THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

COMP 110
Introduction to Programming

Fall 2015

Time: TR 9:30 – 10:45

Room: AR 121 (Hanes Art Center)

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Previous Class

- What did we discuss?

Today

- Announcements
  - Lab1: **due Wed, Sep 9 at 11:55 PM**
  - Midterm is on Thu, Oct 8
- Scanner
- String
- If-else

Some Scanner Class Methods

Scannner_Object_Name`.next()`
Returns the `String` value consisting of the next keyboard characters up to, but not including, the first delimiter character. The default delimiters are whitespace characters.

Scannner_Object_Name`.nextLine()`
Reads the rest of the current keyboard input line and returns the characters read as a value of type `String`. Note that the line terminator `'\n'` is read and discarded; it is not included in the string returned.

Scannner_Object_Name`.nextInt()`
Returns the next keyboard input as a value of type `int`.

Scannner_Object_Name`.nextDouble()`
Returns the next keyboard input as a value of type `double`.

Scannner_Object_Name`.nextFloat()`
Returns the next keyboard input as a value of type `float`.

Some `Scanner` Class Methods

Scannner_Object_Name`.nextLong()`
Returns the next keyboard input as a value of type `long`.

Scannner_Object_Name`.nextByte()`
Returns the next keyboard input as a value of type `byte`.

Scannner_Object_Name`.nextShort()`
Returns the next keyboard input as a value of type `short`.

Scannner_Object_Name`.nextBoolean()`
Returns the next keyboard input as a value of type `boolean`. The values of `true` and `false` are entered as the words *true* and *false*. Any combination of uppercase and lowercase letters is allowed in spelling *true* and *false*.

Scannner_Object_Name`.useDelimiter(`*Delimiter_Word*`);`
Makes the string *Delimiter_Word* the only delimiter used to separate input. Only the exact word will be a delimiter. In particular, blanks, line breaks, and other whitespace will no longer be delimiters unless they are a part of *Delimiter_Word*.

This is a simple case of the use of the `useDelimiter` method. There are many ways to set the delimiters to various combinations of characters and words, but we will not go into them in this book.

`nextLine()` Method Caution

- The `nextLine()` method reads
  - The remainder of the current line,
  - Even if it is empty.

`nextLine()` Method Caution

- Example – given following declaration.

```
int n;
String s1, s2;
n = keyboard.nextInt();
s1 = keyboard.nextLine();
s2 = keyboard.nextLine();
```

- Assume input shown

```
42
and don't you forget it.
```

`n` is set to `42`

but `s1` is set to the empty string.

The class String

- String
  - sequence of zero or more characters
  - enclosed in double quotation marks
  - null or empty strings have no characters
  - numeric strings consist of integers or decimal numbers
  - length is the number of characters in a string
- The class String is used to manipulate strings
- Examples:
  - "Hello World"
  - "1234"
  - "45.67"
  - ""

Strings

- Every character has a position in the string (starting with 0)

```
"Hello World"
 0123456789...
```

- The length of the string is the number of characters in it
  - what's the length of `"Hello World"`?

    11
    (count the space)

Parsing Numeric Strings

- In Java, input from the user comes in the form of a string
  - we need to know how to get the numeric values out of the string
- Numeric String
  - a string with only integers or decimal numbers
  - "6723", "-823", "345.76"

String Concatenation

- A string cannot be split between two lines

X
```
String greeting = "How are you doing
                  today";
```

- Concatenation (**+**) - produces one string where the second string has been appended to the first

```
String greeting = "How are you doing" +
                  " today?";
```

greeting **How are you doing today?**

String Concatenation

- Operator + can be used to concatenate two strings or a string and a numeric value or character
- Precedence rules still apply
- Example:

```
String str;
int num1 = 12, num2 = 26;
str = "The sum = " + num1 + num2;
```

str **The sum = 1226**

Questions

What is the result of the following String concatenations?

```
String str1 = "Hello";
String str2 = "World";
String str3 = str1 + " " + str2;
```

