



### Time Complexity:-

- How long computation takes to execute!
- In TM, this could be measured as no. of moves which are required to perform computation.
- no. of m/c cycles.

### Space Complexity:-

- How much storage is required for computation?
- In TM, no. of ~~cells~~ cells are used.
- no. of bytes used.

# Types of Complexity classes

① P-class :- Set of decision is solvable in polynomial time of in the class P.

If there exists an algorithm A such that

- A takes instance of D as i/p
- A always o/p's the correct answer. Yes or No.
- Exists a polynomial  $p$  such that the execution of A on i/p size  $n$  always terminates in  $p(n)$  at fewer steps.

eg: MST (minimum Spanning tree) problem is in class P.

The class P is often considered as synonymous with the class of computationally feasible problems. although in practice this is somewhat unrealistic.

## NP class

A decision problem is non-deterministically polynomial time solvable or in the class NP if there exists an algorithm

A such that

- There exists a polynomial  $p$  such that for each potential witnesses of each instance of size  $n$  of  $D$ , the execution of the algorithm  $A$  takes at most  $p(n)$  steps.
- Think of a non-deterministic computer as a computer magically "guesses" a solution, then has to verify that it is correct.
  - If solution exists, computer always guesses it.
  - One way to imagine it: a parallel computer that can freely spawn an infinite no. of process.

- Have one process work on each possible.
- All process attempts to verify that their solution works
- If a process finds it has a working solution

So NP: problem verifiable in polynomial time.

⇒ Every problem in this class can be solvable in exponential time using exhaustive search.