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Notion of algorithm

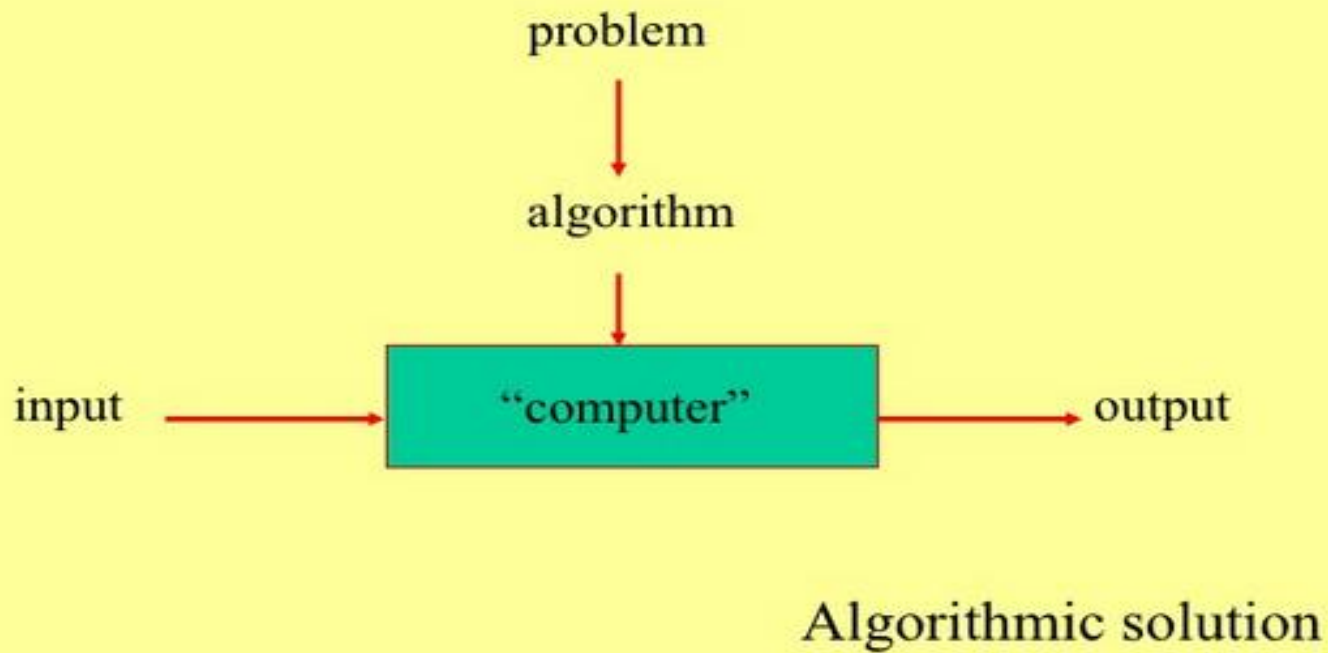
AP/IT



An algorithm is a sequence of unambiguous instructions for solving a problem, i.e., for obtaining a required output for any legitimate input in a finite amount of time.



Representation of Algorithm





Properties of Algorithm

1. Finiteness

terminates after a finite number of steps

2. Definiteness

rigorously and unambiguously specified

3. Input

valid inputs are clearly specified

4. Output

can be proved to produce the correct output given a valid input

5. Effectiveness

steps are sufficiently simple and basic



Types of Algorithm



- There are three ways to writing an algorithm:
 - EUCLID's Algorithm
 - Consecutive integer checking Algorithm
 - Middle school procedure



EUCLID's Algorithm

- Step 1
If $n = 0$, return m and stop; otherwise go to Step 2
- Step 2
Divide m by n and assign the value of the remainder to r
- Step 3
Assign the value of n to m and the value of r to n . Go to Step 1.

```
while n ≠ 0 {  
    r ← m mod n  
    m ← n  
    n ← r  
}  
return m
```



Consecutive integer checking Algorithm

- Step 1
Assign the value of $\min\{m,n\}$ to t
- Step 2
Divide m by t . If the remainder is 0, go to Step 3;
otherwise, go to Step 4
- Step 3
Divide n by t . If the remainder is 0, return t and stop;
otherwise, go to Step 4
- Step 4
Decrease t by 1 and go to Step 2



Middle school procedure

- Step 1
Find the prime factorization of m
- Step 2
Find the prime factorization of n
- Step 3
Find all the common prime factors
- Step 4
Compute the product of all the common prime factors
and return it as $\text{gcd}(m,n)$