str3 **Hello World**

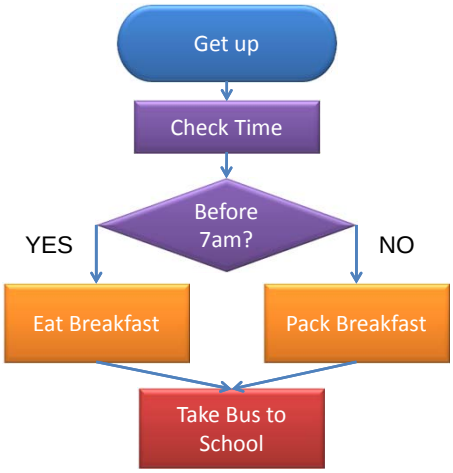
```
int num1 = 10;
int num2 = 2;
String str = "The difference is " +
             (num1 - num2);
```

str **The difference is 8**

Flow of Control

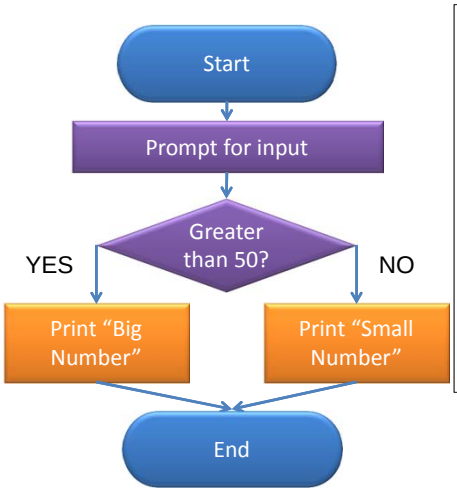
- *Flow of control* is the order in which a program performs actions.
  - Up to this point, the order has been sequential.
- A *branching statement* chooses between two or more possible actions.
- A *loop statement* repeats an action until a stopping condition occurs.

Flow Chart




```
Student.getUp();
if (time < 7) {
  Student.eatBreakfast();
}
else { // time >= 7
  Student.packBreakfast();
}
Student.takeBus();
```


Java Example




```
import java.util.*;

public class FlowChart {
  public static void main(String[] args) {
    System.out.println("Give me an integer:");
    Scanner keyboard = new Scanner(System.in);
    int inputInt = keyboard.nextInt();
    if (inputInt > 50)
    {
      System.out.println("Big number");
    }
    else
    {
      System.out.println("Small number");
    }
  }
}
```

What if your input is exactly 50?

If and Else

– Take two minutes and write down an example pseudocode of one If and Else Statement

– For example:

```
if (avgQuizGrade >= 90) {
        Topic.startNext();
}
else {
        Topic.redoLast();
}
```


Java Comparison Operators

FIGURE 3.4 Java comparison operators

Math Notation	Name	Java Notation	Java Examples
=	Equal to	==	`balance == 0` `answer == 'y'`
≠	Not equal to	!=	`income != tax` `answer != 'y'`
>	Greater than	>	`expenses > income`
≥	Greater than or equal to	>=	`points >= 60`
<	Less than	<	`pressure < max`
≤	Less than or equal to	<=	`expenses <= income`

Expressions

- Expression?
  - An **expression** can be a variable, a value, or a combination made up of variables, values and operators
  - An expression **has a value**
  - **Arithmetic expression**: a combination of numbers with a number value
    - *10, taxRate/100, (cost + tax) * discount*
  - **String expression**: a combination of Strings with a String value
    - *"Hello", "The total cost is " + totalCost*

Boolean Expressions

- A combination of values and variables by comparison operators. Its value can only be ***true*** or ***false***
- Example expressions
  - *5 == 3; // false*
  - *variable <= 6; // depends on the value of variable*
    - What if variable is 5? What if variable is 6?
  - *myInt != temp; // depends on both values*
    - What if myInt is 0 and temp is 2?

Syntax for IF statement

- Syntax rule for if statement:
  - *if (boolean expression)*
    { statements; }

&&: and

- What if you need multiple expressions to be true?
- Syntax rule:
  - *(expression) && (expression) && …*
    - Expressions go in ( )
  - (Time < 7) && (I've prepared breakfast)
- Will only be true if **ALL** statements are true

||: or

- What if you need ONE expression to be true out of many expressions
- Syntax rule:
  - ***(expression)*** **||** ***(expression)*** **|| …**
    - Again, expressions go in ( )
  - (I've had breakfast) || (Time > 7)
- Will be true if **ONE** expression is true

!: not

- Syntax rule:
  - ***!(expression)***
    - Again, expressions go in ( )
  - !(I've had breakfast)
- Will be **true** if the expression is **false**
- **! is not recommended**
  - **You will get confused. Try to write expressions straightforward**
    - Use (cost != 3) instead of !(cost == 3)
    - Use (time <= 7) instead of !(time > 7)

