CHAPTER-VIII

Comparative Analysis of the Models Studied under Different Situations
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Comparative Analysis of the Models Studied under Different Situations

A system working under some specific situations can not be considered as best as compared to other similar systems working under some different situations. Hence, the present chapter compares the models studied in Chapters III to VII considering different situations for a system to get the answer of a question as to which and when one model better than the other so far as the profitability of system is concerned.

Comparative study of the models has been made between the models taking two at a time through graphs and various conclusions have been drawn observing the trend of the graphs as well as the cut-off points.

(a ) **Comparison Between the Models Discussed in Chapter III and Chapter IV**

Models on two-unit standby system have been discussed in chapters III and IV. The model discussed in chapter III has only one mode of failure i.e unit can be failed only by direct failure but in the model discussed in chapter IV, the unit can be failed via partial failure or by direct failure. The repair of the units would be done on FCFS basis and only offline repair can be done on failure of the unit. For making the comparison between the two models, various conclusions have been drawn through graphs as follows:

Fig.8.1 shows the behaviour of the difference between the profit, i.e., \((P_3 - P_4)\) with respect to revenue per unit up time \((C_0)\) of an oil delivering system for different values of cost per unit time for which the repairman is busy for repair \((C_1)\)
Fig. 8.1

From Fig., following is concluded:

(i) The difference \((P_3 - P_4)\) increases as the revenue \((C_0)\) increases. Also, the difference becomes higher for higher values of cost \((C_1)\).

(ii) For \(C_1 = 10\), \((P_3 - P_4)\) > or = or < 0 according as \(C_0 >\) or = or < 34.116. Hence Model of Chapter III is better or worse than the Model of Chapter IV whenever \(C_0 >\) or < 34.116. Both the models are equally good if \(C_0 = 34.116\).

(iii) For \(C_1 = 50\), \((P_3 - P_4)\) > or = or < 0 according as \(C_0 >\) or = or < 31.69. Hence, Model of Chapter III is better or worse than the Model of Chapter IV whenever \(C_0 >\) or < 31.69. Both the models are equally good if \(C_0 = 31.69\).

(iv) For \(C_1 = 100\), \((P_3 - P_4)\) > or = or < 0 according as \(C_0 <\) or = or > 28.66. Hence Model of Chapter III is better or worse than the Model of Chapter IV whenever \(C_0 >\) or < 28.66. Both the models are equally good if \(C_0 = 28.66\).

Fig. 8.2 depicts the behaviour of the difference between the profit, i.e., \((P_3 - P_4)\) with respect to cost per unit replacement \((C_4)\) of an oil delivering system for different values of cost of alternate performance \((C_5)\).
From the Fig., following is concluded:

(i) The difference \((P_3 - P_4)\) increases as the cost \((C_4)\) increases. Also, the difference becomes higher for higher values of cost \((C_5)\).

(ii) For \(C_5 = 500\) \((P_3 - P_4)\) \(\geq 0\) according as \(C_4 \geq 20211.835\).

Hence Model of Chapter III is better or worse than the model of Chapter IV whenever \(C_4 \geq 20211.835\). Both the models are equally good if \(C_4 = 20211.835\).

(iii) For \(C_5 = 520\) \((P_3 - P_4)\) \(\geq 0\) according as \(C_4 \geq 21435.18\).

Hence, Model of Chapter III is better or worse than the Model of Chapter IV whenever \(C_0 \geq 21435.18\). Both the models are equally good if \(C_4 = 21435.18\).

(iv) For \(C_5 = 540\) \((P_3 - P_4)\) \(\geq 0\) according as \(C_4 \leq 22658.525\).

Hence Model of Chapter III is better or worse than the Model of Chapter IV whenever \(C_0 \leq 22658.525\). Both the models are equally good if \(C_4 = 22658.525\).
Fig. 8.3 reveals the behaviour of the difference between the profit, i.e., \((P_3 - P_4)\) with respect to partial failure rate \(\lambda_1\) of an oil delivering system for different values of revenue \((C_0)\)

![Graph of profit difference vs partial failure rate](image)

**Fig. 8.3**

From the Fig, following is concluded:

(i) The difference \((P_3 - P_4)\) increases as the partial failure rate \(\lambda_1\) increases. Also, the difference becomes higher for higher values of cost \((C_0)\).

