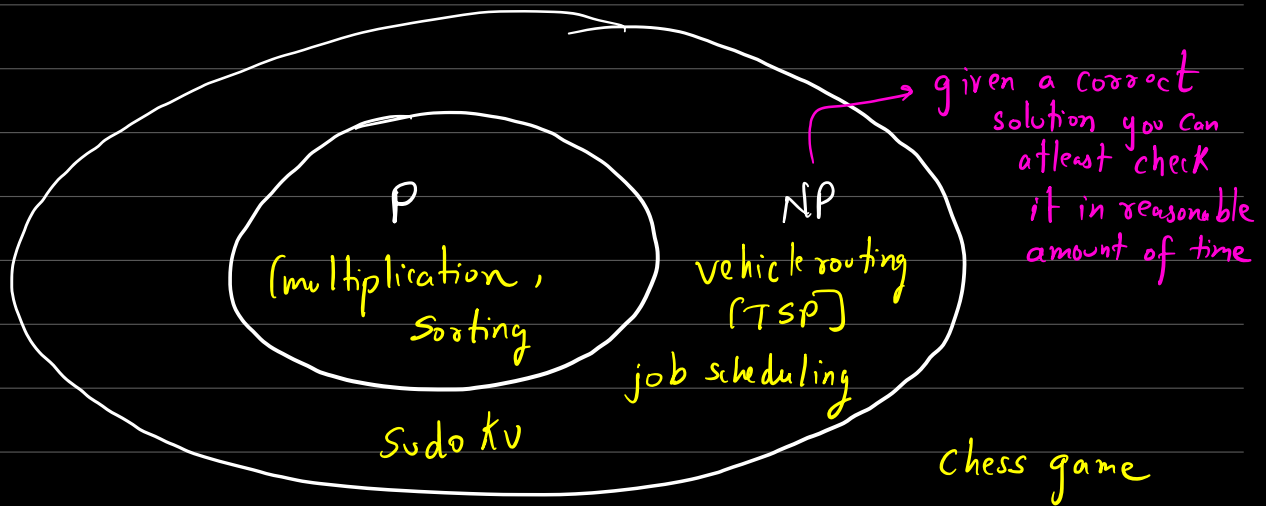


Topic:- P, NP, NP Hard and NP complete.



Polynomial Time [P]:- It includes problems for which there exists an efficient algorithm that can provide a solution in a reasonable amount of time.

Examples:- Sorting algorithms like Merge Sort, Quick Sort, Searching algorithms like Binary Search.

Efficiency:- $O(n^k)$ k is constant and n is input size

NP [Nondeterministic Polynomial Time]: We can verify the answer in polynomial time. While finding a solution might be a hard task.
Examples:- Subset sum problem, Hamiltonian cycle

Efficiency:- Solutions can be verified in Polynomial Time

NP-hard and NP Complete:- Problems that are at least as hard as the hardest problems in NP.

NP-hard may or may not be in NP. NP-complete problem, is both NP and NP-hard.

Many NP hard problems can be reduced to another NP problems, that is if we can solve one problem efficiently, then all the problems it can be reduced to can also be solved.

Examples:- Knapsack Problem, Traveling salesman Problem

