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Comparative Analysis of two Reliability Models with Regard to Undertaking the Failed Unit by Ordinary or Expert Repairman with the Concept of Instruction Time

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ABSTRACT

The present paper deals with comparative analysis of two reliability models with instruction by an expert to avoid the possibility of incorrect repair done by the ordinary repairman and two types of repair policy such as resume repair policy and policy adopted at the more degraded stage due to damage made by the ordinary repairman during try for repair. The purpose of taking the idea of instruction in the paper is to avoid the possibility of incorrect process of repair done by the ordinary repairman. In model 1 it is assumed that the expert repairman when comes for repairing a failed unit, repairs all the units which fail during his stay in the system. In the model 2 it is assumed that every failed unit first goes under the repair of ordinary repairman who starts repair after getting the instructions from the expert.

INTRODUCTION

The situation of a repair policy wherein repair is started by the expert from the more degraded stage caused by the ordinary repairman due to mishandling has not been taken earlier.

The concept of two types of repairman i.e., one ordinary and the other expert has been discussed by different authors including [1-3]. The idea of instruction was first introduced by Kumar et al. [4]. Later on, it was discussed by some other authors including [7-8] who studied it together with concepts of accidents, two of repairmen, etc. There may be situations wherein the ordinary repairman is not only able to do some complex repairs but also may adopt incorrect process.

In order to nullify the possibility of incorrect process and to reduce the stay of the expert repairman, the idea of introduction time is introduced in the paper of reference 5. After getting instruction, the ordinary repairman repairs the unit by adopting the correct process. However during repair, he may damage the unit due to mishandling or some other causes and in this case repeat repair policy (type-II) is adopted by the expert repairman. Chances are there that even after getting instruction he may not be able to complete the repair successfully and hence resume repair policy is adopted by the expert. If at the time of imparting instruction for a failed unit the other unit is operative, it is assumed that instruction time finishes before the failure of the latter. Moreover if by the time of completion of the repair of a failed unit by the expert, the second unit is found in failed state, it is also repaired by the expert. The present paper investigates comparative analysis of two reliability models with regard to undertaking the failed unit by ordinary or expert repairman with the concept of instruction time.

For Model 1
If at the time of completion of the repair of a failed unit by the expert, the second unit is found in failed state, it is also repaired by the expert.

For Model 2
Every failed unit first goes under the repair of ordinary repairman who starts repair after getting instructions from the expert.

Pairwise comparative analysis of the models through graphs is carried out for the same particular cases as taken in the previous references for concerned models. The assumed values for various rates/costs/probabilities have been mentioned along with graphs. Let P_{51} be the profit of the model discussed in reference 5 and P_{52} be the profit of model of the reference 6. We have compared the models through graphs on the basis of profit aspect.

Comparison between Models Discussed in Reference 5 and Reference 6

Two models for two-unit cold standby systems with instruction rate have been discussed in Reference 5. Following conclusions for the comparison between these two models have been drawn by plotting two graphs:

(1) Graph showing the behaviour of the difference between profits P_{52} and P_{51} with respect to cost (C_2) for different values of instruction cost (C_8) has been plotted as in **Fig. 1**.

(a) The difference increases for increase in the values of cost (C_2) and becomes higher for higher values of cost (C_8).

(b) For $C_8 = 200$, $(P_{52} - P_{51}) >$ or = or < 0 according as $C_2 >$ or = or $<$ 9541.47. Hence, Model 2 is better or worse than Model 1 if $C_2 >$ or $<$ 9571.47. Both the models are equally good if $C_2 = 9571.47$.

(c) For $C_8 = 400$, $(P_{52} - P_{51}) >$ or = or < 0 according as $C_2 >$ or = or $<$ 9431.38. Hence, Model 2 is better or worse than Model 1 if $C_2 >$ or $<$ 9431.38. Both the models are equally good if $C_2 = 9431.38$.

(d) For $C_8 = 600$, $(P_{52} - P_{51}) >$ or = or < 0 according as $C_2 >$ or = or $<$ 9291.26. Hence Model 2 is better or worse than Model 1 if $C_2 >$ or $<$ 9291.26. Both the models are equally good if $C_2 = 9291.26$.