(ii) For \(C_0 =10\), \((P_3 - P_4) > 0 = or < 0\) according as \(\lambda_1 > 0 = or <.001584\). Hence Model of Chapter III is better or worse than the Model of Chapter IV whenever \(\lambda_1 > or < .001584\). Both the models are equally good if \(\lambda_1 = .001584\).

(iii) For \(C_0 = 12\) \((P_3 - P_4) > 0 = or < 0\) according as \(\lambda_1 > 0 = or < .001518\). Hence, Model of Chapter III is better or worse than the Model of Chapter IV whenever \(\lambda_1 > 0 = < .001518\). Both the models are equally good if \(\lambda_1 = .001518\).
(iv) For \( C_0 = 14 \ (P_3 - P_4) > or = or < 0 \) according as \( \lambda_1 < or = or > .001453 \). Hence Model of Chapter III is better or worse than the Model of Chapter IV whenever \( \lambda_1 > or = or < .001453 \). Both the models are equally good if \( \lambda_1 = .001453 \).

(b) **Comparison between the Models Discussed in Chapter III and Chapter VI**

Two standby units models are discussed in both the chapters. The model discussed in chapter III has only one mode of failure i.e unit can be failed only by direct failure but in the model discussed in chapter VI, the unit can be failed via partial failure or by direct failure. In this model oil delivering system has both offline and online repair facility for partial failure. The repair of the units would be done on FCFS basis. For making the comparison between the two models, various conclusions have been drawn through graphs as follows:

**Fig.8.4** represents the behavior of the difference between the profit, i.e., \((P_3 - P_6)\) with respect to cost \((C_0)\) of an oil delivering system for different values of cost \((C_1)\).
From the Fig. 8.4 following is concluded:

(i) The difference \((P_3 - P_6)\) increases as the cost \((C_0)\) increases. Also, the difference becomes higher for higher values of cost \((C_1)\).

(ii) For \(C_1 = 10\) \((P_3 - P_6) > or = or < 0\) according as \(C_0 > or = or < 19.1883\). Hence Model of Chapter III is better or worse than the Model of Chapter VI whenever \(C_0 > or < 19.1883\). Both the models are equally good if \(C_0 = 19.1883\).

(iii) For \(C_1 = 12\) \((P_3 - P_6) > or = or < 0\) according as \(C_0 > or = or < 17.2204\). Hence, Model of Chapter III is better or worse than the Model of Chapter VI whenever \(C_0 > or < 17.2204\). Both the models are equally good if \(C_0 = 17.2204\).

(iv) For \(C_1 = 14\) \((P_3 - P_6) > or = or < 0\) according as \(C_0 < or = or > 15.2526\). Hence Model of Chapter III is better or worse than the Model of Chapter VI whenever \(C_0 > or < 15.2526\). Both the models are equally good if \(C_0 = 15.2526\).

Fig. 8.5 shows the behavior of the difference between the profit, i.e., \((P_3 - P_6)\) with respect to cost \((C_4)\) of an oil delivering system for different values of cost \((C_5)\).
From the Fig. 8.5, following is concluded:

(i) The difference \( (P_3 - P_6) \) increases as the cost \( (C_4) \) increases. Also, the difference becomes higher for higher values of cost \( (C_5) \).

(ii) For \( C_5 = 500 \), \( (P_3 - P_6) > = or < 0 \) according as \( C_4 > = or < 4440.789 \). Hence Model of Chapter III is better or worse than the Model of Chapter VI whenever \( C_4 > = or < 4440.789 \). Both the models are equally good if \( C_4 = 4440.789 \).

(iii) For \( C_5 = 550 \), \( (P_3 - P_6) > = or < 0 \) according as \( C_4 > = or < 5836.481 \). Hence, Model of Chapter III is better or worse than the Model of Chapter VI whenever \( C_0 > = or < 5836.481 \). Both the models are equally good if \( C_4 = 5836.481 \).

(iv) For \( C_5 = 600 \), \( (P_3 - P_6) > = or < 0 \) according as \( C_4 > = or < 7232.189 \). Hence Model of Chapter III is better or worse than the Model of Chapter VI whenever \( C_0 > = or < 7232.189 \). Both the models are equally good if \( C_4 = 7232.189 \).

