CS102

Introduction to data structures, algorithms, and object-oriented programming

System.out.println and print

println, in the System.out class, allows you to output a String.

```
System.out.println("Welcome to Vassar College!");
```

This method puts in a newline after printing the String. You can use the line System.out.println(); with no String argument to put a blank line in your output.

System.out.print("This is a line with no newline after it."); print() is a method that does not put in a newline. The problem with this is that, if you end your program with a print, it brings up the cursor immediately after the output.

System.out.println and print

Inside the String argument to println, any variable concatenated to a String using the + operator is automatically reformatted into a String.

```
System.out.println("x is "+x+" and y is "+y);
```

At times, concatenating the empty String first causes all subsequent values to be converted to their String equivalent:

```
char beta = 'B';
String letters = ""; // set letters to empty string
letters += ""+beta+" ";
```


System.out.printf

printf, in the System.out class, allows you to specify the number of places after the decimal point when printing a double. The printf method's first argument is a String that contains a *format string*. The format string is embedded in the String argument as %1.2f as shown below and in Section 2.4.1 of our textbook.

```
System.out.printf("Your BMI is %1.2f.\n", bMI);
```

The \n embeds a newline after the String is printed. The comma separates the String with embedded format characters from the variable to be embedded in the String.

printf can be used to format any type of data. Look it up in the API.

Scanner, Eck Section 2.4.6

A class in the java.util package that provides methods to read input from the keyboard. To use a Scanner to read from the keyboard (standard input), you need to instantiate an object of type Scanner.

```
Scanner in = new Scanner(System.in);
System.out.println("Please enter a number.");
double rnum = in.nextDouble();
System.out.printf
    ("Number in dollars is $%1.2f.\n", rnum);
```

The keyword new is used to create a new object of type Scanner.

The input is done by calling the nextDouble instance method of the new Scanner object.

System.in refers to the keyboard.

JOptionPane

A class in the javax.swing package that provides another way of taking input from the keyboard. To use a JOptionPane to read from the keyboard (standard input), you need to call a static method in the JOptionPane class.

```
String in = JOptionPane.showInputDialog
            ("Please enter a line of text");
```

This causes a pop-up dialog box to appear with a blank for input.

For output, use another method from the JOptionPane class:

```
JOptionPane.showMessageDialog
            (null,"The answer is 42");
```

null is the default value for any object type. In graphics programs, this is often a JFrame.

Iterative Control Structures (Ch. 3)

for loop* Section 3.4

while loop* Section 3.3

do while loop* Section 3.3

* indicates the keywords are directly followed by ()s. These ()s contain a conditional (boolean expression)

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Blocks - Eck 3.1

Statements inside a loop are grouped by enclosing them in {}s, a block.

Blocks can contain any number of statements, including 0.

As a matter of good programming style, you should write one statement per line, use indentation to indicate statements that are contained inside a block, and include vertical space between separate parts of the program.

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for loop – Eck 3.4

A for loop repeats a statement or multiple statements as long as the boolean-expression is true.

for(initialize counter; boolean-expression; change-loop-counter) red:

```
int sum = 0;
int n = Integer.parseInt
       (JOptionPane.showInputDialog("Enter number: "));

for(int i = 1; i <= n; i++) {
    sum += i;
}
JOptionPane.showMessageDialog
     (null,"Sum of numbers from 1 to "+n+" is "+sum);
```

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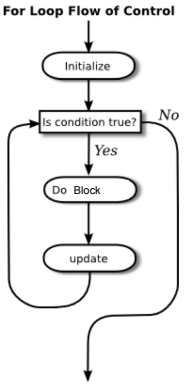
for loops – Eck 3.4

A loop control variable is declared, initialized, tested, and modified in the for loop statement.

