Selection and Repetition Revisited

CSC 1051 – Data Structures and Algorithms I

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Some slides in this presentation are adapted from the slides accompanying Java Software Solutions by Lewis & Loftus
Selection structures in Java

• Conditional statement:

```java
if (n > 0)
    System.out.print("positive");
else
    System.out.print("negative");
```

• Other selection structures (Chapter 6 in text)
  – the `conditional` operator
  – the `switch` statement
The Conditional Operator Syntax

```
condition ? expression1 : expression2
```

- If the `condition` is true, `expression1` is evaluated; if it is false, `expression2` is evaluated
- The value of the entire conditional operator is the value of the selected expression
- Example: Rewrite this →

```java
if (n > 0)
    System.out.print("positive");
else
    System.out.print("negative");
```
The conditional operator is **not a statement**

```java
(n > 0) ? System.out.print("positive") : System.out.print("negative");
```
More examples:

```java
int bit = (ans.equalsIgnoreCase("Yes") ? 1 : 0);
String status = (age < 18 ? "child" : "adult");
```

- The conditional operator requires three operands so it is sometimes called the **ternary** operator.

Hands on: try this in the Person class!
Try this:

Using `if/else`:

```javascript
if (HAPPY)
    page.drawArc (x+15, y+30, 20, 10, 180, 180);
else
    page.drawArc (x+15, y+30, 20, 10, 0, 180);
```

– Rewrite using conditional operator:
Try this:

*Rewrite this statement so that "Dime" is printed if num equals 1.*

```java
System.out.println ("Your change is " + num + "Dimes");
```

use conditional operator:
The **switch** Statement: multi-way branches

Recall: Logic of an if-else statement
The **switch** Statement: multi-way branches

**switch** statement logic

Note: this is a simplified flowchart of the logic of the switch statement
The switch Statement - example

```java
public String toString()
{
    String result = "";
    switch (faceValue)
    {
        case 1:
            result = "one";
            break;
        case 2:
            result = "two";
            break;
        case 3:
            result = "three";
            break;
    }
    return result;
}
```

Hands on: try this in the Die class!

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The switch Statement in general

```java
switch (expression)
{
    case value1:
        statement-list1
    case value2:
        statement-list2
    case value3:
        statement-list3
    default:
        statement-list-n
}
```

- integer, char, or enumerated types (Java 7 also allows Strings)
- NO floating point values
- NO ranges of values (eg: 0<x<10)

If `expression` matches `value2`, control jumps to here

If none of the values match the `expression`, control jumps to here
So… the logic of the switch is more like this:

Note: this is still a simplified flowchart of the logic of the switch statement
import java.util.Scanner;

public class GradeReport
{
    // Reads a grade from the user and prints comments accordingly.
    public static void main (String[] args)
    {
        int grade, category;

        Scanner scan = new Scanner (System.in);

        System.out.print ("Enter a numeric grade (0 to 100): ");
        grade = scan.nextInt();

        category = grade / 10;

        System.out.print ("That grade is ");
        continue
continue

```java
switch (category) {
    case 10:
        System.out.println("a perfect score. Well done.");
        break;
    case 9:
        System.out.println("well above average. Excellent.");
        break;
    case 8:
        System.out.println("above average. Nice job.");
        break;
    case 7:
        System.out.println("average.");
        break;
    case 6:
        System.out.println("below average. You should see the");
        System.out.println("instructor to clarify the material "
        + "presented in class.");
        break;
    default:
        System.out.println("not passing.");
}
```

Hands on: try removing one of the break statements

Sample Run

Enter a numeric grade (0 to 100): 91
That grade is well above average. Excellent.
import java.util.Scanner;

public class SwitchExample {
// Example of using a switch statement. Counts number of digits, zeros,
// whitespace, and others in a line of input.

public static void main (String[] args) {
    Scanner scan = new Scanner(System.in);
    int digits = 0, zeros = 0, whitespace = 0, other = 0;

