

P & NP

- The problems can be categorized as follow

- ① Optimization Problem
- ② Decision Problem

→ Optimization Problem - They are those problems for which the objective is to maximize or minimize some values

→ Decision Problem - There are many problems for which the ans is a Yes or No. These types of problems are known as decision problem

→ P class Problem - Problems that can be solved in polynomial time. More specifically, they are the problems that can be solved in time $O(n^k)$ for some constant k where n is the size of the input to the problem

→ NP class Problem - NP stand for non deterministic polynomial time. A problem is in NP if you can quickly test whether a solⁿ is correct.

→ Reducibility → If we can convert one instance of a problem A into problem B, then it means that A is reducible to B.

Solution of Algorithm

Polynomial
Time

Non-Polynomial
Time

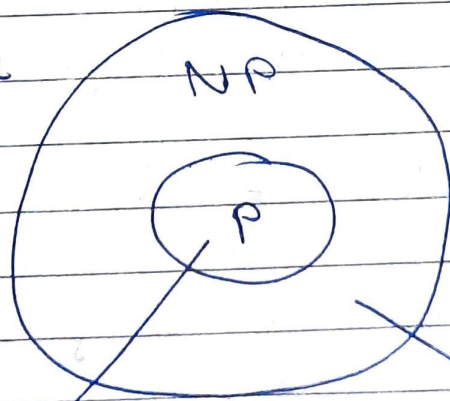
(All sorting & searching algo)

NP class Problem - A Problem which cannot be solved on polynomial time but is verified in polynomial time is known as NP class problem
 e.g. TSP, Su-Do-Ku

5	3			7				
6			1	9	5			
	8	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

NP class

- Hard to Solve
 &
 Easy to Verify
 in
 Exponential
 time



Tractable

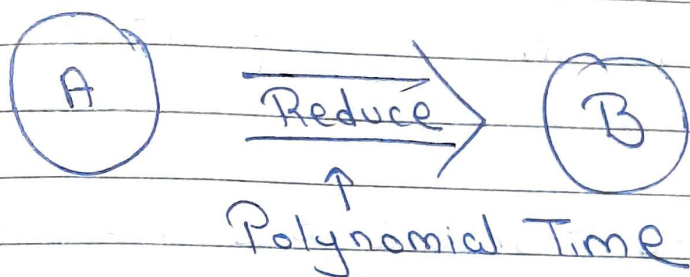
P class

Easy to Solve
 &
 Easy to Verify
 Polynomial time

Intractable

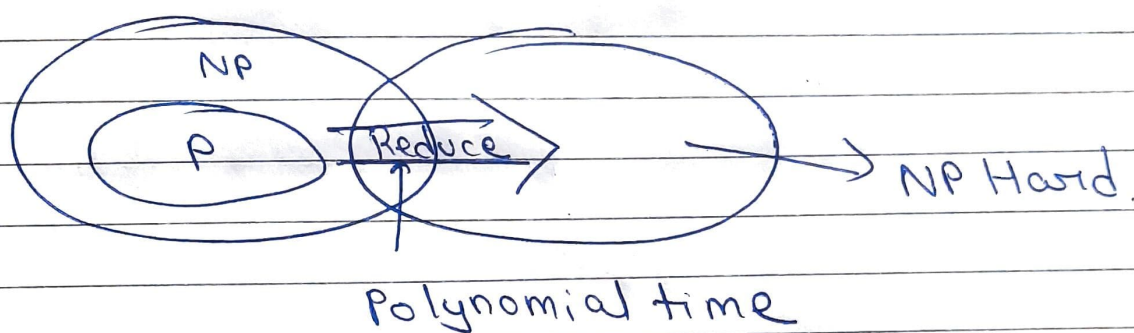
$P \subseteq NP$

Reduction



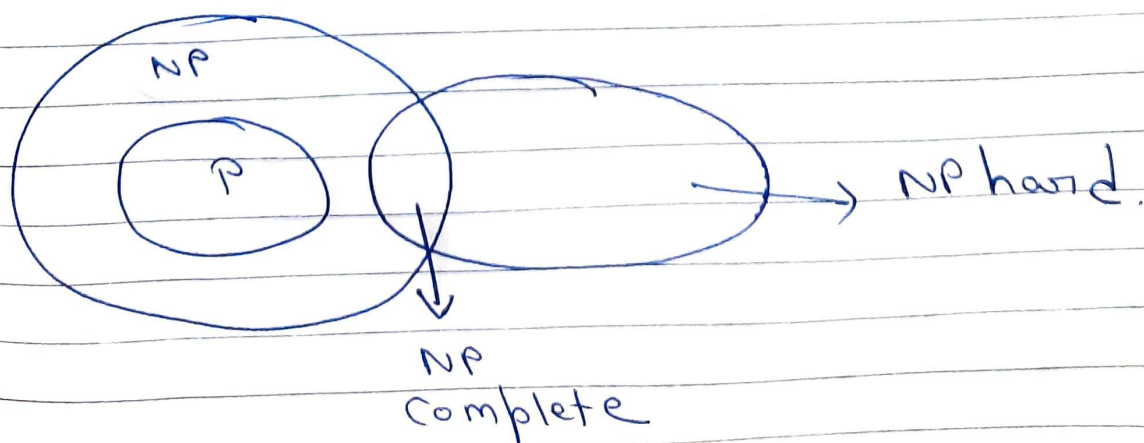
NP Hard

A problem is NP hard if every problem in NP can be polynomial reduced to it.



NP Complete

The group of problems which are both in NP and NP hard are known as NP-complete problems.



- NP Complete Problem: - NP hard Problem

Decision Problem

Optimization Problems

- All NP Complete Problems are NP-hard but all NP-hard Problems are not NP-Complete.