Fig. 8.6 reveals the behavior of the difference between the profit, i.e., \( (P_3 - P_6) \) with respect to partial failure rate \( \lambda_1 \) of an oil delivering system for different values of revenue \( (C_0) \).
From the Fig., following is concluded:

(i) The difference \((P_3 - P_6)\) increases as the cost \((\lambda_1)\) increases. Also, the difference becomes higher for higher values of cost \((C_0)\).

(ii) For \(C_0 = 23\), \((P_3 - P_6) > = or < 0\) according as \(\lambda_1 > or = or < .0056\). Hence Model \(P_3\) of Chapter III is better or worse than the Model \(P_6\) of Chapter VI whenever \(\lambda_1 > or = or < .0056\). Both the models are equally good if \(\lambda_1 = .0056\).

(iii) For \(C_0 = 24\), \((P_3 - P_6) > or = or < 0\) according as \(\lambda_1 > or = or < .0049\). Hence, Model \(P_3\) of Chapter III is better or worse than the Model of \(P_6\) Chapter VI whenever \(\lambda_1 > or = or < .0049\). Both the models are equally good if \(\lambda_1 = .0049\).

(iv) For \(C_0 = 25\), \((P_3 - P_6) > or = or < 0\) according as \(\lambda_1 > or = or < .00423\). Hence Model \(P_3\) of Chapter III is better or worse than the Model \(P_6\) of Chapter VI whenever \(\lambda_1 > or = or < .00423\). Both the models are equally good if \(\lambda_1 = .00423\).

(c) **Comparison between the Models Discussed in Chapter IV and Chapter V**

Models with two unit standby system are discussed in both the chapters. The model discussed in chapter IV and chapter V has two mode of failure i.e. unit can be failed via partial failure or by direct failure. In chapter IV and chapter V oil delivering system has only offline repair facility for partial failure. In chapter IV repair is done on FCFS basis but in chapter V priority is given to partially failed unit for repair. For making the comparison between the two models, various conclusions have been drawn through graphs as follows:

**Fig. 8.7** depicts the behavior of the difference between the profit, i.e., \((P_4 - P_5)\) with respect to cost \((C_0)\) of an oil delivering system for different values of cost of busy period of repairman \((C_1)\).
From the Fig., following is concluded:

(i) The difference $(P_4 - P_5)$ increases as the cost $(C_0)$ increases. Also, the difference becomes higher for higher values of cost $(C_1)$.

(ii) For $C_1 = 1000$, $(P_4 - P_5) > = or < 0$ according as $C_0 > = or < 28523.664$. Hence Model of Chapter IV is better or worse than the Model of Chapter V whenever $C_0 > = 28523.664$. Both the models are equally good if $C_0 = 28523.664$.

(iii) For $C_1 = 10000$, $(P_4 - P_5) > = or < 0$ according as $C_0 > = or < 27766.211$. Hence, Model of Chapter IV is better or worse than the Model of Chapter V whenever $C_0 > = 27766.211$. Both the models are equally good if $C_0 = 27766.211$.

(iv) For $C_1 = 20000$, $(P_4 - P_5) > = or < 0$ according as $C_0 > = or < 27001.117$. Hence Model of Chapter IV is better or worse than the Model of Chapter V whenever $C_0 > = 27001.117$. Both the models are equally good if $C_0 = 27001.117$. 
Fig. 8.8 represents the behavior of the difference between the profit, i.e., \((P_4 - P_5)\) with respect to offline repair rate \((\alpha_3)\) of an oil delivering system for different values of cost of busy period of repairman \((C_1)\).

From the Fig, following is concluded:

(i) The difference \((P_4 - P_5)\) increases as the offline repair rate \((\alpha_3)\) increases. Also, the difference becomes higher for higher values of cost of busy period of repairman \((C_1)\).

(ii) For \(C_1 = 1000\), \((P_4 - P_5) > 0 = \text{or} < 0\) according as \(\alpha_3 > 0 = \text{or} < 0.0291\). Hence Model of Chapter IV is better or worse than the Model of Chapter V whenever \(\alpha_3 > < 0.0291\). Both the models are equally good if \(\alpha_3 = 0.0291\).

(iii) For \(C_1 = 10000\), \((P_4 - P_5) > 0 = \text{or} < 0\) according as \(\alpha_3 > 0 = \text{or} < 0.0258\). Hence, Model of Chapter IV is better or worse than the Model of Chapter V whenever \(\alpha_3 > < 0.0258\). Both the models are equally good if \(\alpha_3 = 0.0258\).

