Vehicle Routing, Scheduling and Decision Utility Environment

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Abstract

There have been many papers written in literature in vehicle scheduling. In this paper, we will try to summarize all previous research papers in this area. In this section of the paper we basically deal with Vehicle Scheduling and Routing. We assume a given system for Distribution System replenishment and given set of Distribution Centers ask ourselves how should Vehicles be scheduled or routed to achieve the company’s logistic objectives? The problem as typically formulated is to determine the order turn in which the customers will be visited by delivery or pick-up vehicles otherwise called the route.

Introduction

The questions include the determination of the adequate number of vehicles, the frequency with which each customer should be visited and the times to be associated with the actual stops along the route. Our approach to vehicle routing and scheduling is to first present the discussion with the Travelling Salesman Problem (TSP). This provides an analytical framework. We then consider solution methodologies and further examine some actual operating problems. Some of the problems using vehicle scheduling problems include: (1) garbage route collection system that involve TSP, (2) lawn-mowing system for parks and recreation using TSP, (3) scheduling of like products with automated assembly line with sequence dependent setups, and (4) scheduling like items in a police station.

We assume a given system for DC replenishment and a given set of DCs, and ask: How should vehicles is best scheduled to achieve logistics objectives? The problem, as typically formulated, is to determine the order in which customers will be visited by delivery/pickup vehicles, often called the route. Other questions include determination of the proper number of vehicles, the
frequency with which each customer should be visited, and the times to be associated with the stops along the route.

Our approach to vehicle scheduling is to first present a discussion of the traveling salesmen problem. This provides an analytical framework. We then consider solution methodologies, and thereafter examine some actual operating problems.

**Traveling salesman problem (Scheduling methods for a capacity constrained work center and automated assembly line with sequence dependent setups)**

The Traveling Salesman Problem is one of those easily stated but difficult to solve problems on which mathematicians find it very studiedly but not easily solvable. The statements of problem is given as a set of cities distribution centers (DC) to be visited, what is the least cost or distance method of visiting each city once, starting from the same city and returning to it. The starting and ending city could be a central facility or location.

**Solution Methodologies**

The traveling salesman problem can be formulated as zero-one integer programming problem. Optimal solution approaches include branch and bound procedures similar to those discussed for distribution centers (DC) location problems and dynamic programming problems. Producing optimal solution procedures become computationally costly and the size of the problem goes up with the increase in the number of nodes or cities or in other words as the size of the problem goes up. That is as the number of distribution centers increases the computational cost goes up geometrically.
Heuristic procedures have been devised for this problem that produce reasonably good results in far less time than the optimal procedures. One widely used is based on a time-saved concept. The basic consideration is the time or distance that would be saved if the two distribution centers were visited in a single tour as opposed to visiting each separately different tour.

**Applications of Decision Utility in Park Systems**

Although many quantitative scheduling techniques are designed for production scheduling, other types of scheduling problems have been studied but they have some of the same obstacles listed above for production scheduling. For example, consider the problem of scheduling jobs in a governmental agency where the amount of work to be done almost always exceeds the resources available. In this case, the scheduling problem is deciding how much of each job to do and not do given the amount of resources on hand. For example, in the summer, a parks maintenance district must tradeoff how the number of times jobs like tractor mowing (mowing large open areas), trim mowing (mowing small areas around trees, sidewalks, buildings, etc.), litter removal, and ball field dragging are done in each park (Ozgur, 2018). The main problem is to determine the correct balance between the jobs given the resources available. This is clearly a case where a balance is necessary because doing a lot of litter removal and ball field dragging while doing no mowing would not be acceptable to the tax payers. With decision utility, one has to develop a model that measures algorithmic efficiency. This can implement formulas that solve problems containing tasks rather than products (Brown, 1986). In addition, measuring performance, or considering what to do with information on what was actually accomplished and resources available, is routinely done in manufacturing and decision utility. The importance of measuring performance is the comparison of the number of products produced and the number of products that ideally would have been produced given the available resources.
Application of Decision Utility in Police Stations

Consider the problem of scheduling police officers in a police department where the amount of work to be done almost always exceeds the resources available in a given time period such as summer months. In this case, the scheduling problem is deciding how much of each type of job to do and still protect the public and ensure public safety given the amount of resources on hand for the entire summer months. For each police scheduling period, the police chief used as data a list of the police officers, estimates of the time for a police officer or police car to complete each job in the city, and what additional personnel and equipment was available and needed by the police department for each police activity. A computer schedule was run every two weeks and gave the police chief or the police supervisor an amount of each job the city could accomplish in the next two weeks with the resources predicted to be available (Ozgur, 2018).

We have included many sources that can be used to identify the application of vehicle scheduling and decision utility.
References


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