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, Fawzi Emad, David Mount, Jan Plane
Overview

- Precedence
- Short Circuiting
- Casting
- Static Methods
**Precedence**

- Explains how to evaluate expressions
  - What is value of $1 - 2 + 3 \times 4$?
  - **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

- \( x \times y + -z \)
  Same as \((x \times y) + (-z)\)

- \((x \leq y \&\& y \leq z \mid\mid w > z)\)
  Same as \(((x \leq y) \&\& (y \leq z)) \mid\mid (w > z)\)

What is value of \( 1 - 2 + 3 \times 4 \)?

\[
= 1 - 2 + 3 \times 4 \\
= 1 - 2 + (3 \times 4) \\
= (1 - 2) + 12 \\
= -1 + 12 \\
= 11
\]
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:
  ```c
  if (2 * x++ < 5 * z + 3 && -w != x / 2)
  ```

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

- Best:
  ```c
  if (((2 * x++) < (5 * z + 3)) && (-w != (x / 2)))
  ```
Alternative #1
if ((temp >98 && temp <=100) || (systolic <=120 && diastolic < 80))...

Alternative #2
boolean tempIsOK = (.....)
boolean BPIsOK = (....)
if (tempIsOK || BPIsOK)....
As soon as Java knows an answer → it quits evaluating the expression.

What does Java print?

```java
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?
  ```java
  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

\[ \text{int } x = 7.2; \]
\[ \text{double } y = 6; \]

- 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
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

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

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

```java
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
  ```java
  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?