

St. Joseph's College of Arts and Science, Cuddalore.

Question Bank

PG Research Department of Mathematics

Class: I M.Sc Mathematics

Subject Name: Operation Research

Subject Code: EPMT810T

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UNIT – 1

2 Marks

1. Define Dummy Activity.
2. Define the three time estimates involved in PERT Technique.
3. State any two difference between PERT and CPM.
4. Define critical Path.
5. Define Optimistic time and pessimistic time

5 Marks

6. State the difference between PERT and CPM.
7. What are the significance of using PERT/CPM.
8. Explain in detail about the three phases of project management.
9. An assembly is to be made from two parts X and Y. Both parts must be turned on a lathe and Y must be polished whereas X need not be polished. The sequence of activities together with their predecessors is given below.

A c t i v i t y	D e s c r i p t i o n	P r e d e c e s s o r A c t i v i t y
A	Open work order	-
B	Get material for X	A

C	Get material for Y	A
D	Turn X on lathe	B
E	Turn Y on lathe	B, C
F	Polish Y	E
G	Assemble X and Y	D, F
H	Pack	G

Draw a network diagram for the project.

10. Explain the steps involved in resource smoothing.

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10Marks

11. The following represents the activities associated with the project.

A c t i v i t i e s	A	B	C	D	E	F	G	H	I
Optimistic time	5	1 8	2 6	1 6	1 5	6	7	7	3
Pessimistic Time	1 0	2 2	4 0	2 0	2 5	1 2	1 2	9	5
Most likely time	8	2 0	3 3	1 8	2 0	9	1 0	8	4

- (i) Find the expected activity time and variance.
- (ii) Find the earliest and latest expected completion times of each event.
- (iii) Find the critical path.
- (iv) Find the probability of expected completion time of the project if the original scheduled time of completing the project is 41.5 weeks.

12. A network with the following activity durations and manpower requirements is given.

Analysis the project from point of view of resources to bring out the necessary steps involved in the analysis and smoothing of resources.

A c t i v i t i e s	1-2	2-3	2-4	3-5	4-6	4-7	5-8	6-8	7-9	8-10	9-10
Duration (days)	2	2	0	2	5	4	5	6	3	4	6
Manpower required	4	4	0	2	3	6	2	8	7	4	3

13. Listed in the table are the activities.

A c t i v i t y	P r e d e c e s s o r s	D u r a t i o n (d a y s)
A	-	6
B	A	4
C	B	7
D	A	2
E	D	4
F	E	1
G	-	2
H	G	1
I	J , H	6
J	-	1
K	A	9
L	C , K	3
M	I , L	5

- Drew a network diagram for this project
- Find the critical path, What is its length?

14. A project is represented by the network show and has the following data.

T a s k	A	B	C	D	E	F	G	H	I
Optimistic time	5	1 8	2 6	1 6	1 5	6	7	7	3
Pessimistic Time	1 0	2 2	4 0	2 0	2 5	1 2	1 2	9	5
Most likely time	8	2 0	3 3	1 8	2 0	9	1 0	8	4

Determine the following.

- Find the expected task time and variance.
- Find the earliest and latest expected completion times of each event.
- Find the critical path.

15. A project with the following activities duration and manpower requirement is given.

A c t i v i t i e s	1-2	1-3	1-4	2-5	2-6	3-7	4-8	5-9	6-9	7-8	8-9
Duration (days)	2	2	0	2	5	4	5	6	3	4	6

Manpower required	5	4	0	2	3	6	2	8	7	4	3
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- (i) Draw the network diagram of the project indicating the earliest start, earliest finish, latest finish and float of each activity.
- (ii) There are 11 persons who can be employed for this project. Carry out the appropriate manpower leveling so that fluctuation of work force requirement from day-to-day is as small as possible.