The initialization is done inside the parenthesis, at the beginning of the loop.

```
int sum = 0;
int n = 100;
for(int i = 1; i < n, i++)
{
  sum += i;
}
```



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Nested for loops (inside method block)

```
String str;  // Line of text entered by the user.
int count;   // Number of different letters found in str.
char letter; // A letter of the alphabet.

str = JOptionPane.showInputDialog("Please type in a line of text.");
str = str.toUpperCase(); // call on non-static method in object str
count = 0;  // initialize count
JOptionPane.showMessageDialog
          (null,"Your input contains the following letters:");

for ( letter = 'A'; letter <= 'Z'; letter++ )
{
    int i; // Position of a character in str.
    for ( i = 0; i < str.length(); i++ ) {
        if ( letter == str.charAt(i) ) {
           System.out.print(letter);
           System.out.print(' ');
           count++;
           break;
        }
    }
}
```

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While loop

A while loop will repeat a statement only so long as a specified condition (boolean expression) remains true. A while loop has the form:

```
while (boolean-expression) {     // 1. b-e
       inner block statements    // 2. b-e true
}                                //    goto 1
                                 // 3. b-e false
```

1. boolean-expression (b-e) is evaluated
2. if b-e is true, evaluate inner block statements
3. if b-e is false, start evaluating statements after block

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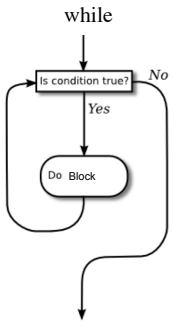
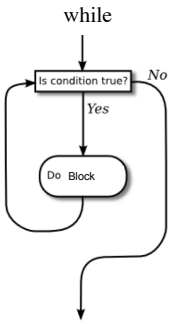
while flow of control diagrams



The initialization is done outside the body of the loop.

A loop control variable is modified inside the body of the while. Eventually, the condition becomes false and the while loop ends.

while flow of control diagrams




```
int sum = 0;
int n = 100;
int i = 1;

while(i < n) {
  sum += i;
  i++;
}
```


Loop and a half using break

A loop that stops when a positive integer is entered.

```
int n;
while (true) {
    n = Integer.parseInt
        (JOptionPane.showInputDialog
                    ("Enter a positive integer: "));
    if (n > 0) {
        break;
    }
    System.out.println("Try again.");
} // end of while loop
JOptionPane.showMessageDialog(null, "The number is "+ n);
```


Strings

Strings are sequences of characters. Methods we will use on Strings include length, toUpperCase, charAt, indexOf, substring:

"abcdefg".length() returns 7

"tomorrow".toUpperCase() returns "TOMORROW"

String petString = "cats and dogs";

petString.charAt(6) returns 'n'

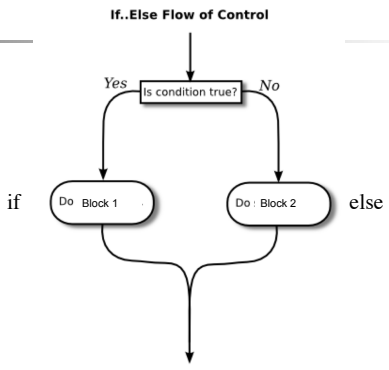
petString.indexOf('o') returns 10

petString.indexOf('X') returns -1

if Decision Statement – Eck 3.5

1. **if …else**: "either-or" type statement, each with its own block of code.
2. **if** alone with a block of code, only runs block if the expression is true.
3. **if**, **else if**, **else if**, …, **else**. Multi-way decision statement, each part with its own block of code.
4. **?:** Short form of if…else.

if and else are like cond in Racket. Only one clause in the group is executed and the rest are ignored. The else at the end is like that in the cond, a default condition.



?: operator—alternative to if else

```
String line= JOptionPane.showInputDialog
             ("Please enter a line of text: ");
int count = line.length();
println("Your input contains "+count+
       ((count>1) ? " letters.\n": " letter. \n"));
```

This code snippet first reads a line of text from the user and then prints the result. Either letters or letter is embedded in the String that is printed.

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Algorithms – Eck 3.2

Step-by-step description of how to solve a problem.

Each line of human language must be broken down into a language solvable by a computer.

Developing a program from a human language form involves what is called *stepwise refinement*. That is, re-write each line into a form called *pseudocode* and then write it in a computer language.

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