Algorithms and Flowcharts

T.A. Asmaa Hamad El-saied

DECISION STRUCTURES

NESTED IFS

One of the alternatives within an IF-THEN-ELSE statement may involve further IF-THEN-ELSE statement

Example 1

Write an algorithm that reads three numbers and prints the value of the largest number.

Example 1

```
Step 1: Start
Step 2: Input N1, N2, N3
Step 3: if (N1>N2) then
if (N1>N3) then
                 MAX '← N1
                                   [N1>N2, N1>N3]
            else
                 MAX \leftarrow N3
                                   [N3>N1>N2]
           endif
        else
            if (N2>N3) then
                 MAX ← N2
                                   [N2>N1, N2>N3]
           else
                                   [N3>N2>N1]
                 MAX \leftarrow N3
          endif
        endif
Step 4: Print "The largest number is", MAX
Step 5: End
```

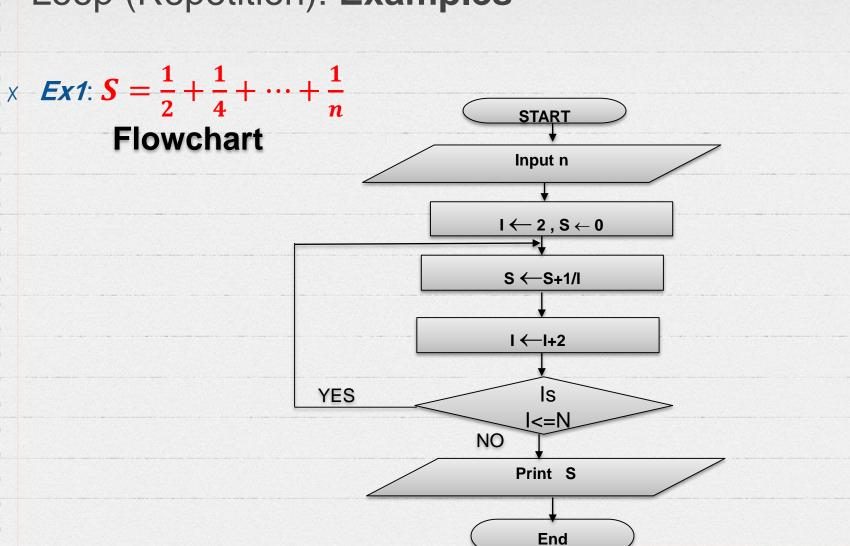
Loop (Repetition)

Ex1: Design an algorithm with a natural number, n, as its input which calculates the following formula and writes the result in the standard output:

$$S=\frac{1}{2}+\frac{1}{4}+\cdots+\frac{1}{n}$$

```
Step 1: Start
Step 2: Input n
```

Step 3:
$$I \leftarrow 2$$
 and $S \leftarrow 0$



□ *Ex2*: Write an algorithm and draw a flow chart to calculate x^n.

Step 7: End

```
Step 1: Start

Step 2: Input x, n

Step 3: result ← x

Step 4: Counter ← 1

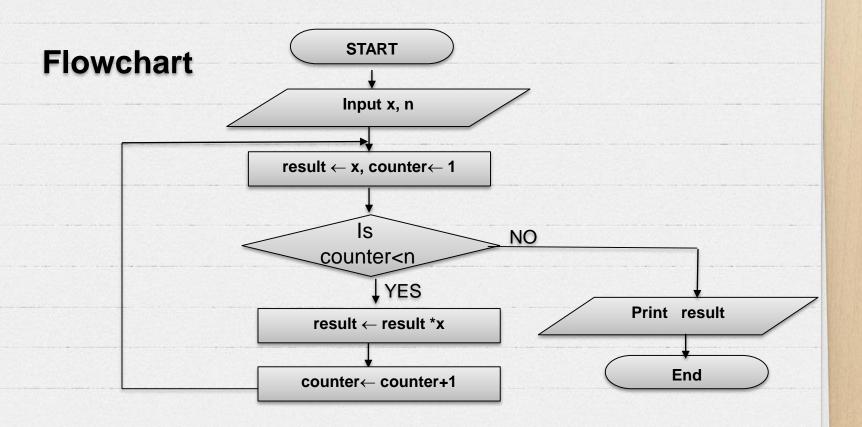
Step 5: if (Counter < n) then

result ← result* x

Counter ← Counter + 1

go to step 4

Step 6: Print result
```



Ex3: Write an algorithm and draw a flow chart to calculate the factorial of a number (N).

```
Step 1: Start

Step 2: Input N

Step 3: fact ← 1

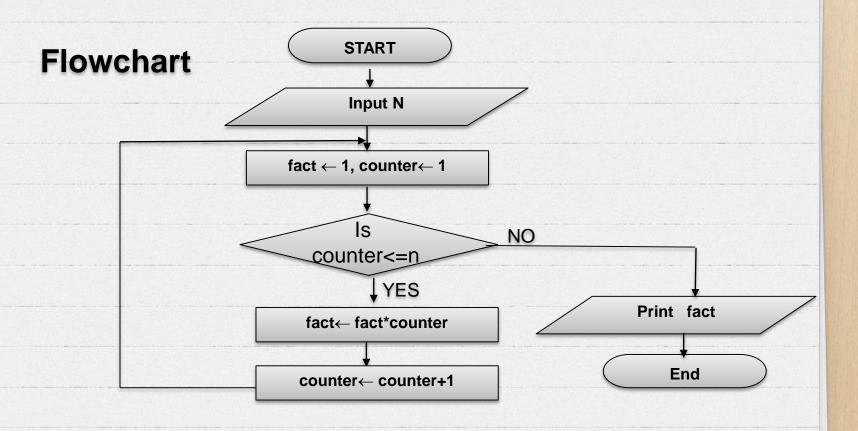
Step 4: Counter ← 1

Step 5: if (Counter <= n) then
fact ← fact* counter

Counter ← Counter + 1
go to step 4

Step 6: Print fact

Step 7: End
```



□ **Ex4**: Write an algorithm to generate(print) first 50 items of the Fibonacci series:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...?

☐ Is a series in which, the next number is found by adding up the two numbers before it.

The 2 is found by adding the two numbers before it (1+1). The 3 is found by adding the two numbers before it (1+2),

And the 5 is (2+3),

and so on!

□ An algorithm 0,1, 1, 2, 3, 5, 8,...?

```
Step 1: Start
```

go to step 3

Step 10: End

Exercises

- □ Write an algorithm and draw a flowchart to enter a number and displays whether the number is positive or negative.
- □ Write an algorithm and draw a flowchart to generate odd numbers between 1000 and 2000 and then prints them in the standard output. It should also print total sum.
- □ Write an algorithm and draw a flowchart for the problem of determining prime number?
- □ Write a Algorithm that computes the first 20 terms of the expression:

$$\frac{1}{n} + \frac{3}{n^2} + \frac{5}{n^3} + \cdots$$

Thanks!