    System.out.print("Input line>");
    String message = scan.nextLine();

    int count = 0;
    continue

    Sample Run
    Input line>10, 9, 8, 7, 6, 5, 4, 3, 2, 1, Lift off!
    11 Digits, of which 1 is a zero
    11 whitespace
    18 others
while (count < message.length()) {
    switch (message.charAt(count)) {
        case '0':  zeros++;
        case '1':
        case '2':
        case '3':
        case '4':
        case '5':
        case '6':
        case '7':
        case '8':
        case '9':  digits++; break;
        case ' ':  case '\t': whitespace++; break;
        default:   other++;
    } // end switch
    count++;
} // end while
System.out.print(digits + " Digit" + (digits==1 ? "" : "s");
System.out.print("", of which " + zeros);
System.out.println((zeros==1 ? " is a zero " : " are zeros ");
System.out.println(whitespace + " whitespace");
System.out.println(other + " other" + (other==1 ? "" : "s");
}
Loops revisited: do & for loops

Repetition structures in Java, so far:

**while** loop:

```java
int count = 0;
while (count < 5)
{
    System.out.println (count);
    count++;
}
```

- Other repetition structures (Chapter 6 in text)
  - the **do** loop
  - the **for** loop
The **do** Statement in Java

• A **do** *statement* has the following syntax:

```java
do {
    statement-list;
} while (condition);  //end do
```

• The *statement-list* is executed once initially, and then the *condition* is evaluated.

• The *statement-list* is executed **repeatedly** until the condition becomes *false*.
The **while** and **do** loops are similar.

```java
int count = 0;
while (count < 5)
{
    System.out.println (count);
    count++;
}
```

```java
int count = 0;
do
{
    System.out.println (count);
    count++;
} while (count < 5);
```
Similar – but not the same:

while Loop

condition evaluated

true

statement

false

condition evaluated

true

statement

false

int count = 0;
while (count < 5)
{
    System.out.println (count);
    count++;
}

do Loop

statement

true

condition evaluated

false

int count = 0;
do
{
    System.out.println (count);
    count++;
} while (count < 5);

• The body of a do loop executes at least once
Try this:

• Write a do loop to print the even numbers from 2 to 100.
For some things the **do** loop is more appropriate:

```java
System.out.println(“input a number >5”);
int num = scan.nextInt();

while (num <= 5)
{
    System.out.println(“type a number >5”);
    num = scan.nextInt();
}
```

```java
do
{
    System.out.println(“type a number >5”);
    num = scan.nextInt();
} while (num <= 5);
```
For some things the **do** loop is more appropriate:

```java
int answer = 1;
while (answer == 1)
{
    System.out.print("Enter QP ");
    qp = scan.nextInt();

    System.out.print ("Enter Credits ");
    credits = scan.nextInt();

    gpa = (double) qp / credits;
    System.out.println("GPA = " + gpa);
    System.out.print("Again? 1=yes,0=no ");
    answer = scan.nextInt();
}
System.out.println("Thank you. Goodbye.");
```

repeating a computation
Another example: ReverseNumber.java

```java
import java.util.Scanner;
public class ReverseNumber {
    public static void main (String[] args) {
        int number, lastDigit, reverse = 0;
        Scanner scan = new Scanner (System.in);
        System.out.print ("Enter a positive integer: ");
        number = scan.nextInt();
        do {
            lastDigit = number % 10;
            reverse = (reverse * 10) + lastDigit;
            number = number / 10;
        } while (number > 0);
        System.out.println ("That number reversed is " + reverse);
    }
}
```

