the line
 - Name → main
 - Parameter List → String args[]
 - Return type → void
 - Access → public (more on this later)
 - Modifier → static

Non-main static public methods: defining, invoking and commenting

- ▶ Defined based on a name and a list of parameters

```
public static void name(parameterlist){  
    body  
}
```

- ▶ Invoked by stating its name and giving an argument for each element of the parameter list

```
name(argumentlist);
```

- ▶ **parameter list**
 - type name for each item in the list
 - e.g. (MyGrid grid, char where)
- ▶ **argument list**
 - expression for each item in the list
 - e.g. (grid, 't')
- ▶ Each method must have a well defined purpose
 - That information goes into a comment before the method definition
 - Each parameter's purpose should be explained
 - Return value's purpose should be explained

Static methods

- ▶ A static method is associated with a class
 - Not an individual instance (object)
- ▶ Must have all of the same parts as the main method

```
public/private static returnType name(argList){  
    body  
}
```
- ▶ The public/private static ... component is called the prototype
- ▶ **Example:** Driver.java, Triangle.java
- ▶ Notice that in Java we can have multiple classes and one can refer to the other if they are in the same location (package)
- ▶ What happens when a method is called?
- ▶ private vs. public
- ▶ Every class in Java can have a main method
- ▶ What happens if we try to run a class without a main method?