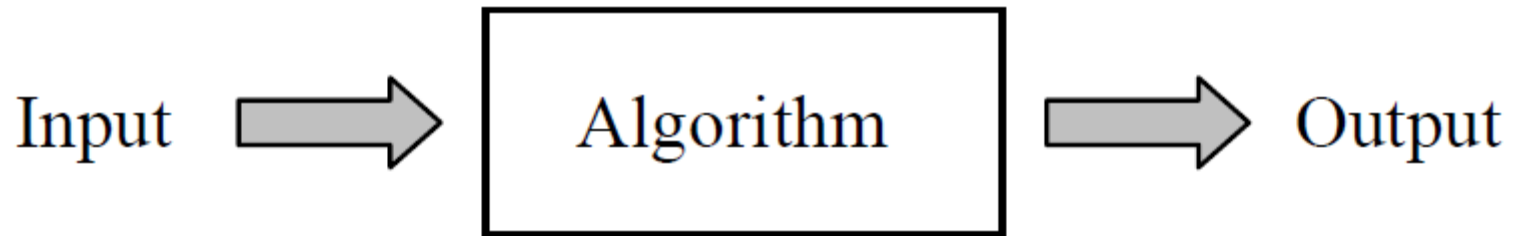# CSIT113
Problem Solving

Week 2a

Algorithm

consists of a set of instructions that take

- **Input :** Some value or set of values
- **Algorithm:** manipulate them following the prescribed steps
- **Output:** produces some value or set of values

Input ➡ Algorithm ➡ Output

Euclidean algorithm

compute gcd(A,B) (greatest common divisor) of two integers A & B

1. Let A and B be integers with A>B≥0

2. If B=0 then gcd(A,B)=A and the algorithm ends

3. Otherwise, find q and r such that
   A = qB + r where 0≤r<B
   Then gcd(A,B) = gcd(B,r)
   Replace A by B and B by r. Go to step 2

Example

Compute gcd(128,56)

A= 128, B=56 so A and B are different from 0

1. Use division to get A = 2x56 + 16. So q = 2 and r = 16
   Now A = 56 and B = r = 16. Go back to Step 2

2. Use division to get A = 3 x 16 + 8. so q = 3 and r = 8
   Now A = 16 and B = r = 8. Go back to Step 2

3. Use division to get A = 2 x 8. So q=2 and r = 0
   Now A = 8 and B = r = 0. Go back to step 2 and get gcd = A = 8.

Pseudocode (pseudo-code)

1. is a term which is often used in programming and algorithm

2. allows the programmer to represent the implementation of an algorithm

3. is normally a mixture of English statements, some math notations, and some selected keywords

4. is for human reading, not computers

Euclidean algorithm

Input A,B

If A < B, swap(A,B)

While B is not equal to 0

  r = A mod B

  A = B

  B = r

EndWhile

Output B

Factorial

Factorial of a positive integer N, denoted by N!, is the product of all positive integers less than or equal to N:

$$N! = N \times (N-1) \times \ldots \times 2 \times 1$$

For example:

- $5! = 1 \times 2 \times 3 \times 4 \times 5 = 120$
- $0! = 1$

Algorithm Factorial

Input: a positive number N ≥ 1

      number nFactorial   #variable

      nFactorial : = 1

      while N > 1 do

            nFactorial : = nFactorial * N

            N := N-1

      endwhile

      return nFactorial

References

- https://en.wikipedia.org/wiki/Pseudocode
- https://blog.usejournal.com/how-to-write-pseudocode-a-beginners-guide-29956242698