(iv) For \(C_1 = 20000\), \((P_4 - P_5) > 0 = \text{or} < 0\) according as \(\alpha_3 < 0 = \text{or} > 0.0232\). Hence Model of Chapter IV is better or worse than the Model of Chapter V whenever \(\alpha_3 > < 0.0232\). Both the models are equally good if \(\alpha_3 = 0.0232\).
Fig. 8.9 shows the behaviour of the difference between the profit, i.e., $(P_4 - P_5)$ with respect to partial failure rate $\lambda_1$ of an oil delivering system for different values of revenue ($C_0$).

From the Fig., following is concluded:

(i) The difference $(P_4 - P_5)$ increases as the cost ($\lambda_1$) increases. Also, the difference becomes higher for higher values of cost ($C_0$).

(ii) For $C_0=21000$, $(P_4 - P_5) > 0$ or $< 0$ according as $\lambda_1 > 0$ or $\leq 0.00180$. Hence Model of Chapter IV is better or worse than the Model of Chapter V whenever $\lambda_1 > 0.00180$. Both the models are equally good if $\lambda_1 = 0.00180$.

(iii) For $C_0=21500$, $(P_4 - P_5) > 0$ or $< 0$ according as $\lambda_1 > 0$ or $< 0.00174$. Hence, Model of Chapter IV is better or worse than the Model of Chapter V whenever $\lambda_1 > 0.00174$. Both the models are equally good if $\lambda_1 = 0.00174$.

(iv) For $C_0=22000$, $(P_4 - P_5) > 0$ or $< 0$ according as $\lambda_1 > 0$ or $< 0.00195$. Hence Model of Chapter IV is better or worse than the Model of Chapter V whenever $\lambda_1 > 0.00195$. Both the models are equally good if $\lambda_1 = 0.00195$. 

![Graph showing the difference of profits $(P_4 - P_5)$ vs partial failure rate $\lambda_1$ for different values of revenue ($C_0$).](image)
From the above three graphs it can be found out easily that when \((P_4 - P_5) > 0\) then there is no need to give priority of repair for partially failed unit in the oil delivering system and repairs can be done on FCFS basis. When \(P_4 - P_5 < 0\) then it is beneficial for the oil delivering system to give priority of repair for partial failed unit.

(d) **Comparison between the Models Discussed in Chapter IV and Chapter VI**

Models with two unit standby system are discussed in both the chapters. The model discussed in chapter IV and chapter VI has two mode of failure. i.e. unit can be failed via partial failure or by direct failure. In chapter IV oil delivering system has only offline repair facility for partial failure, but in chapter VI oil delivering system has both offline as well as online repair facility for partial failure. The repair of the units would be done on FCFS basis. For making the comparison between the two models, various conclusions have been drawn through graphs as follows:

**Fig.8.10** reveals the behavior of the difference between the profit, i.e., \((P_4 - P_6)\) with respect to cost \((C_0)\) of an oil delivering system for different values of cost of alternate performance \((C_5)\).
From the Fig., following is concluded:

(i) The difference \((P_4 - P_6)\) decreases as the cost \((C_0)\) increases. Also, the difference becomes higher for lower values of cost \((C_5)\).

(ii) For \(C_5 = 1000\), \((P_4 - P_6)\) > or = or < 0 according as \(C_0 < or = or > 113398.881\). Hence Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(C_0 < or > 113398.881\). Both the models are equally good if \(C_0 = 113398.881\).

(iii) For \(C_5 = 2000\), \((P_4 - P_6)\) > or = or < 0 according as \(C_0 < or = or > 104285.9751\). Hence, Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(C_0 < or > 104285.9751\). Both the models are equally good if \(C_0 = 104285.9751\).

(iv) For \(C_5 = 3000\), \((P_4 - P_6)\) > or = or < 0 according as \(C_0 < or = or > 95173.1367\). Hence Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(C_0 > or < 95173.1367\). Both the models are equally good if \(C_0 = 95173.1367\).

Fig. 8.11 depicts the behavior of the difference between the profit, i.e., \((P_4 - P_6)\) with respect to offline repair rate \((\alpha_3)\) of an oil delivering system for different values of online repair rate \((\alpha_4)\).
From the Fig., following is concluded:

(i) The difference \((P_4 - P_6)\) increases as the offline repair rate \((\alpha_3)\) increases. Also, the difference becomes higher for higher values of offline repair rate \((\alpha_4)\).

