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Short communication

A note on "Production lot sizing with quality screening and rework"

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ABSTRACT

Recently, Moussawi-Haidar et al. (2016) considered a production process with random supply and an inspection process performed during and at the end of production. Two economic production quantity models with defective items were developed, in which Model 1 assumes that defective items are sold at a discounted price at the end of inspection process, and Model 2 assumes that defective items are reworked at a cost at the end of inspection process. In the paper, there are some mathematical expressions which are to be corrected. We first present the mathematical expressions corrected and establish the necessary conditions for which there is an optimal solution. We next provide the correct solutions to the numerical example.

1. Introduction

Moussawi-Haidar et al. [1] presented the above-mentioned paper, which dealt with determining the optimal production lot size in an imperfect production process in which two scenarios for dealing with defective items produced are considered to minimize the total inventory cost. In the first scenario, defective items are sold at a discounted price at the end of inspection process. In the second scenario, defective items are reworked at a cost. The paper differs from the previous studies (e.g., Hayek and Salameh [2], Jamal et al. [3], Cardenas-Barron [4], Pearn et al. [5]) by integrating the inspection time into the production-inventory model with rework.

I have read the paper with a considerable interest and I found that there are some mathematical expressions with errors in the Model 2. Therefore, the solution to the numerical example is also incorrect. I think that the readers of Applied Mathematical Modelling journal may be interested in knowing the correct mathematical expressions and the correct solution to the numerical example, besides, the conditions for which there is an optimal solution.

2. The model of Moussawi-Haidar et al

The following assumptions are considered to develop the mathematical model:

- Shortages are not allowed.
- The production rate is greater than the demand rate, $\alpha > \beta$.
- The demand during the production is met from good items only.

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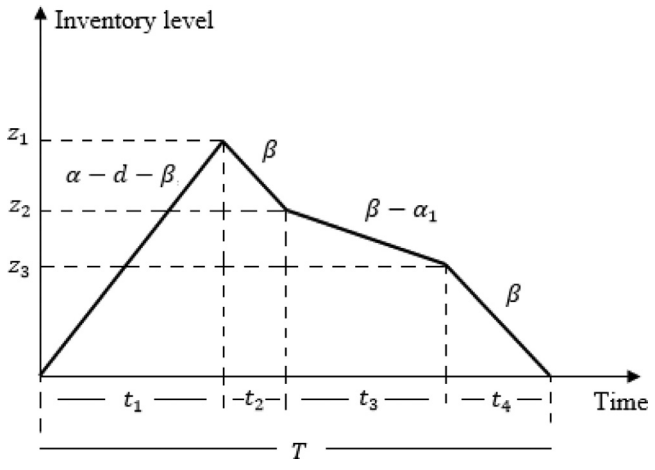

Fig. 1. On-hand inventory level of good items.

- The inspection rate is greater than the demand rate, $x > \beta$.
- The inspection cost during the production is higher than that after the production, $d_1 > d_2$.
- The holding cost of defective items being reworked is greater than that of the good items.
- The defective items are reworked at the end of the inspection process at a cost.

The following notations are used throughout the paper:

α	production rate per unit time.
β	demand rate of the final product per unit time.
α_1	rework rate of defective items per unit time, $\alpha_1 < \beta$.
y	total number of items produced during a production cycle.
T	production cycle.
t_1	production uptime, $t_1 = y/\alpha$.
t_2	inspection time after the production.
t_3	the time period needed to rework the defective items.
t_4	the time period to consume all on-hand inventories after the rework.
z_1	the maximum level of on-hand inventory of good items in units, when production process ends.
z_2	the level of on-hand inventory of good items in units, when the inspection after production ends.
z_3	the maximum level of on-hand inventory of good items in units, when the rework process ends.
K	fixed production setup cost.
P	random proportion of defective items, with probability density function $f(P)$.
x	inspection rate per unit per unit time.
d	production rate of defective items per unit time.
d_1	inspection cost per item during production.
d_2	inspection cost per item after production ends.
h	holding cost per unit per unit time.
h_1	holding cost of defective items being reworked per unit per unit time, $h_1 > h$.
S	unit selling price of good quality items.
C_p	unit production cost.
C_r	the rework cost per unit.

Fig. 1 depicts the behavior of the on-hand inventory of good items. The time duration of a cycle is the summation of the production time, the inspection time after the production, the rework time and the production downtime. That is:

$$T = t_1 + t_2 + t_3 + t_4. \tag{1}$$

It is assumed that demand during the production is met only good items. Therefore, during the production, a number of units are inspected before they are sold to customers. To be able to satisfy demand from good items only, more than the demand is inspected. The total number of units inspected during the production is:

$$\frac{\beta t_1}{(1-P)}. \tag{2}$$

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