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# COMBINATORIAL OPTIMIZATION PROBLEMS

## Introduction:

**Optimization Problem:** In mathematics and computer science, an optimization problem (OP) is the problem of finding the best solution from all feasible solutions. OPs can be divided into two categories depending on whether the variables are continuous or discrete.

**Combinatorial Optimization:** In applied mathematics and theoretical computer science, combinatorial optimization (CO) is a topic that consists of finding an optimal object from a finite set of objects.

**Combinatorial Optimization Problem:** An OP with discrete variables is known as a combinatorial optimization problem (COP). In a COP, we are looking for an object such as an integer, permutation or graph from a finite set.

The aim of is to investigate the use of various optimization exacts and heuristics to solve the COP's.

## Background:

In many such problems, exhaustive search is not feasible. It operates on the domain of those optimization problems, in which the set of feasible solutions is discrete or can be reduced to discrete, and in which the goal is to find the best solution.

## Applications for CO:

Applications for CO include, but are not limited to:

- Developing the best airline network of spokes and destinations.

- Deciding which taxis in a fleet to route to pick up fares.
- Determining the optimal way to deliver packages.

COP's can be viewed as searching for the best element of some set of discrete items; therefore, in principle, any sort of search algorithm or metaheuristic can be used to solve them. However, generic search algorithms are not guaranteed to find an optimal solution, nor are they guaranteed to run quickly (in polynomial time).

### **Specific Problems of COP:**

The most specific problems of COP are:

- Assignment problem.
- Closure problem.
- Constraint satisfaction problem.
- Cutting stock problem.
- Integer programming.
- Knapsack problem.
- Linear programming.
- Minimum spanning tree.
- Nurse scheduling problem
- Traveling salesman problem.
- Vehicle routing problem.
- Vehicle rescheduling problem.
- Weapon target assignment problem.