16. A small project is composed of seven activities whose time estimates are listed in the table below.

UNIT-2

2 Marks

1. Define set-up cost.
2. State the three different approaches used to check the status of an inventory.
3. Define relevant costs in an inventory.
4. Define holding cost

5 Marks

5. Explain classification of EQR Models.
6. Write the steps of Inventory Model Building.

7. Explain the purchase cost, holding cost and ordering cost involved in an inventory.
8. Explain the reason for carrying inventory.

10 Marks

9. a) A product is sold at the rate of 50 pieces per day and is manufactured at a rate of 250 pieces per day. The set-up cost of the machine is Rs.1,000 and the storage cost is found to be Rs.0.0015 per pieces per day. With labour charges of Rs.3.20 per piece, material cost at Rs.2.10 per piece and overhead cost of Rs.4.10 per piece, find the minimum cost batch size if the interest charges are 8 percent number of cycles required in a year for the manufacture of this product.
10. A manufacture has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts Rs.0.60 per unit per year. The set-up cost per run is Rs.80.00. Find the optimum run size and the minimum average yearly cost.
11. Explain the EOQ model with different rates of demand and prove that $EOQ = \sqrt{2DC_o/TC_h}$
12. The production department of a company requires 3,600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs.36 and the cost of carrying inventory is 25 percent of the investment in the inventories. The price is Rs.10 per kg. Determine the ordering policy for raw material.
13. Explain the EOQ model with different rates of demand and prove that $EOQ = \sqrt{2DC_o/C_h}$
14. A company that operates for 50 weeks in a year is concerned about its stocks of copper cable. This cost is Rs.240 a meter and there is a demand for 8000 meters a week. Each replenishment costs Rs.1,050 for administration and Rs.1,650 for delivery while holding costs are

estimated at 25 percent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company?

How is the gross profit if the company wanted to maximize its profits rather than minimize cost?

What is the gross profit if the company sells the cable for Rs.360 a meter.

UNIT-3

2 marks

1. What are the characteristics of a queuing system.
2. Write the Kendall's notation of an queuing model.
3. Prove that the probability of the queue being non-empty for $(M/M/1):(\infty/FCFS)$ model is $(\lambda/\mu)^2$.
4. Define queue discipline

5 Marks

5. Explain pure Death process
6. Explain classification of queuing model.
7. Obtain the system of differential difference equation for a equating model $(M/M/1):(\infty/FCFS)$.
8. Draw thestructure of queuing system and explain in detail.
9. Explain pure birth process.

10Marks

- 10.A television repairman finds that the time spent on his jobs has an exponential distribution with a mean of 30 minutes. If he repairs set in the order in which they came in, and if the arrival of sets follows a poisons distribution approximately with an average rate of 10 per 8 hour day, what is the repairman's expected idle time each day? How many job are ahead of the average set just brought in?
- 11.Arrivals at telephone booth are considered to be Poisson with an average time of 10 minutes between one between one arrival and the next.

12. Obtain the system of differential difference equation for a queueing model (M/M/1):(∞/FCFS).

13. Arrival rate of the telephone calls at a telephone booth is according to Poisson distribution, with an average time of 10 minutes between two consecutive arrivals. The length of telephone call is assumed to be exponentially distributed, with mean 3 minutes.

- (i) Determine the probability that a person arriving at the booth will have to wait.
- (ii) Find the average queue length that forms from time to time.
- (iii) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least four minutes for the phone. Find the increase in flow of arrivals which will justify a second booth.
- (iv) What is the probability that an arrival will have to wait for more than 10 minutes before the phone is free?
- (v) What is the probability that he will have to wait for more than 10 minutes before the phone is available and the call is also complete?

14. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes, calculate the following.

- (i) The mean queue size.
- (ii) The probability that the queue size exceeds 10.
If the input of trains increases to an average 33 per day, what will be the change in (1) and (2).

15. A supermarket has two sales girls at the sales counters. If the service time for each customer is Exponential with mean of 4 minutes and if the

people arrive in a Poisson fashion at the rate of 10 an hour then calculate the:

- (i) Probability that a customer has to wait for being served.
- (ii) Expected percentage of idle time for each sales girl.
- (iii) If a customer has to wait what is the expected length of his waiting time.

