Handout 5

Loops.

Loops implement repetitive computation, a k a iteration.

Java loop statements:

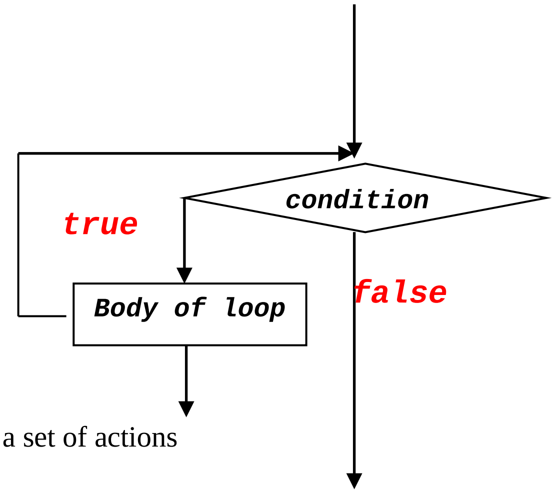
```
while
do-while
for
```

1. Start with the *while-loop.* Syntax

```
while(condition)
      Statement;     //body of loop


      or

while(condition)
{
         //body of loop
         First_Statement;
              ...
         Last_Statement;
}
```



Several logical loop organizations

1. counting loops – know exactly how many times to repeat a set of actions
   - usually done with a use of a counter variable
   - counter is initialized before the loop starts executing
   - counter is updated after each iteration of the loop

Example: print numbers from 0 to m.

```
public class SimpleCountingLoop {
    public static void main(String[] args) {
       int i = 0; // the counter variable - to keep track of
                   // number of times gone through the loop
       int m = 5;
       while (i < m){
          System.out.println("i is " + i + " now.");
          i++;
       }
      System.out.println("Done. i is " + i );
   }
}
```

Question: What will happen if m = -5? If the `i++;` in the loop body is omitted?

Programming and Debugging Pitfalls: infinite loops, off by one

Practice problems: for all the problems, assume Scanner kb = new Scanner (System.in);

1. Write a code segment that allows the user to enter 10 numbers and computes and prints out their sum, average, product.

2. Write a code segment that asks the user how many numbers there are in a list, then allows the user to enter the numbers and computes and prints out the smallest and the largest number.

3. Write a code segment that prints out all characters of a string one character per line.

2.condition controlled loops – repeat while a certain condition is true

- sentinel-controlled loops – stop repeating when a certain *sentinel* value is encountered

Examples:

1. Let user input numbers until user enters 0.

0 is the **sentinel** in this case.

```
Scanner kbrd =  new Scanner (System.in);
aNum = kbrd.nextInt();
while ( aNum != 0 ) {
      System.out.print(aNum);
      aNum = kbrd.nextInt() ;

}
```

Practice problems:

1. Write a code segment that continues to read a number from its user, until an *even* number is entered.

2. Write a code segment that continues to read user input until the user enters a number between 0 and 9.

- boolean flag controlled loops – stop when a boolean variable that reflects a certain state is false

  Example: describe what happens, when the following code segment is executed.

```
Scanner kb = new Scanner(System.in);
      System.out.println("Please enter a number:");
      int prevNum = kb .nextInt();
      int currNum;
      boolean nomatch = true; // boolean flag
      while (nomatch) // same as nomatch == true
      {
           System.out.println("Please enter next number:");
           currNum = kb.nextInt();
           if (currNum == prevNum)
                nomatch = false;
           prevNum = currNum;

      }
```

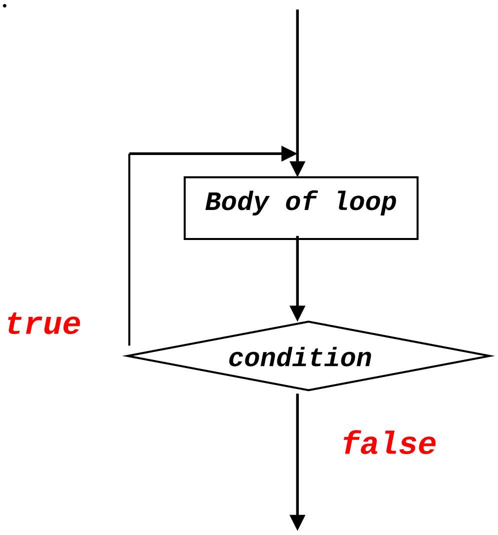
Practice problem: How to make the above loop terminate in case no match occurred after 5 numbers were entered?

