# 2018

## 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)* Define the term 'free float'.

*(b)* "The problem of network is to find a course of action which minimizes some measure of performance." The measure can be

*(i)* time

*(ii)* cost

*(iii)* time, cost, distance travelled, etc.

*(iv)* None of the above

( Choose the correct option )

(c) In case of items whose maintenance cost increases with time and the value of money also changes with time, replace if the operating cost of next period is _____ the weighted average of the previous costs.

( Fill in the gap )

(d) State the full form of 'ABC analysis'.

(e) The carrying cost is _____ to the quantity to be kept in stock and the time to which the inventory is maintained.

( Fill in the gap )

(f) What is the fundamental objective of inventory control?

(g) What do you mean by 'buffer stock'?

**2.** Answer the following questions : 2×4=8

(a) What are the practical limitations in using PERT?

(b) Distinguish between individual replacement policy and group replacement policy.

(c) State the important characteristics of a network analysis.

(d) Explain clearly the different costs that are involved in inventory problems.

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

*(a)* Derive an economic order quantity model for an inventory problem when shortage costs are not allowed and replenishment is periodic.

*(b)* Discuss the policy of replacement of items whose maintenance cost increases with time but the value of money remains constant during the period.

*(c)* The cost of a machine is ₹ 3,000. The resale value and the running costs are given as below :

| *Year* | : | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| *Recurring Cost* (in ₹) | : | 600 | 700 | 800 | 900 |
| *Resale Value* (in ₹) | : | 2,000 | 1,033 | 1,000 | 750 |

| *Year* | : | 5 | 6 | 7 |
|---|---|---|---|---|
| *Recurring Cost* (in ₹) | : | 1,000 | 1,200 | 1,500 |
| *Resale Value* (in ₹) | : | 500 | 300 | 300 |

At what stage the replacement of the machine is due?

*(d)* What are the three estimates needed in PERT analysis? How do you use these estimates to compute the expected activity time and the variance in the activity time?

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

(a) A project has the following time schedule :

| | | | | | | |
|---|---|---|---|---|---|---|
| *Activity* | : | 1–2 | 1–3 | 1–4 | 2–5 | |
| *Time* (in weeks) | : | 2 | 2 | 1 | 4 | |
| *Activity* | : | 3–6 | 3–7 | 4–6 | 5–8 | 6–9 |
| *Time* (in weeks) | : | 8 | 5 | 3 | 1 | 5 |
| *Activity* | : | 7–8 | 7–9 | | | |
| *Time* (in weeks) | : | 4 | 3 | | | |

Construct PERT network and compute *(i)* total float for each activity, *(ii)* critical path and its duration. Also find the maximum number of cranes the project must have for its activities 2–5, 3–7 and 8–9 without delaying the project. Is there any change required in PERT network? If so, indicate the name.

*Or*

Describe the step-by-step procedure of determining the critical path and its duration.

(b) Suppose the maintenance cost of a machine increases with time and the value of money decreases at a constant rate. Then find the best replacement age of the machine which minimizes the total of all future discounted costs.

*Or*

The following mortality rates have been observed for a certain type of light bulbs :

| | | | | | | |
|---|---|---|---|---|---|---|
| *Week* | : | 1 | 2 | 3 | 4 | 5 |
| *Percent failing by the end of the week* | : | 10 | 25 | 50 | 80 | 100 |

There are 1000 bulbs in use and it costs ₹ 1 to replace an individual bulb which has burnt out. If all bulbs were replaced simultaneously, it would cost 25 paise per bulb. It is proposed to replace all bulbs at fixed intervals, whether or not they have burnt out and to continue replacing burnt out bulbs as they fail. At what interval should all the bulbs be replaced?

*(c)* Derive an economic lot size with different rates of demand in different cycles.

*Or*

An aircraft uses rivets at approximately constant rate of 5000 kg per year. The rivets cost ₹ 20 per kg and the company personnel estimate that it costs ₹ 200 to place an order and the

carrying cost of inventory is 10% per year.

*(i)* How frequently should orders for rivets be placed and what quantities should be ordered for?

*(ii)* If the actual costs are ₹ 500 to place an order and 15% for carrying cost, the optimum policy would change. How much is the company losing per year because of the imperfect cost information?

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