University of British Columbia
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**Conditionals II**

**Lecture 11, Thu Feb 9 2006**

based on slides by Kurt Eiselt

http://www.cs.ubc.ca/~tmm/courses/cpsc111-06-spr

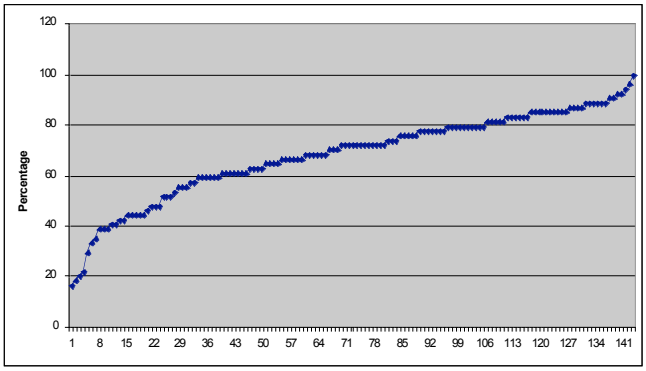
## Reading

- This week: Chapter 6 all (6.1-6.4)
- Next week: Chapter 7 all (7.1-7.4)
- Reading summary so far:
  - Chap 1, 2, 3, 4, 6
  - (no Chap 5!)

## News

- Next week is reading week
  - no lectures or labs or tutorials
- Midterms returned today
  - Grades, statistics already posted on WebCT
  - returned end of class, line up by last name reversed (Z-A)
- Assignment 1 was returned Tue
  - pick up after class if you don't have it yet

## Midterm Results




## News

- Reminder: protocol for regrade requests
  - read solution and marking scheme first, carefully
    - no regrade requests accepted until at least 24 hours after material is handed back
      - exception: arithmetic errors
  - regrade requests must be in writing (paper or email)
    - assignments: to marker (listed on cover sheet)
      - if still have dispute after discussion with TA, can escalate to instructor
    - exams: to instructor

## Recap: Static Methods

- Static methods do not operate in context of particular object
  - cannot reference instance variables because they exist only in an instance of a class
  - compiler will give error if static method attempts to use nonstatic variable
- Static method *can* reference static variables
  - because static variables exist independent of specific objects

## Recap: Static Methods in `java.Math`

- Java provides you with many pre-existing static methods
- Package `java.lang.Math` is part of basic Java environment
  - you can use static methods provided by Math class
  - examples:

```
> Math.sqrt(36)
6.0
> Math.sin(90)
0.8939966636005579
> Math.sin(Math.toRadians(90))
1.0
> Math.max(54,70)
70
> Math.round(3.14159)
3
```

```
> Math.random()
0.7843919693319797
> Math.random()
0.4253202368928023
> Math.pow(2,3)
8.0
> Math.pow(3,2)
9.0
> Math.log(1000)
6.907755278982137
> Math.log10(1000)
3.0
```

## Recap: Conditional Statement

- Conditional statement: choose which statement will be executed next based on boolean expression
  - changes control flow
- Example

```
if (age < 20)
   System.out.println("Really, you look like you are "
                      + (age + 5) + ".");
```

## Recap: Boolean Expressions

- Boolean expression: test which returns either true or false when evaluated
  - aka conditional
- Consists of operands and operators, like arithmetic expression
  - but operators only return true or false when applied to operands
- Two different kinds of operators
  - relational
    - sometime split into relational and equality
  - logical

## Recap: Relational Operators

- Tests two values (operands)
- Operators
  - == equal
    - returns true if they are equal, false otherwise
    - note: do not confuse this with =
  - != not equal
    - returns true if they are not equal, false otherwise
  - < less than
  - <= less than or equal to
  - > greater than
  - >= greater than or equal to

## Recap: Logical Operators

- Way to combine results from relational operators into single test
- AND, OR, and NOT
  - in terms from math or philosophy class
- Operators
  - && logical AND
  - || logical OR
  - ! logical NOT

## Objectives

- Understand how to compare objects and primitive data types
- Understand syntax to use for conditionals and switch statements

## Comparing Strings

- How do we test for equality between Strings?
- Reminder:
  - Strings are sequences of alphanumeric characters
  - create with constructor
    - `String firstname = new String("Donald");`
  - or with shortcut
    - `String lastname = "Duck";`
  - Strings are objects, not primitive types!

