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Comparative analysis of cost benefit evaluation of two reliability models with instruction, replacement and two of the three types of repair policy

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Abstract
The present paper introduces the instruction time and the possibility that ordinary repairman may damage the unit to the extent that: (i) it rather goes to more degraded stage but repairable (ii) it may become irreparable and hence replaced. Two-unit cold standby system is examined and two has been analysed by making use of Semi-Markov Processes and regenerative point technique. Various measures of system effectiveness including profit incurred have been evaluated. Various conclusions have been drawn through graphical study for a particular case.

Keywords: comparative analysis, benefit evaluation, two reliability models, repair policy

Introduction
Extending the idea discussed in earlier papers [5-8], the present paper considers the possibility that the ordinary repairman may damage the unit in such a way that it can not be repaired and hence there is no other way but to replace it by a new one. A two-unit cold standby system has been analysed and two reliability models have been taken up. Other assumptions are same as those taken in Reference-5.

The system is analysed by making use of semi-Markov processes and regenerative point technique. The various measures of system effectiveness have been obtained.

Let P_{51} be the profit discussed in reference 5, P_{52} be the profit discussed in reference 6, P_{61} be the profit taken in reference 7 and P_{62} be the profit discussed in reference 8.

Comparison between profit of models discussed in reference 5, 6, 7 and 8.
Graphs have been plotted for making the comparison between the first models and between the second models of the two references varying replacement cost/instruction rate/failure rate. The behaviour observed is explained below:

Comparison between profit of model of reference 5 and reference 6
Fig. 1 shows the behaviour of the difference $(P_{61} - P_{51})$ with respect to cost (C_7) for different values of failure rate (λ). Through the figure following conclusions are drawn here:

1. The difference $(P_{61} - P_{51})$ is higher for higher values of λ upto $C_7 < 535$ but the difference decreases more rapidly for higher values of λ, as a result of which the trend gets reversed for $C_7 > 640$.
2. For $\lambda = 0.01$, $(P_{61} - P_{51}) >$ or $=$ or < 0 according as $C_7 <$ or $=$ or > 757.66. So, Model 1 of reference 6 is better or worse than Model 1 of reference 5 if $C_7 <$ or > 757.66. Both the models are equally good if $C_7 = 757.66$.
3. For $\lambda = 0.03$, $(P_{61} - P_{51}) >$ or $=$ or < 0 according as $C_7 <$ or $=$ or > 678.2. So, Model 1 of the reference 6 is better or worse than Model 1 of reference 5 if $C_7 <$ or > 678.2. Both the models are equally good if $C_7 = 678.2$.
4. For $\lambda = 0.05$, $(P_{61} - P_{51}) >$ or $=$ or < 0 according as $C_7 <$ or $=$ or > 620.36. So Model 1 of reference 6 is better or worse than Model 1 of reference 5 if $C_7 <$ or > 620.36. Both the models are equally good if $C_7 = 620.36$.

