



An optimal shipment strategy for imperfect items in a stock-out situation

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ABSTRACT

The objective of this paper is to minimize the expected total cost by consolidating a number of batches of imperfect quality products of different cycles for a single shipment and maximize the expected average profit function. Shortages are allowed at the end of each ordering cycle and are partially backlogged. The stock-out period is assumed to be exponentially distributed. The ordered lot size and cycle length of all the ordering cycles of a shipping cycle are considered to be equal. The model is analyzed for both infinite and finite planning horizons. The percentage of defective items in a lot is assumed to follow a uniform distribution. All the fractions of imperfect quality items in the ordering cycles of each shipping phase are assumed to be independent and identically distributed. After the completion of a screening process, one portion of the perfect quality products is used to serve partial backlogging at a cost per unit and the rest of the stock is used to adjust the demand. Calculus method is used to obtain the optimal number of order cycles for shipment. Optimal shortage period, optimal lot size and expected average profit for the model are developed on both of the finite and infinite time horizons. A comparison between the our models and Maddah and Jaber's (2008) [1] model is done through numerical studies which are also used to illustrate the models graphically.

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1. Introduction

In a manufacturing process, it is impossible to produce 100% perfect quality products. Production of imperfect items is a very natural phenomenon. These imperfect items are either reworked or used in another inventory system. Again, now-a-days, 'Stock-out' and 'partial backlogging' are well known events in any inventory control system. Generally, shortages occur due to the following reasons:

- (i) Presence of defective items.
- (ii) Damage, spoilage, evaporation, etc., reduces the stock.
- (iii) To avoid such damages (specially, in case of food, medicines, etc.) and the corresponding monetary losses, sellers do not like to overstock.
- (iv) Insufficient space for storage is also a reason of shortage.
- (v) Sometimes shortage is a created event of the seller himself to increase the market demand and price of a product.

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