

Lecture Set #3: Conditional and Iterative Structures

Control Structures

- if branching
- if / else branching
- logical operators
- nesting of control structures
- proper indenting and spacing conventions
- java identifier naming conventions
- named constants
- while loop
- do-while loop
- for loop



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Control Flow and Conditionals



- **Control flow:** the order in which statements are executed
 - General rule: top to bottom
 - Several Control Structures that change that
- **Conditional statements:** permit control flow to be dependent on (true/false) conditions
 - if
 - if-else

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if and if-else



The if and if-else statements should have the following form:

- ```
if (condition) {
 statements;
}
```

  - tests the condition
  - if true statement is done; otherwise it is skipped
- ```
if (condition) {  
    statements1;  
} else {  
    statements2;  
}
```

 - tests the condition
 - if true, statements1 is done; otherwise statements2 is done

Java and White Space



You can add: carriage returns, spaces, tabs

wherever you want in Java

Properly used, this makes your program easier to read and understand

About Java

The following web pages provide detailed references to information about

Sun's "Code Conventions"

Guide for proper style when programming in Java.

Sun's Java Homepage

It is the place to come when you really need the latest technical sp

Sun's Java Tutorial

This page has a number of links to books and web pages about Ja

Java SDK 5.0 General Documentation

This page contains technical documentation for the Java Software

<http://java.sun.com/docs/codeconv/html/CodeConvTOC.doc.html>

Logical Operators

Used for forming more complex conditions.



- “and” &&

```
if ( temp >= 97 && temp <= 99 ) {  
    System.out.println( "Patient is healthy" );  
}
```

- “or” ||

```
if ( months >= 3 || miles >= 3000 ) {  
    System.out.println( "Change your oil" );  
}
```

- “not”: !

```
if ( ! phone.equals( "301-555-1212" ) ) {  
    System.out.println( "Sorry, wrong number" );  
}
```

- **Short Circuiting**

- Once the answer is known – stop evaluation of the expression

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Blocks



- What happens?

```
if ( i > 10 )  
    i = 10;  
    saturate = true;
```

- Desired: both `i`, `saturate` are set only when `i > 10`
- Actual: only the `i=10` statement is dependant
 - Only one statement can be associated with `if`
 - The `saturate` assignment statement is not part of the `if`
- **Blocks** solve this problem

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Blocks

- What happens?

```
if (i > 10)
    i = 10;
    saturate = true;
else
    k = 100;
```
- Desired: both `i`, `saturate` are set only when `i > 10`
- Actual: syntax error
 - Only one statement can be associated with `if`
 - The `saturate` assignment statement is not part of the `if`
 - The `else` can't find the `if` it belongs to
- **Blocks** solve this problem also

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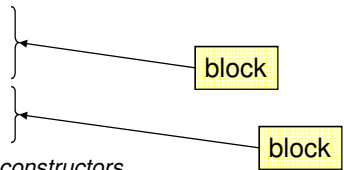


What Blocks Are

- Blocks are sequences of statements "glued together" into one
- Form:

```
{
    <statement 1>;
    <statement 2>;
    ...
}
```
- Example:

```
if (i > 10) {
    i = 10;
    saturate = true;
} else {
    i = i+1;
}
```


- `if`, `if-else`, `{...}` are *statement constructors*
 - They take statement(s) and convert them into a new statement
 - Implications: `if` statements, etc. can also appear inside ("be nested within") one another

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Issues with if-else



- Nested If/Elses can be Ugly and Confusing!
 - indent and block carefully
- The “Dangling Else” Problem
 - Java rule: else is associated with “innermost” possible if
- Cascading Elses
- WE WILL USE { ... } FOR ALL IF, IF-ELSE, IF-ELSE-IF, STATEMENTS

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In Projects



- You must use **meaningful variable names**
 - it must tell the purpose of that variable – what it is meant to hold
 - it can not have so much abbreviation that only you can read it
- You must use Java convention indenting and brace placement
 - the indenting show the purpose in nesting
 - with braces in the “Java determined” places with respect to the lines of code
- Java convention of capitalization of identifiers
 - variables and methods start with lower case
 - classes and interfaces start with upper case
 - variables, methods, classes and interface use camelCase
 - constants are all uppercase with underscores between words
- You must have “Fully Blocked” if statements and looping structures
- You must have all lines less than or equal to 80 columns of text
- You must use **named constants** for any literal values that will not change during program execution