2. do-while loop: similar to while-loop, but condition is checked at the end of each iteration. The body of the loop is going to be executed at least once.

```
do
      Statement;   //body of loop

while(condition);


do
{
         //body of loop
         First_Statement;
              ...
         Last_Statement;
} while(condition);
```

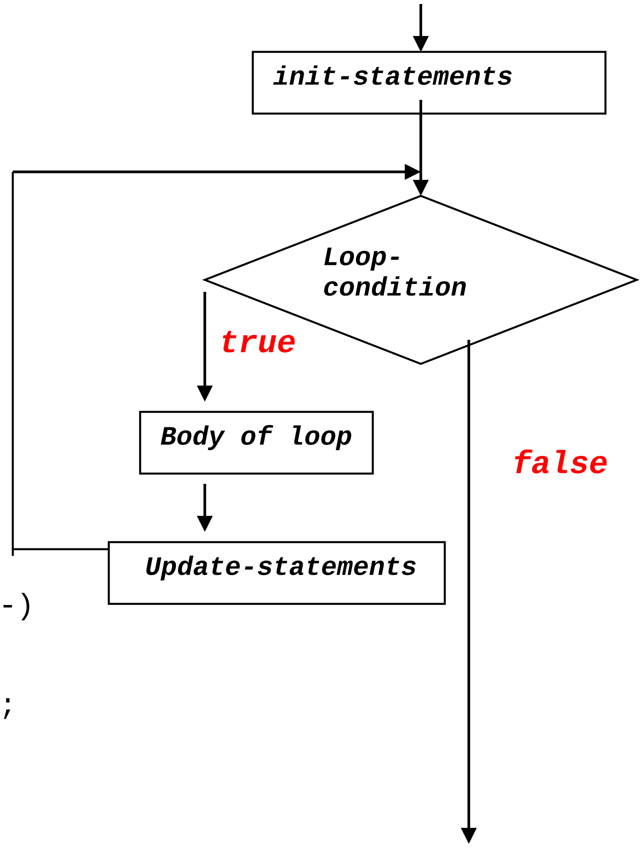


Practice problem:

1. Write a code segment that continues to read a number from the user, until the user enters an *even* number. Use a do-while loop.

3. for –loops – especially useful for counting loops. Syntax:

```
for (init-statements; loop-condition; update-statements)
{
        //body of loop
        First_Statement;
            ...
        Last_Statement;
}
```



Example: count down from 9 to 0

```
for( int count = 9; count >= 0; count--)
{
   System.out.print("T = " + count);
   System.out.println(" and counting");
}

System.out.println("Blast off!");
```

Practice problems.

1. Write a code segment that prints out a reverse of the string entered by the user, e.g. given "Walter" it would print "retlaW".

2. Write a code segment that reads in a string and a character from the user, and prints out the number of occurrences of the character inside that string.

4. Nested loops:

When one loop is placed within the body of another, the entire construct is called "nested loops".

Example:

```
for (int m = 1;  m <= 10; m++)
{

      count = 1; // initialize the counter variable
      while ( count <= m ) {
            System.out.print(count);
            count = count + 1; // same as count++
      }
      System.out.println("\n ***") ;
}
```

Practice problems

1. Print out a triangular pattern based on value stored in variable `rows` . The pattern below shows what's printed for value of rows equal to 7.

```
1
22
333
4444
55555
666666
7777777
```

2. What output is produced by the following code segment:

```
int k, s;

for (int j = 1; j <= 10; j++) {
      if (j % 3 == 0){

          for (k = j, s = 0; k>=0; k--){
              s += k;
          }

      System.out.println("j is "+ j+ " k is " +k+ " s is " + s);
      }
  }
```