Logical Operators

FIGURE 3.7 The Effect of the Boolean Operators && (*and*), || (*or*), and ! (*not*) on Boolean Values

Value of *A*	Value of *B*	Value of *A* && *B*	Value of *A* || *B*	Value of ! (*A*)
true	true	true	true	false
true	false	false	true	false
false	true	false	true	true
false	false	false	false	true

Comparison vs. Logical Operators

- Comparison operators connect values or variables
  - After connection, it's a boolean expression
  - *a > b*
  - *c == d*
- Logical operators connect boolean expressions
  - *(a > b) && (c == d)*

More Complex Boolean Expressions

- Combination of && and ||
  - *(((3 < 7)||(2==5)) && ((4!=2) && (1 <= 1)))*
  - *(((true)||(false)) && ((true) && (true))*
  - *(true) && (true)*
  - *true*
- ***if*** *(((I'm at Subway) && (You're at Subway)) ||*
  ((I'm at Starbucks) && (You're at Starbucks))

```
{
    I will see you;
}
```


Boolean Variable

- A boolean variable saves a boolean value

```
    boolean systemsAreOK =
  ((temperature <= 100) && (thrust >= 12000) && (cabinPressure > 30));
// You can use "=" to assign a boolean value to a boolean variable
if (systemsAreOK){
// It's the same as if (systemsAreOK == true)
   System.out.println("Initiate launch sequence.");
    }
else{
    System.out.println("Abort launch sequence.");
    }
```

Assignment vs. Equal To

- *int n1=1;*
- *Int n2=2;*
- *if (n1 = n2) {…}*
  - **Error!!!!** It's an assignment statement!
- *if (n1 == n2) {…}*
  - Correct. It's a boolean expression now.

Some Terminology follows…

Class Loader

- A Java program typically consists of several pieces called *classes.*
- Each class may have a separate author and each is compiled (translated into byte-code) separately.
- A *class loader* (called a *linker* in other programming languages) automatically connects the classes together.

Programmer, User, Package…

- The person who writes a program is called the *programmer.*
- The person who interacts with the program is called the *user.*
- A *package* is a library of classes that have been defined already.
  - `import java.util.Scanner;`

Arguments, Variables…

- The item(s) inside parentheses are called *argument(s)* and provide the information needed by methods.
- A *variable* is something that can store data.
- An instruction to the computer is called a *statement*; it ends with a semicolon.
- The grammar rules for a programming language are called the *syntax* of the language.

Programming

- Programming is a creative process.
- Programming can be learned by discovering the techniques used by experienced programmers.
- These techniques are applicable to almost every programming language, including Java.

Object-Oriented Programming

- Our world consists of *objects* (people, trees, cars, cities, dogs, etc.).
- Objects have state and behavior. A car has *state* (model, color, fuel level, etc), and *behavior* (start, change gear, brake, etc).
- An object's behavior can affect its state and the state of other objects.
- Object-oriented programming (*OOP*) treats a program as a collection of objects, each with behaviors and state.

OOP Terminology

- Behaviors are included as *methods.*
- State is contained in a set of attributes.
- A class defines the methods and attributes.
- An object is an instance of a class. A program may have several instances of a class. (myCar, yourCar, herCar)
- Each object (instance of a class) has a the same set of methods, but its own attribute values. (state)

Scanner Class

```
Scanner keyboard = new Scanner(System.in);
keyboard.nextLine();
```

- **`Scanner`** is a class
- **`keyboard`** is an instance of the Scanner class
- **`nextLine()`** is a method (behavior) of the Scanner class.
- The Scanner has an internal attribute (state) which stores the delimiter.

Scanner Class

- The object performs an action when you *invoke* or *call* one of its methods

```
objectName.methodName(argumentsTheMethodNeeds);
```

Algorithms

- By designing methods, programmers provide actions for objects to perform.
- An *algorithm* describes a means of performing an action.
- Once an algorithm is defined, expressing it in Java (or in another programming language) usually is easy.

Algorithms

- An algorithm is a set of instructions for solving a problem.
- An algorithm must be expressed completely and precisely.
- Algorithms usually are expressed in English or in *pseudocode.*

Next class

- More if-else

→ Reading Assignment: Chapter 2