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Named Constants

- If same value should be used in several places, how to ensure consistency?
 - i.e. Check on temperature may be performed more than once
 - i.e. Same prompt might be printed in several places
- `final int MAX_OK_TEMP = 99;`
 - Just like a regular variable declaration/initialization, except...
 - Special term `final`
 - Necessity of initial value
 - Any valid variable name will work, but convention is to use all capitals
- Difference from non-final variables: assignment attempt leads to error!
- **literals** (= named values)

e.g.

```
if (temp >= 212 || temp <= 32) ...  
if (temp >= BOILING || temp <= FREEZING)
```

e.g.

```
System.out.print ("Enter integer: ");  
System.out.print (PROMPT);
```

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Naming Rules and Conventions

- What is legal for variable names?
 - Letters, digits, \$, _
 - Can't start variable name with digit
 - Avoid reserved words
 - Avoid names starting or ending with \$ or _
- Use camelCase:
 - Variables & Methods use lower-case for first letter
 - Classes/Interfaces use upper-case for first letter
- **Naming Conventions:** Standards developed over time.
 - Variables and methods:** Start with lowercase, and use uppercase for each new word:
`dataList2 myFavoriteMartian showMeTheMoney`
 - Class names:** Start with uppercase and uppercase for each new word:
`String JOptionPane MyFavoriteClass`
 - Named constants** (variables whose value never changes): All uppercase with underscores between words:
`MAX_LENGTH DAYS_PER_WEEK BOILING_POINT`
- Make variable names not too long, not too short
 - **Bad:** `crlltm`
 - **Bad:** `theCurrentItemBeingProcessed`
 - **Good:** `currentItem`

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Meaningful Variable Names

- Choose names for your variables to reflect their purpose
- Bad

```
String string = "";  
System.out.println ("Enter name: ");  
string = sc.next();  
if (string.equals ("John Doe")) ...
```

- Good

```
String name = "";  
System.out.println ("Enter name: ");  
name = sc.next();  
if (name.equals ("John Doe")) ...
```



Loops in Java

- So far our programs execute every program statement at most once
- Often, we want to perform operations more than once:
 - "Sum all numbers from 1 to 10"
 - "Repeatedly prompt user for input"
- Loops allow statements to be executed multiple times. Loop types in Java:
 - while
 - do-while
 - for
- Call "iteration"



while and do-while Loops

- **while** and **do-while** loops contain:
 - A statement, called the **body**
 - A boolean **condition**
 - Idea: the body is executed one more time as long as the condition is true
- **while-loop**: The condition is tested before each body execution

```
while ( <condition> ) {  
    <body>  
}
```
- **do-while-loop**: The condition is tested after each body execution

```
do{  
    <body>  
} while ( <condition> );
```
- **Main difference**: do-while loop bodies always executed at least once because it is “bottom tested” rather than “top tested”



Types of loops

- indefinite iteration
 - usually tests something that is coming from outside the loop structure (e.g. input)
 - needs to eventually change from true to false
- counted iteration
 - something that is controlled inside the loop
 - to start at some value and count up or down until some set ending point



for loop

- **for-loop**: The counter is set, the condition is tested before each body execution, the update is performed at the end of each iteration

```
for (<initialization>; <condition>; <update>) {  
    <body>  
}
```

- Usually used for counted loops, but any of the parts can be left empty.



Infinite Loops

- Loops can run forever if condition never becomes false
- Be careful when programming loops!
 - Add statements for termination into loop body first
 - Often these statements are at end of body
 - e.g.

```
while (i <= 10) {  
    System.out.println(i);  
    i = i + 1;  
}
```



Variables, Blocks and Scoping

- Variables can be declared anywhere in a Java program
- When are the declarations active?
 - After they are executed
 - *Only inside the block in which they are declared*
- **Scope rules** formalize which variable declaration are active when
 - **Global variables**: scope is entire program
 - **Local variables**: scope is a block



Nested Loops

- while, do-while are statement constructors (like if and if-else: they use blocks)
- Loops can thus be used inside other loops!



Nesting Example

```
public class NestedLoops {  
  
    public static void main(String[] args) {  
  
        int rowNumber = 1;  
        while (rowNumber < 10) {  
            int colNumber = 1;  
            while (colNumber < 10) {  
                System.out.print((rowNumber + colNumber) % 2);  
                colNumber = colNumber + 1;  
            }  
            System.out.println();  
            rowNumber = rowNumber + 1;  
        }  
    }  
}
```

Inner loop

Outer loop

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