Chapter 9

Some Studies in Multi–Storage Inventory System: Using Genetic Algorithm

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ABSTRACT

In this chapter, a multi-storage inventory system has been considered to develop a deterministic inventory model in finite planning horizon. Realistically, it is shown that due to large stock and insufficient space of existing own warehouse (OW); excess items are stored in single rented warehouse (RW). Due to different preserving facilities and storage environment, inventory holding cost is considered to be different in different warehouses. Here, the replenishment cycle lengths are of equal length, the demand rate is a continuous linear increasing function of time and partially backlogged shortages are allowed in all cycles. In each cycle, the replenishment cost is assumed to be dependent linearly on lot size and the stocks of RW are also transported to OW in continuous release pattern. The model is formulated as a constrained non-linear mixed integer cost objective function under single management. Finally, results with a sensitivity analysis have been shown with the help of a real coded GA.

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1.0 INTRODUCTION

In the field of inventory management, an important problem associated with the inventory maintenance is to decide where to stock the goods. This problem does not seem to have attracted much attention of researchers in this field. In this regard, the basic assumption in the traditional inventory models is that the management owns a store (warehouse) with unlimited capacity. However, in some situations, it is not always true. In the busy markets like super market, corporation market, municipality market etc., the storage space of a show – room is limited. When an attractive price discount for bulk purchase is available or the cost of procuring goods is higher than the inventory related other costs or there are some problems in frequent procurement or the demand of items is very high, management then decides to purchase (or produce) a large amount of items at a time. These items may not be accommodated in the existing storage (viz., the owned warehouse, OW) due to limited capacity. Then for storing the excess items, one (sometimes more than one) additional warehouse is hired on rental basis. This rented warehouse (RW) may be located near the OW or a little away from it. It is generally assumed that the holding cost in RW is greater than that in OW. Moreover, items should be always available at OW for the convenience of business as the actual service to the customer is carried out at OW only. Hence, the items are stored first in OW and only excess stock is stored in RW. As the holding cost in RW is greater than that in the OW, the stocks of RW are emptied first by transporting the stocks from RW to OW in order to reduce the holding cost. Generally, the items of RW are transferred to OW in a continuous / bulk release pattern to meet up the demand until the stock level in RW is emptied and lastly the items of OW are released. This type of problem is known as multi – storage (warehouse) problem.

Approximately twenty eight years before, Hartely (1976) in U.S.A., first introduced two storage problem in his book “Operations Research –A Managerial Emphasis”. In his analysis, he ignored the cost of transportation for transferring the goods from RW to OW. After Hartely, Sarma(1983) in India, first investigated two storage inventory model in the year 1983. Murdeswar and Sathi (1985) extended this model by assuming a finite rate of replenishment. Dave (1989) modified the EOQ models of Sarma (1983). Dave (1989) considered finite as well as infinite rate of replenishment under some assumptions and gave an algorithm for each model to get a complete solution. The above models were formulated for non-deteriorating items without allowing the shortages. Considering the shortages, Sarma (1987) formulated a model of deteriorating items with infinite replenishment rate. Next, Pakhala and Achary (1992) developed the two warehouse models with finite rate of replenishment and shortages taking time as discrete and continuous variable respectively. In their models, the scheduling period was taken as constant and prescribed and the
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