## Comparing Strings

- Relational operator == is wrong way to compare

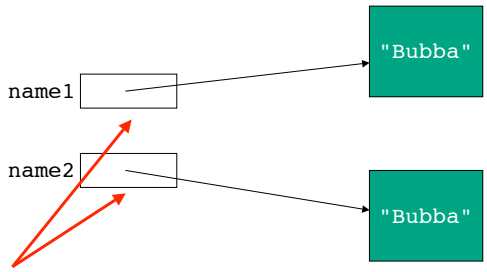
```
String name1 = "Bubba";
String name2 = "Bubba";
System.out.println(name1 == name2);  // prints false
```

- Equals method is right way to compare Strings

```
String name1 = "Bubba";
String name2 = "Bubba";
System.out.println(name1.equals(name2)); // prints true
```

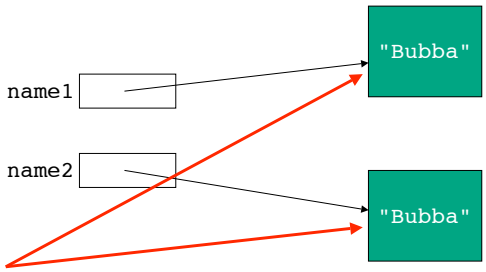
  - why? diagrams will help

## Comparing Strings




- these values tested for equality with test of **`name1 == name2`**
- two different pointers (references), so **`false`**

## Comparing Strings




- these values tested for equality with **`name1.equals(name2)`**
- contents of objects are same, so **`true`**

## Short-Circuting Evaluation

- Consider again expression

```
if ((b > a) && (c == 10))
   System.out.println("this should print");
```

- Java evaluates left to right
  - if `(b>a)` is false, does value of `(c == 10)` matter?
  - no! result of && must be false since one operand already evaluated to false
  - short-circuiting: Java does not evaluate
    - aka lazy evaluation

## Short-Circuting Evaluation

- Consider different expression

```
if ((b > a) || (c == 10))
   System.out.println("this should print");
```

- Java evaluates left to right
  - if `(b>a)` is true, does value of `(c == 10)` matter?
  - no! result of || must be true since one operand already evaluated to true

## If Syntax

- Syntax
  - reserved word **`if`**
  - followed by boolean expression enclosed in parentheses
  - followed by statement

```
if (x == y)
   System.out.println("x equals y! ");
```

- Results
  - if boolean evaluates to true, statement is executed
  - otherwise statement is skipped, execution continues with statement immediately following if statement

## If-Else Syntax

- If statement may include optional else clause
  - reserved word else
  - followed by another statement

```
if (x == y)
   System.out.println("x equals y!");
else
   System.out.println("x is not equal to y!");
```

- Results
  - if boolean evaluates to true, first statement is executed
  - otherwise (if boolean evalutes to false), statement following else is executed

## Block Statements

- Often want to do many actions, not just one, based on condition
- Replace single statement with many statements surrounded by curly braces

```
if (x == y)
{
   System.out.println("x equals y!");
   System.out.println("I'm happy");
}
else
{
   System.out.println("x is not equal to y");
   System.out.println("I'm depressed");
   System.out.println("How about you?");
}
```

## Block Statements

- What if we leave out block in else clause?

```
if (x == y)
{
   System.out.println("x equals y!");
   System.out.println("I'm happy");
}
else
   System.out.println("x is not equal to y");
   System.out.println("I'm depressed");
   System.out.println("How about you?");
```