UNIT-4

2 Marks

1. What is replacement?
2. What is meant by Gradual Failure?
3. What is meant by Sudden failure?
4. Define renewal density function.

5 Marks

5. Explain about various types of failure.
6. A certain piece of equipment is extremely difficult to adjust. During a period when no adjustment is made the running cost increases linearly with time at a rate of b rupees per hour. The running cost immediately after an adjustment is not precisely know until the adjustment has been made. Before the adjustment the resulting running cost X is a random variable with density function $f(X)$. if each adjustment costs K rupees when should the replacement made?
7. A firm is considering replacement of a machine, whose cost price is Rs.12,200 and the scrap value Rs.200. the running costs are found from experience to be as follows:

Y e a r	1	2	3	4	5	6	7	8
Running cost (Rs.)	2 0 0	5 0 0	8 0 0	1200	1800	2500	3200	4000

When should the machine be replaced?

8. A pipeline is due for repairs. The repair would cost Rs.10,000 and would last for three years. Alternately, a new pipeline can be laid at a cost of Rs.30,000, which would for 10 years. Assuming the cost of capital to be

10 percent and ignoring salvage value, which alternative should be chosen.

10 arks

9. The data collected in running a machine, the cost of which is Rs.60,000 are given below.

Y e a r	1	2	3	4	5
Resale value (Rs)	42,000	30,000	20,400	14,400	9,650
Cost of spares (Rs)	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine

- 10.State and prove the theorem on Group Replacement Policies.

11. A bakery keeps stock of a popular brand of cake. Previous experience show the daily demand pattern for the item with associated probabilities as given below:

Daily demand (number)	0	1	2	3	4	5
P r o b a b i l i t y	0.01	0.20	0.15	0.50	0.12	0.02

Use the following sequence of random numbers to stimulate the demand for next 10 days. Random numbers:25,39,65,76,12,05,73,89,19,49.

Also estimate the daily average demand for the cakes on the basis of the simulated data.

- 12.Explain about the various types of simulation.

- 13.A whose purchase price is Rs.2,00,000 are as follows.

Y e a r	1	2	3	4	5	6	7
Running cost (Rs)	30,000	38,000	46,000	58,000	72,000	90,000	1,10,000
Resale value (Rs)	1,00,000	50,000	25,000	12,000	8,000	8,000	8,000

What is the optimum period of replacement?

14. Let the value of the money be assumed to be 10 per cent per year and suppose that machine A is replaced after every three years whereas machine B is replaced every six years. The yearly costs(in Rs) of both the machines are given as under.

Y e a r	1	2	3	4	5	6
Machine A	1 , 0 0 0	2 0 0	4 0 0	1 0 0 0	2 0 0	4 0 0
Machine B	1 , 7 0 0	1 0 0	2 0 0	3 0 0	4 0 0	5 0 0

Determine which machine should be purchased.

UNIT-5

2 Marks

1. Define simulation
2. Define Monto Carlo simulation
3. Write any two advantage and disadvantage of simulation.
4. Write the roles of computers in simulation.

5 Marks

5. What are the types of simulation
6. What are the steps involved in simulation process.
7. Write the advantages and disadvantages of simulation.
8. Explain the applications of simulation.

10 marks

9. A firm is considering replacement of a machine, whose cost price is Rs.12,200 and the scrap value Rs.200. the running costs are found from experience to be as follows:

Y e a r	1	2	3	4	5	6	7	8
Running cost (Rs.)	2 0 0	5 0 0	8 0 0	1200	1800	2500	3200	4000

When should the machine be replaced?

10. Using random numbers to simulate a sample, find the probability that a packet of 6 products does not contain any defective product, when the production line produces 10 per cent defective products. Compare your answer with the expected probability.

10. Write the steps of simulation process.