Sample Run

Enter a positive integer: 2896
That number reversed is 6982
Another example: EvenOdd.java

```java
import javax.swing.JOptionPane;

public class EvenOdd {
    // Determines if the value input by the user is even or odd.
    // Uses multiple dialog boxes for user interaction.
    public static void main (String[] args)
    {
        String numStr, result;
        int num, again;
        do
        {
            numStr = JOptionPane.showInputDialog("Enter an integer: ");
            num = Integer.parseInt(numStr);

            result = "That number is " + ((num%2 == 0) ? "even" : "odd");

            JOptionPane.showMessageDialog(null, result);
            again = JOptionPane.showConfirmDialog(null, "Do Another?");
        }
        while (again == JOptionPane.YES_OPTION);
    }
}
```

The JOptionPane class provides methods for creating dialog boxes.
import javax.swing.JOptionPane;

public class EvenOdd
{
    public static void main (String[] args)
    {
        String numStr, result;
        int num, again;
        do
        {
            numStr = JOptionPane.showInputDialog("Enter an integer: ");
            num = Integer.parseInt(numStr);
            result = "That number is " + ((num%2 == 0) ? "even" : "odd");
            JOptionPane.showMessageDialog(null, result);
            again = JOptionPane.showConfirmDialog(null, "Do Another?");
        }
        while (again == JOptionPane.YES_OPTION);
    }
}
**for**: a loop with built in “counter”

- **Initialization**
- **Condition evaluated**
  - True
  - Statement
  - Increment
  - False

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**for**: a loop with built in “counter”

```java
int count = 0;
while (count < 5) {
    System.out.println (count);
    count++;
}
Example
```
**for**: a loop with built in “counter”

```java
for (int count = 0; count < 5; count++)
    System.out.println (count);
```

**Example**

```java
int count = 0;

while (count < 5)
{
    System.out.println (count);
    count++;
}
```
The **for** Statement

- A **for** loop is functionally equivalent to the following **while** loop structure:

```plaintext
initialization;
while ( condition )
{
    statement;
    increment;
}
```

```plaintext
for ( initialization ; condition ; increment )
    statement;
```
The for Statement

- A for statement has the following syntax:

```plaintext
for ( initialization ; condition ; increment )
    statement;
```

- The initialization is executed once before the loop begins.
- The condition is tested after the initialization and again before each iteration.
- The increment is executed at the end of each iteration.
- The statement is executed while the condition is true.
The **for** Statement - Example

- A **for statement** has the following syntax:

```
for (int count = 0; count < 5; count++)
    System.out.println (count);
```

- The **initialization** is executed once before the loop begins.
- The **condition** is tested after the **initialization** and again before each iteration.
- The **increment** is executed at the end of each iteration.
- The **statement** is executed while the **condition** is true.
The **for** Statement

- The increment section can perform any calculation:

```java
for (int num=100; num > 0; num -= 5)
    System.out.println (num);
```

A **for** loop is well suited for executing statements a specific number of times that can be calculated or determined in advance.
Try this:

• Write a for loop to print the even numbers from 2 to 100.
Example: ReverseNumberAsString.java

```java
import java.util.Scanner;

public class ReverseNumberAsString {
    public static void main (String[] args)
    {
        int number;
        String reverse = "";
        Scanner scan = new Scanner (System.in);

        System.out.print ("Enter a positive integer: ");
        number = scan.nextInt();
        String original = Integer.toString(number);

        for (int i=0; i<original.length(); i++)
            reverse = original.charAt(i) + reverse;

        System.out.println ("That number reversed is " + reverse);
    }
}
```

Sample Run

Enter a positive integer: 2896
That number reversed is 6982
Example: Stars.java

```java
public class Stars {
    public static void main (String[] args) {
        final int MAX_ROWS = 10;

        for (int row = 1; row <= MAX_ROWS; row++) {
            for (int star = 1; star <= row; star++)
                System.out.print (*");

            System.out.println();
        }
    }
}
```

Output

```
*
**
***
****
*****
******
*******
********
*********
**********
```

Exercise: can you make it print the row number in (1, 2, 3… ) at the beginning of each line?