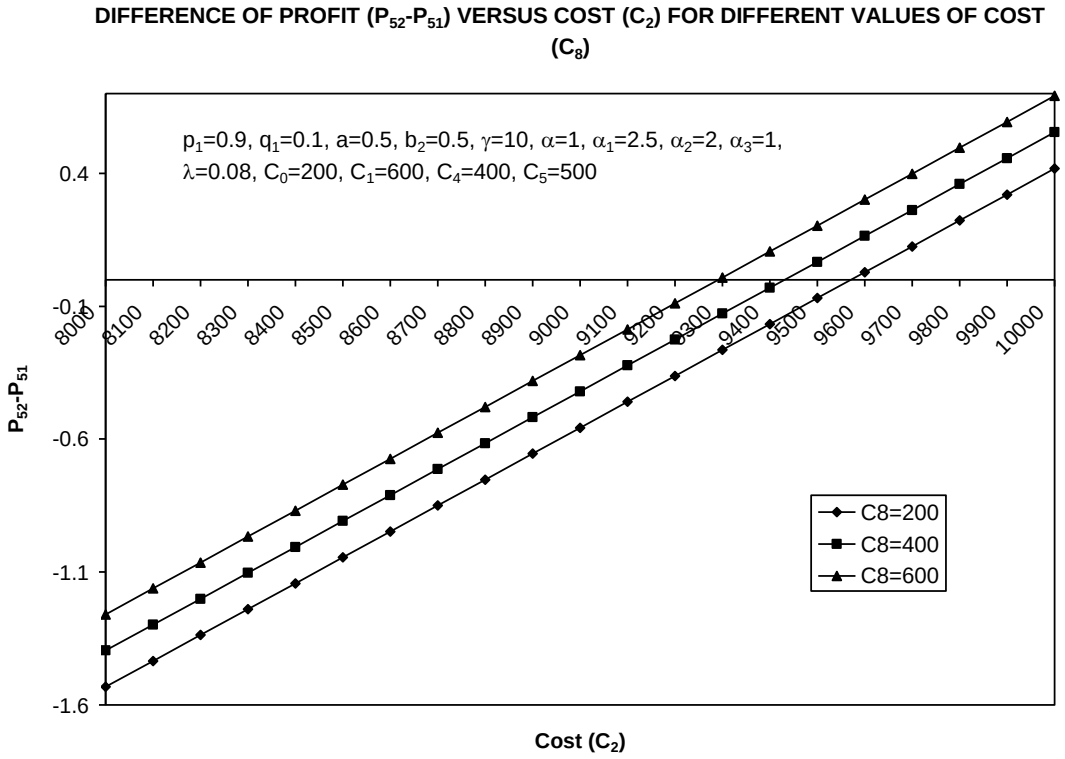

Fig. 1

(2) **Fig. 2** depicts the behaviour of the difference between profits P_{52} and P_{51} with respect to probability (p_1) for different values of probability (b_2) that ordinary repairman can damage the unit. Following conclusions are drawn :

(a) The difference increases for increase in the values of probability (p_1) and becomes lower for higher values of probability (b_2). It is noticeable that for lower values of b_2, Model 2 is always better than Model 1 irrespective of the values of p_1.

(b) For $b_2 = 0.1$ and $b_2 = 0.5$, $(P_{52} - P_{51}) > 0$ irrespective of the values of probability (p_1). Hence Model 2 is better than Model 1.

(c) For $b_2 = 0.9$, $(P_{52} - P_{51}) >$ or = or < 0 according as $p_1 >$ or = or < 0.106. So Model 2 of reference 5 is better than Model 1 of reference 5 if $p_1 >$ or < 0.106. Both the models are equally good if $p_1 = 0.106$.

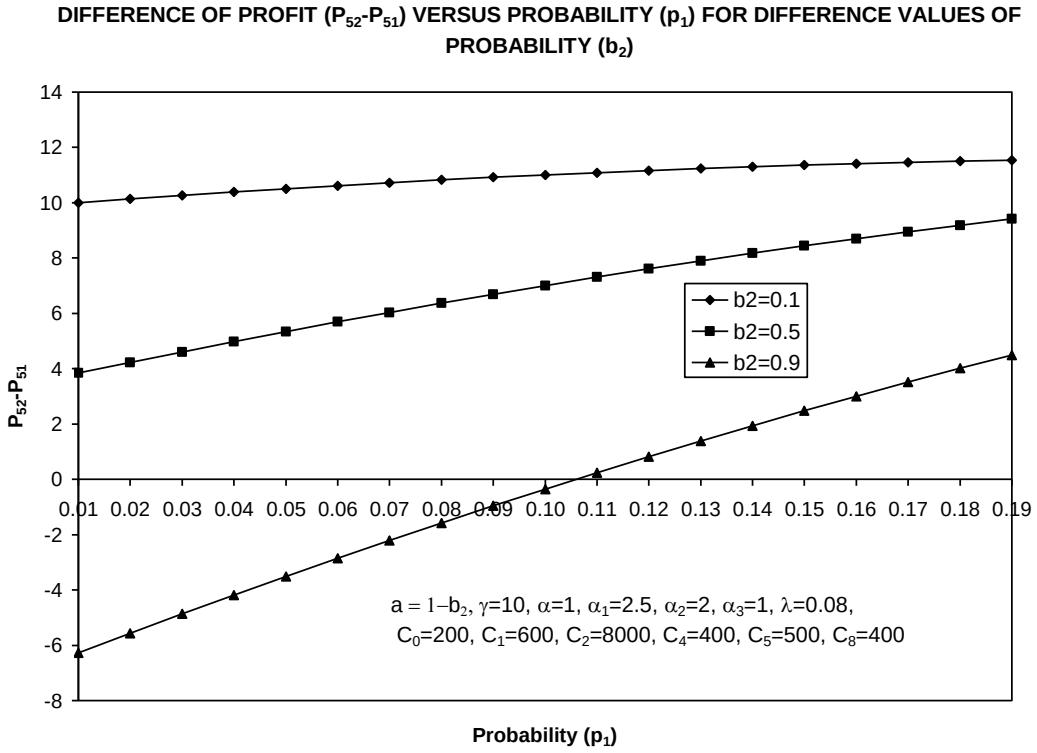

Fig. 2

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