(ii) For \(\alpha_4 = .2\), \((P_4 - P_6) > 0\) or \(\leq 0\) according as \(\alpha_3 > 0\) or \(\leq 0\) or \(\leq 0.16594\). Hence Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(\alpha_3 > 0\) or \(< 0.16594\). Both the models are equally good if \(\alpha_3 = 0.16594\).

(iii) For \(\alpha_4 = .4\), \((P_4 - P_6) > 0\) or \(\leq 0\) according as \(\alpha_3 > 0\) or \(\leq 0\) or \(< 0.17718\). Hence, Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(\alpha_3 > 0\) or \(< 0.17718\). Both the models are equally good if \(C_0 = 0.17718\).

(iv) For \(\alpha_4 = .6\), \((P_4 - P_6) > 0\) or \(\leq 0\) according as \(\alpha_3 \leq 0\) or \(\geq 0\) or \(\geq 0.190043\). Hence Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(\alpha_3 > 0\) or \(< 0.190043\). Both the models are equally good if \(\alpha_3 = 0.190043\).

Fig. 8.12 represents the behavior of the difference between the profit, i.e., \((P_4 - P_6)\) with respect to partial failure rate \((\lambda_1)\) of an oil delivering system for different values of revenue \((C_0)\).
From the fig, following is concluded:

(i) The difference \((P_4 - P_6)\) decreases as the cost \((\lambda_1)\) increases. Also, the difference becomes higher for lower values of cost \((C_0)\).

(ii) For \(C_0 = 500000\), \((P_4 - P_6) > or \leq or < 0\) according as \(\lambda_1 < or = or > .002629\).
    Hence Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(\lambda_1 > or < 02629\). Both the models are equally good if \(\lambda_1 = 002629\).

(iii) For \(C_0 = 550000\), \((P_4 - P_6) > or = or < 0\) according as \(\lambda_1 < or = or > .002353\).
    Hence, Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(\lambda_1 < or > .002353\). Both the models are equally good if \(\lambda_1 = .002353\).

(iv) For \(C_0 = 600000\), \((P_4 - P_6) > or = or < 0\) according as \(\lambda_1 < or = or > .002128\).
    Hence Model of Chapter IV is better or worse than the Model of Chapter VI whenever \(\lambda_1 > or < 02128\). Both the models are equally good if \(\lambda_1 = 002128\).

From the above three graphs it can be found out easily that when \((P_4 - P_6) > 0\) then there is no need to provide online repair facility for partial failure in the oil delivering system. When \((P_4 - P_6) < 0\) then online repair facility for partial failure can be provided in the oil delivering system.

(f) **Comparison between the Models Discussed in Chapter V and Chapter VII**

Models with two units standby systems are discussed in both the chapters. The model discussed in chapter V and chapter VII has two mode of failure .i.e. unit can be failed via partial failure or by direct failure. In chapter V oil delivering system has only offline repair facility but in chapter VII system has both offline as well as online repair facility for partial failure and priority is given to partially failed unit over completely failed unit in both the two models for repair. For making the comparison between the two models, various conclusions have been drawn through graphs as follows:
Fig. 8.13 shows the behavior of the difference between the profit, i.e., \((P_5 - P_7)\) with respect to cost \((C_0)\) of an oil delivering system for different values of cost per visit of repairman \((C_4)\). From the graph, following is concluded:

From the Fig. following is concluded

(i) The difference \((P_5 - P_7)\) decreases the cost \((C_0)\) increases. Also, the difference becomes higher for higher values of cost \((C_4)\).

(ii) For \(C_4 = 63000\), \((P_5 - P_7) > or = or < 0\) according as \(C_0 < or = or > 25.2974\). Hence Model of Chapter V is better or worse than the Model of Chapter VII whenever \(C_0 < or > 25.2974\). Both the models are equally good if \(C_0 = 25.2974\).

(ii) For \(C_4 = 64000\), \((P_5 - P_7) > or = or < 0\) according as \(C_0 < or = or > 27.668\). Hence, Model of Chapter V is better or worse than the Model of Chapter VII whenever \(C_0 < or > 27.668\). Both the models are equally good if \(C_0 = 27.668\).