## Nested If Syntax

- Statements within if-else statements can themselves be if-else statements

```
public class NestTest
{
  public static void main (String[] args)
  {
    int x = 1; int y = 3; int z = 2;

    if (x == y)
        if (y == z)
        {
            System.out.println("all three values the same");
        }
        else
        {
            System.out.println("y is not equal to z");
        }
    else
        System.out.println("x is not equal to y");
  }
}
```

## Nested If Syntax

- Multiple **`else`** statements also legal

```
if( Boolean expression 1 )
{
    // statements
}
else if( Boolean expression 2 )
{
    // statements
}
else if( Boolean expression 3 )
{
    // statements
}
else
{
    // statements
}
```

## Nested If Syntax

- Rewriting `NestTest` using multiple else statements

```
public class NestTest2
{
  public static void main (String[] args)
  {
    int x = 1; int y = 3; int z = 2;

    if ((x == y) && (y == z))
    {
        System.out.println("all three values the same");
    }
    else if ((x == y) && (y != z))
    {
        System.out.println("y is not equal to z");
    }
    else
        System.out.println("x is not equal to y");
  }
}
```

## Comparing Floating Point Numbers

- Is 0.3 the same thing as 1.0/10.0 + 1.0/10.0 + 1.0/10.0 ???
- Let's try it out...

```
double sum = 1.0/10.0 + 1.0/10.0 + 1.0/10.0;
double literal = .3;
if (sum == literal)
   System.out.println ("Yup, they match");
else
   System.out.println ("Nope, don't match");
System.out.println("Sum is "+sum+" literal +" literal);
```

## Comparing Floating Point Numbers

- Is 0.3 the same thing as 1.0/10.0 + 1.0/10.0 + 1.0/10.0 ???
- No - very close, but not exactly what you expect
  - 0.30000000000000004
- Beware! Write tests for "darn near equal" like:

```
if (Math.abs(f1 - f2) < TOLERANCE)
   System.out.println ("Essentially equal.");
```

  - where TOLERANCE is small number appropriate to problem like 0.00000001

## Comparing Characters

- You can compare character types with relational operators

```
'a' < 'b'
'a' == 'b'
'a' < 'A'
```

- Remember, cannot compare Strings with relational operators
  - or any other objects!
  - must use methods like equals

## Switch Syntax

- Use switch statement to get program to follow one of several different paths based on single value

```
switch (finalMark)
{
    case 4:
        System.out.println("You get an A");
        break;
    case 3:
        System.out.println("You get a B");
        break;
    case 2:
        System.out.println("You get a C");
        break;
    default:
        System.out.println("See you next year");
}
```

## Switch Syntax

- Expression should be int, char
  - (or enumerated type)

```
switch (finalMark)
{
    case 4:
        System.out.println("You get an A");
        break;
    case 3:
        System.out.println("You get a B");
        break;
    case 2:
        System.out.println("You get a C");
        break;
    default:
        System.out.println("See you next year");
}
```

## Switch Syntax

- Case values cannot be variables

```
switch (finalMark)
{
    case 4:
        System.out.println("You get an A");
        break;
    case 3:
        System.out.println("You get a B");
        break;
    case 2:
        System.out.println("You get a C");
        break;
    default:
        System.out.println("See you next year");
}
```

## Switch Syntax

- Default statement optional, but very good idea

```
switch (finalMark)
{
    case 4:
        System.out.println("You get an A");
        break;
    case 3:
        System.out.println("You get a B");
        break;
    case 2:
        System.out.println("You get a C");
        break;
    default:
        System.out.println("See you next year");
}
```

## Switch Syntax

- Break statements really important

```
switch (finalMark)
{
    case 4:
        System.out.println("You get an A");
        break;
    case 3:
        System.out.println("You get a B");
        break;
    case 2:
        System.out.println("You get a C");
        break;
    default:
        System.out.println("See you next year");
}
```