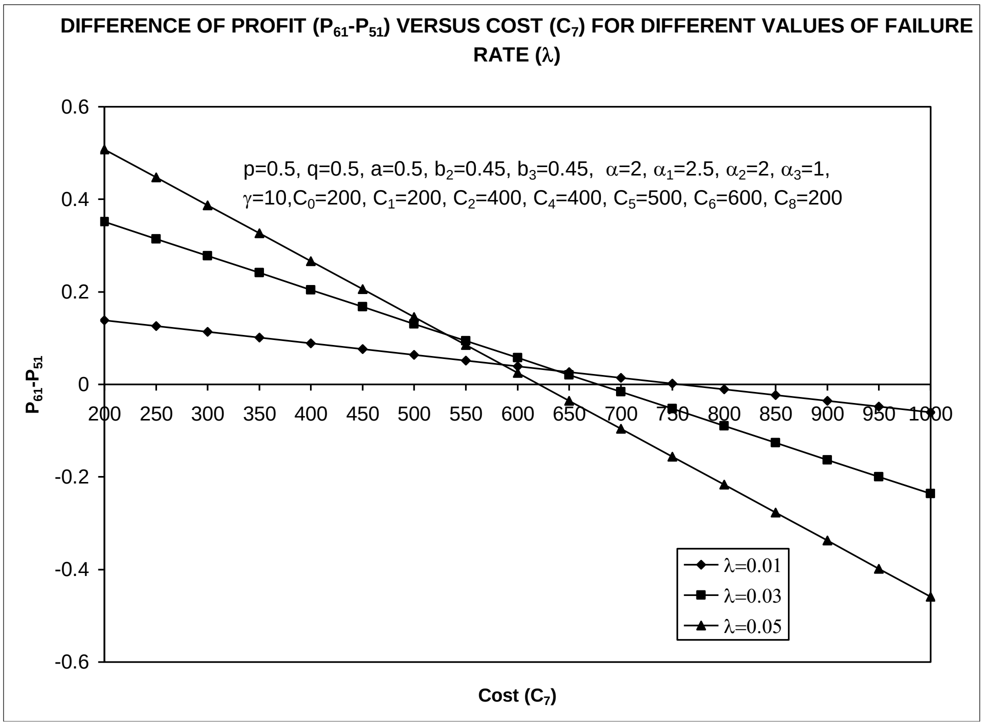

Fig 1

Comparison between profit of model of reference 7 and reference 8

Fig. 2 shows the behaviour of the difference ($P_{62} - P_{52}$) with respect to cost (C_7) for different values of failure rate (λ). Following conclusions are drawn here:

1. The difference is higher for higher values of λ for the starting values of cost (C_7), i.e., upto 475. But the difference decreases more rapidly for higher values of λ, as a result of which its nature reverses and becomes lower for higher values of λ when $C_7 > 660$.
2. For $\lambda = 0.01$, ($P_{62} - P_{52}$) > or = or < 0 according as C_7 < or = or > 328.98. So, Model 2 of reference 6 is better or worse than Model 2 of reference 5. Both the models are equally good if $C_7 = 328.98$.
3. (iii) For $\lambda = 0.03$, ($P_{62} - P_{52}$) > or = or < 0 according as C_7 < or = or > 425.47. So Model 2 of reference 6 is better or worse than Model 2 of reference 5 if C_7 < or > 425.47. Both the models are equally good if $C_7 = 425.47$.

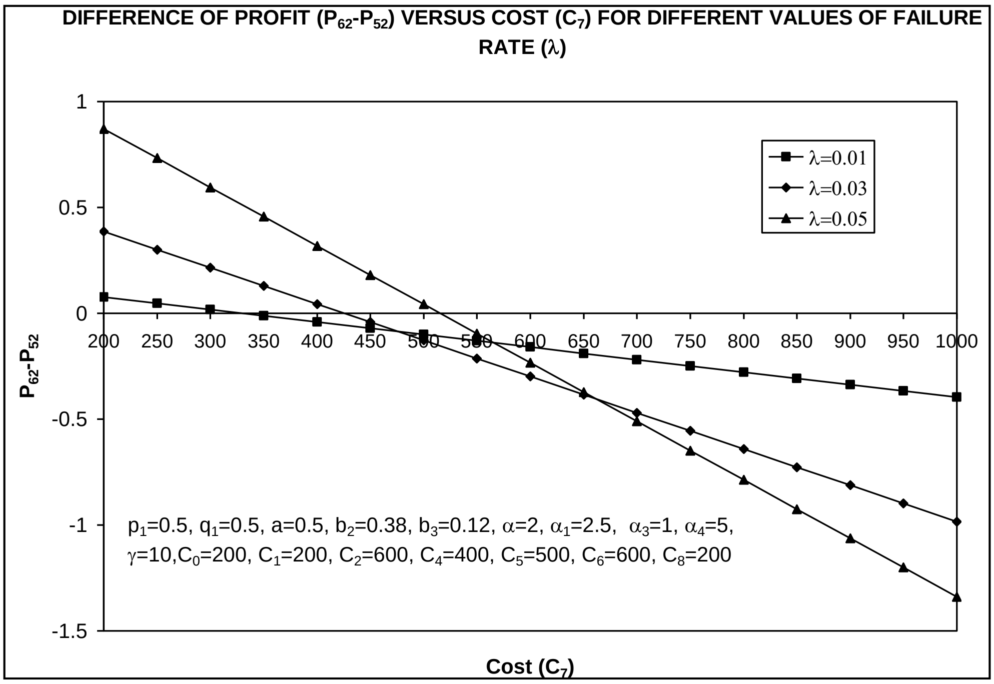

Fig 2

4. For $\lambda = 0.05$, ($P_{62} - P_{52}$) > or = or < 0 according as C_7 < or = or > 515.27. So Model 2 of reference 6 is better or worse than Model 1 of reference 5 if C_7 < or > 515.27. Both the models are equally good if $C_7 = 515.27$.

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