(iii) For \(C_4 = 65000\), \((P_5 - P_7) > or = or < 0\) according as \(C_0 < or = or > 30.0397\). Hence Model of Chapter V is better or worse than the Model of Chapter VII whenever \(C_0 < or > 30.0397\). Both the models are equally good if \(C_0 = 30.0397\).
VII whenever $C_0 < \text{ or } > 30.0397$. Both the models are equally good if $C_0 = 30.0397$.

Fig. 8.14 reveals the behavior of the difference between the profit, i.e., $(P_5 - P_7)$ with respect to cost per visit of repairman ($C_4$) for different values of cost of busy period of repairman ($C_1$)

![Graph showing difference of profits vs cost per visit of repairman](image)

From the Fig., following is concluded:

(i) The difference $(P_5 - P_7)$ increases the cost ($C_4$) increases. Also, the difference becomes higher for higher values of cost ($C_1$).

(ii) For $C_1 = 100$, $(P_5 - P_7) > \text{ or } = \text{ or } < 0$ according as $C_4 > \text{ or } = \text{ or } < 56547.800$.

Hence Model of Chapter V is better or worse than the Model of Chapter VII whenever $C_4 > \text{ or } < 56547.800$. Both the models are equally good if $C_4 = 56547.800$.

(iii) For $C_1 = 120$, $(P_5 - P_7) > \text{ or } = \text{ or } < 0$ according as $C_4 > \text{ or } = \text{ or } < 59331.472$.

Hence, Model of Chapter V is better or worse than the Model of Chapter VII whenever $C_1 > \text{ or } < 59331.472$. Both the models are equally good if $C_1 = 59331.472$.

(iv) For $C_1 = 140$, $(P_5 - P_7) > \text{ or } = \text{ or } < 0$ according as $C_4 > \text{ or } = \text{ or } < 62115.3365$.

Hence Model of Chapter V is better or worse than the Model of Chapter VII
whenever \( C_4 > \) or \(< 62115.3365 \). Both the models are equally good if \( C_4 = 62115.3365 \).

**Fig. 8.15** depicts the behaviour of the difference between the profit, i.e., \((P_5 - P_7)\) with respect to partial failure rate \( \lambda_1 \) of an oil delivering system for different values of cost of busy period of repairman \( (C_4) \)

From the Fig., following is concluded:

(i) The difference \((P_5 - P_7)\) increases as the cost \((\lambda_1)\) increases. Also, the difference becomes higher for higher values of cost \((C_4)\).

(ii) For \( C_4 = 54000 \), \((P_5 - P_7) > or = or < 0 \) according as \( \lambda_1 > or = or < .00723 \). Hence Model of Chapter V is better or worse than the Model of Chapter VII whenever \( \lambda_1 > or < .00723 \). Both the models are equally good if \( \lambda_1 = .00723 \).

(iii) For \( C_4 = 56000 \), \((P_5 - P_7) > or = or < 0 \) according as \( \lambda_1 > or = or < .00705 \). Hence, Model of Chapter V is better or worse than the Model of Chapter VII whenever \( \lambda_1 > or < .00705 \). Both the models are equally good if \( \lambda_1 = .00705 \).

(iv) For \( C_4 = 58000 \), \((P_5 - P_7) > or = or < 0 \) according as \( \lambda_1 > or = or < .00688 \). Hence Model of Chapter V is better or worse than the Model of Chapter VII whenever \( \lambda_1 > or < .00688 \). Both the models are equally good if \( \lambda_1 = .00688 \).
From the above three graphs it can be found out easily that when \((P_5 - P_7) > 0\) then there is no need to provide online repair facility for partially failed unit in the oil delivering system. When \((P_5 - P_7) < 0\) then it is beneficial for the oil delivering system to have online repair facility for partially failed unit.

(g) Comparison between the Models Discussed in Chapter VI and Chapter VII

Models with two standby units are discussed in both the chapters. The model discussed in chapter VI and chapter VII has two mode of failure i.e. unit can be failed via partial failure or by direct failure. In chapter VI and chapter VII oil delivering system has both offline as well as online repair facility for partial failure. In chapter VI repair is done on FCFS basis but in chapter VII priority is given to partially failed unit for repair. For making the comparison between the two models, various conclusions have been drawn through graphs as follows.

