2019

STATISTICS

(Major)

Paper : 5.4

(Operation Research)

Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer the following as directed : 1×7=7

(a) The main objective of replacement is to direct the organization for maximizing its ____.

(Fill in the blank)

(b) What is present worth factor?

(c) The inventory is maintained for efficient and smooth running of _____ affairs.

(Fill in the blank)

(d) Who has first developed the concept of EOQ?

(i) Fisher

(ii) F. Harris

(iii) Erlang

(iv) Johnson

(Choose the correct option)

(e) What is perpetual inventory system?

(f) Define 'error of redundancy'.

(g) An activity is said to be critical if a delay in its start will cause a further delay in the completion date of the entire project.

(Write True or False)

2. Answer the following questions in short : 2×4=8

(a) What are the four categories of activities in network diagram?

(b) What are the situations which make the replacement of items necessary?

(c) Write down the names of any four types of inventory models.

(d) Write any two advantages of inventory control.

3. Answer any *three* of the following questions : 5×3=15

(a) Explain the concept of 'Economic Order Quantity' in inventory control with proper sketch.

(b) A shopkeeper has a uniform demand of an item at the rate of 600 items per year. He buys from a supplier at a cost of ₹ 8 per item and the cost of ordering is ₹ 12 each time. If the stock holding cost is 20% per year of stock value, how frequently should he replenish his stock and what is the optimal order quantity?

(c) Write down any five differences between PERT and CPM techniques.

(d) The data collected in running a machine, the cost of which is ₹ 60,000, are given below :

Year	:	*1*	*2*	*3*
Resale Value (in ₹)	:	42,000	30,000	20,400
Cost of Spares (in ₹)	:	4,000	4,270	4,880
Cost of Labour (*in* ₹)	:	14,000	16,000	18,000

Year	:	*4*	*5*
Resale Value (in ₹)	:	14,400	9,650
Cost of Spares (in ₹)	:	5,700	6,800
Cost of Labour (*in* ₹)		21,000	25,000

Determine the optimum period for replacement of the machine.

(e) At time zero all items in a system are new. Each item has a probability $q\ (=1-p)$ of failing immediately before the end of the second month (all items fail by the end of the second month). If all the items are replaced as they fail, show that the expected number of failures $f(x)$ at the end of the month x will be

$$f(x) = \frac{N}{(1+q)}[1-(-q)^{x+1}]$$

where N is the number of items in the system.

4. Answer the following questions : 10×3=30

(a) Discuss the policy of replacement of items whose maintenance costs increase with time but the value of money remains constant during the period *(i)* if time is measured continuously and *(ii)* if time is measured in discrete units.

Or

Derive the following rules for minimizing costs in case of replacement of item whose maintenance costs increase with time :

(i) Replace if the next period's cost is greater than the weighted average of previous costs

(ii) Do not replace if the next period's cost is less than the weighted average of previous costs

(b) Describe the single item production inventory model with no shortages and derive the formulae for optimum lot size for one run and the optimum time between two runs.

Or

Derive an expression for economic production quantity with finite replenishment with no shortages.

(c) Explain PERT and its importance in network analysis. What are the three estimates needed for PERT analysis? How do you use these estimates to compute the expected activity time and the variance in activity time?

Or

A project consists of a series or tasks labelled $A, B, \cdots, H, I$ with the relationships ($W < X, Y$ means X and Y cannot start until W is completed; $X, Y < W$ means W cannot start until both X and Y are completed). With this notation, construct the network diagram having the following constraints :

$A < D, E$; $B, D < F$; $C < G$; $B, G < H$; $F, G < I$

Find also the optimum time of completion of the project, when the time (in days) of completion of each task is as follows :

Task :	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Time :	23	8	20	16	24	18	19	4	10

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