Analogous Aspacts between Combinatorial Optimization and Optimization Techniques: A Review

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Abstract

Paper contributes towards the clear visibility among combinatorial optimization and optimization techniques by exploring the detailed concept of analogous term according to suitability of optimal methods to concerned problem to be assigned as the objective of the case study. Myriads efforts have been made to focus the various methodologies useful in CO problems but do not give transparent outlook in the area of computer and operation research, but this paper makes reader comfortable to relate the method to the defined problem.

Keywords: *Combinatorial optimization, techniques, analogous, optimal*

Introduction

Many decision making issues regarding resources, machines and people can be formulated under the CO framework to enable a better usage of resources. Combinatorial optimization, an object dealing with operation research and computer science engineering and makes effort towards searching for best solution among large no of finite candidate solution, resources are imposed with certain constraints to achieve optimal solution which should minimize cost and increase profit and makes better utilization of resources. Optimization techniques facilitate the optimal use of network capacity which may result in increased profit and reduce operating cost based on mathematical model, which is a set of inputs-costs, assumptions, demand, constraints, goals, resources and preferences.

Combinatorial optimization

Class of CO problems

P (polynomial time problem) tractable problem: It contains problem that can be solved using algorithm with running time such as o (n) linear running time, o (n^k) polynomial running time and o (2^n) exponential running time, which is more and more rapid

NP hard problem: A decision problem that has only two possible answers, yes or no

NP (non deterministic polynomial time problem): Problem solved by an algorithm that can guess a solution and verify whether guessed solution is optimal or not

Application of CO problems

Combinatorial optimization has been successfully implemented in crew scheduling, jobs to m/c allocation, vehicle routing and scheduling, circuit design and wiring, solid waste management, job shop scheduling, set covering and maximum clique timetabling.

Optimization Techniques

Optimization techniques facilitate the optimal use of network capacity which may result in increased profit and reduce operating cost based on mathematical model,

Definition

Combinatorial optimization, an object dealing with operation research and computer science engineering and makes effort towards searching for best solution among large no of finite candidate solution, resources are imposed with certain constraints to achieve optimal solution which should minimize cost and increase profit and makes better utilization of resources. Asymptotic notation, O is used to describe the complexity of the algorithm (upper bound), Ø is tight bound and lower bound. Asymptotic efficiency of an algorithm, speed, and resource consumption are the bases to compare algorithm, asymptotic efficiency mans how running time of an algorithm increases as the size of the input approaches infinity. Computing time required to find optimal solution of NP hard problems increases as an exponential function of the problem size
which is a set of inputs-costs, assumptions, demand, constraints, goals, resources and preferences.

Exact methods: These are further classified as linear programming and dynamic programming, these are applicable to relatively small problem due to run time and memory restrictions (computational time is more),they guarantee of finding optimum solution or global optimum for a given problem, also have the potential to obtain the optimal answer very accurately for simple and small optimization problems.

Heuristics: Art of discovering new strategies (rules) to solve problem, also experienced based common sense approach with no specific pre-defined rules to apply. Heuristics algorithms bear two major problems, their position within local optima and incompetence for application in various issues. These may be divide in two categories- Kruskal's Algorithm and Prim's algorithm

Meta heuristics: A Meta heuristic is defined as iterative generation process which guides a subordinate heuristic by combining different concept for exploring and exploiting the search space, also carries meaning of upper level new strategies to solve hard and complex

problem. These are high-level search algorithms, developed to find solution that is good enough in small computing time, also are generic methods which offer good solution, even global optimum, within a reasonable computing time, also have output mechanism from the local optimization.

Basic properties of Meta heuristics:

•These are not problem specific.
•Algorithms are approximate and non-deterministic.
•High level strategies that guide the search space.
•Objective is to efficiently explore the search space in order to find optimal solution.
•These may incorporate mechanism to avoid getting trapped in confined area of search space.

Meta heuristics Limitation: Do not guarantee the optimality of the obtained solution and do not define how close the obtained solutions from optimal ones are.

Meta heuristics Applications:

• Applied to combinatorial optimization problems and constraint satisfaction problems
•Applied when problems have large size and when goal is to find a near optimal solution
• Useful in NP- hard optimization problems like Maximum clique problem, Flow shop scheduling, travelling
Salesman problem.

Conclusion: Transparency comes out by exploring the combinatorial optimization and optimization techniques that both are integral part in province of optimization, which includes simple and complex problems as per their applicable area and specifically efforts have been made to conclude towards heuristics and meteheuristics suitability to combinatorial optimization problems and implementation of exact methods to situation where guaranteed optimal solution is required

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