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 Circuited
- 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

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

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

- What is value of \(1 - 2 + 3 \times 4?\)
  
  \[
  = 1 - 2 + 3 \times 4 \\
  = 1 - 2 + (3 \times 4) \\
  = (1 - 2) + 12 \\
  = -1 + 12 \\
  = 11
  \]
Should You Rely on Precedence?

- No!

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

• What does Java print?
  ```java
  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

```java
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
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;`
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 \( \rightarrow \) main
  - Parameter List \( \rightarrow \) String args[]
  - Return type \( \rightarrow \) void
  - Access \( \rightarrow \) public (more on this later)
  - Modifier \( \rightarrow \) 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
  - 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?