Fig. 8.16 represents the behavior of the difference between the profit, i.e., \((P_6 - P_7)\) with respect to Revenue \((C_0)\) of an oil delivering system for different values of cost of alternate performance \((C_5)\).
From the Fig., following is concluded:

(i) The difference \((P_6 - P_7)\) increases as the cost \((C_0)\) increases. Also, the difference becomes higher for higher values of cost \((C_5)\).

(ii) For \(C_5 = 1000\), \((P_6 - P_7) > or = or < 0\) according as \(C_0 > or = or < 80104.05\). Hence Model of Chapter VI is better or worse than the model of Chapter VII whenever \(C_0 > or < 80104.05\). Both the models are equally good if \(C_0 = 80104.05\).

(iii) For \(C_5 = 5000\), \((P_6 - P_7) > or = or < 0\) according as \(C_0 > or = or < 83950.173\). Hence, Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(C_0 > or < 83950.173\). Both the models are equally good if \(C_0 = 83950.173\).

(iv) For \(C_5 = 10000\), \((P_6 - P_7) > or = or < 0\) according as \(C_0 > or = or < 88757.637\). Hence Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(C_0 > or < 88757.637\). Both the models are equally good if \(C_0 = 88757.637\).

Fig. 8.17 Shows the behavior of the difference between the profit, i.e., \((P_6 - P_7)\) with respect to offline repair rate \((\alpha_3)\) of an oil delivering system for different values of cost of busy period of repairman \((C_1)\).
From the graph, following is concluded:

(i) The difference \((P_6 - P_7)\) increases as the offline repair rate \((\alpha_3)\) increases. Also, the difference becomes higher for higher values of cost of busy period of repairman \((C_1)\).

(ii) For \(C_1 = 35000\), \((P_6 - P_7) > or = or < 0\) according as \(\alpha_3 > or = or < 0.2847\).

Hence Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(\alpha_3 > or < 0.2847\). Both the models are equally good if \(\alpha_3 = 0.2847\).

(iii) For \(C_1 = 40000\), \((P_6 - P_7) > or = or < 0\) according as \(\alpha_3 > or = or < 0.2525\).

Hence, Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(\alpha_3 > or < 0.2525\). Both the models are equally good if \(\alpha_3 = 0.2525\).

(iv) For \(C_1 = 45000\), \((P_6 - P_7) > or = or < 0\) according as \(\alpha_3 > or = or < 0.2317\).

Hence Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(\alpha_3 > or < 0.2317\). Both the models are equally good if \(\alpha_3 = 0.2317\).

Fig. 8.18 reveals the behaviour of the difference between the profit, i.e., \((P_6 - P_7)\) with respect to partial failure rate \(\lambda_1\) of an oil delivering system for different values of revenue \((C_0)\)
From the Fig., following is concluded:

(i) The difference \((P_6 - P_7)\) increases as the cost \((\lambda_1)\) increases. Also, the difference becomes higher for higher values of cost \((C_0)\).

(ii) For \(C_0 = 60000\), \((P_6 - P_7) \geq 0\) according as \(\lambda_1 > 0\). Hence Model of Chapter VI

(iii) is better or worse than the model of Chapter VII whenever \(\lambda_1 > 0\).

Both the models are equally good if \(\lambda_1 = 0.0229\).

(iv) For \(C_0 = 65000\), \((P_6 - P_7) > 0\) according as \(\lambda_1 > 0\). Hence, Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(\lambda_1 > 0\). Both the models are equally good if \(\lambda_1 = 0.02003\).

(v) For \(C_0 = 70000\), \((P_6 - P_7) > 0\) according as \(\lambda_1 > 0\). Hence Model of Chapter VI is better or worse than the Model of Chapter VII whenever \(\lambda_1 > 0\). Both the models are equally good if \(\lambda_1 = 0.0175\).

From the above three graphs it can be found out easily that when \((P_6 - P_7) > 0\) then there is no need to give priority of repair for partially failed unit in the oil delivering system and repairs can be done on FCFS basis. When \((P_6 - P_7) < 0\) then it can be recommended to the oil delivering system to give priority of repair for partial failed unit.

**Conclusion**

From the study made, it can be concluded that cut-off points for various rates / probabilities/revenue per unit up time /costs can be obtained which help decide that the user of the system that for the system to be profitable

What should be the lower limit of repair rate,revenue per unit up time ,probability \((p_1)\). What should be the upper limit of failure rate,cost for engaging the repairman. From the cut off point of the revenue per unit up time, the cost price of the product to be produced by the user can be fixed to get at least this revenue.