Repetition (Iteration, Looping)

Example:

Find summation of numbers from 1 to n  \((n<0)\)

\(n=3\quad \text{sum}=1+2+3=6\)

Pseudo code

```
start
read (n)
(L1)if (n>0) then
    sum=0
    i=1
    if (i<=n) then
        sum =sum+1
        i=i+1
    go to L1
end if
display "sum:" sum
```
Example:

\[
\sum_{i=1}^{n} i = 1+2+3+4+\ldots+n
\]

Read \( n \)

\( \text{if} \ (n>0) \ \text{then} \)

\( \text{sum} = 0 \)
\( i = 1 \)

\( \text{if} \ (i \leq n) \ \text{then} \)

\( \text{sum} = \text{sum}+i \)
\( i = i+1 \)

\( \text{go to L1} \)

\( \text{end if} \)

\( \text{else} \)

\( \text{display} \)

\( \text{end if} \)

Using while in the same exercise:

\( \text{read} \ (n) \)

\( \text{if} \ (n>0) \ \text{then} \)

\( \text{sum} = 0 \)
\( i = 1 \)

\( \text{while} \ (i \leq n) \)

\( \text{sum} = \text{sum}+i \)
\( i = i+1 \)

\( \text{end while} \)

\( \text{display} \ \text{"sum:"} \ \text{sum} \)

\( \text{else} \)

\( \text{display} \ \text{"error"} \)

\( \text{end if} \)

stop
Example:

Write a program that finds summation of numbers from 1 to n

```java
import cs1.Keyboard;  // needed for input

public class findSum
{
    public static void main(String[] args)
    {
        int i, n, sum;
        System.out.println("Enter a positive integer: ");
        n = Keyboard.readInt();  // see p.85
        if(n>0){
            sum=0;
            i=1;
            while(i<=n){  // compound statement
                sum = sum + i;
                i = i + 1;
            }  // ends while
            System.out.println("Sum: " + sum);
        }  // ends if
        else
            System.out.println("Error");
    }  // ends main
}  // ends class
```
Example:

Write a program that tests whether a number is prime or not

\[
x = \begin{cases} 
> 0 & \text{if } n \text{ is prime} \\
0 & \text{if } n \text{ is not prime}
\end{cases}
\]

```
import cs1.Keyboard;
public class testPrime {
    public static void main(String[] args) {
        int n, i, x;
        System.out.println("Enter a positive integer:");
        n = Keyboard.readInt();
        i = 2;
        x = n % i;
        i = i + 2;
        while (x != 0 && i < n) {
            x = n % i;
            i = i + 2;
        } // end of while
        if (x != 0)
            System.out.println(n + " is a prime number");
        else
            System.out.println(n + " is not a prime number");
    } // end of class
} // end of class
```

Example

Write a program that calculates factorial of a number (n!)

```
import cs1.Keyboard
public class Factorial
```
public static void main(String[] args) {
    int n;
    System.out.println("Enter the value of n: ");
    n = Keyboard.readInt();
    int nfac, i;
    nfac = 1;
    i = 1;
    while (i <= n) {
        nfac = nfac * i;
        i = i + 1;
    } //end of while
    System.out.println("n! = " + nfac);
}

Note: This is not a defensive program. A defensive program should take precautions in case
the user may make mistakes.

For Statement:
The for statement is a repetition statement that executes the body of a loop a specific number
of times.

for (initialization; condition; update) {
    statement;
    ______;
    ______;
    ______;
}

Example:
for (nfac = 1; i <= n; i = i + 1)
    nfac = nfac * i

Questions and Answers:

Q1. Write a java program that draws this empty triangle.

```
***************
    *     *
     *   *
      * *
       * *
      *   *
     *     *
    *       *
***************
```
Q2. Design and implement an application which determines prime factorization of a positive integer (Last term lab assignment).

A2.
```java
import cs1.Keyboard;
class Primefac
{
    public static void main(String args[])
    {
        int counter,num;
        System.out.println("Enter a number:");
        num=Keyboard.readInt();
        while(num!=-1)
        {
```
int divisor=2;
System.out.println("PrimeExponent");
System.out.println("======t==========");
while(num!=1)
{
    counter=0;
    while(num%divisor==0)
    {
        num/=divisor;
        counter++;
        if(num%divisor!=0)
            System.out.println(divisor+"t"+counter);
    }
    divisor++;
}
System.out.println("Enter -1 to quit, enter a number to continue");
num=Keyboard.readInt();

Q3. Create a program to solve $e^x = x^0/0! + x^1/1! + x^2/2! + x^3/3! + \ldots + x^{10}/10!$
(x must be defined by the user)

A3.
import cs1.Keyboard;
public class e
{
    public static void main (String[] args)
    {
        double a=0, x, n=0, m=0, p, r=1, g=1, t=1;
        System.out.println("Please enter the x value:");
        x = Keyboard.readInt();
        m= Math.pow (x,1);
        while (a <= 10)
        {
            while (g <= r)
            {
                t=t*g;
                g++;
            }
            p = Math.pow (x,n)/t;
            m=m+p;
            r++;
        }
Q4. Write a program to find;

one internal angle,
number of the diagonals,
sum of the internal angles of the polygon.
(The number of the sides of polygon is entered by the user.)

A4.

```java
import cs1.Keyboard;
class Polygon {
    public static void main(String args[]) {
        System.out.println("Enter number of the sides of polygon: ");
        int side=Keyboard.readInt();
        double angle=(side-2)*180;
        double intern=angle/side;
        int diagonal=(side*(side-3))/2;
        System.out.println("The sum of the internal angles of the polygon is " + angle + " degree");
        System.out.println("One internal angle is " + intern + " degree");
        System.out.println("Number of the diagonals is " + diagonal);
        System.out.println();
    }
}
```

Q5. Design and implement an application that calculate the factorization of the number when the user enter a number. The program must stop when the user entered the value less than zero.

A5.

```java
import cs1.Keyboard;
public class Fac
```
```java
{ 
    public static void main(String[] args) 
    { 
        int n; 
        System.out.println("Enter the value of n: "); 
        n= Keyboard.readInt();
        
        while(n>0){
            int i,nfac; 
            for(i=1, nfac=1; i<=n; i++){
                nfac= nfac*i;
            }
            System.out.println(" n! = " +nfac);
            System.out.println("Enter the value of n: "); 
            n= Keyboard.readInt(); 
        }
    }
}
```