

OPERATIONS RESEARCH

(For students admitted in 2014 only)

Time: 3 hours

Max. Marks: 60

All questions carry equal marks

SECTION - A

Answer the following: (05 X 10 = 50 Marks)

- 1 Write a short note on cross-functional specialization requirements in operations research applications.

OR

- 2 A company produces two types of leather belts Type-A and Type-B. A type gives a profit of Rs.10/- per belt and B-gives Rs.5/- per belt. The raw material supply is sufficient for making 850 belts per day. Type-A requires a special buckle and 500 are available per day. There are 700 buckles available for Type-B. Type A needs twice as much time as that required for Type-B and the company can produce 500 belts, if all of them were of Type-A. Formulate a LP model fro this problem and solve it graphically.

- 3 Find the optimum transportation plan such that the total transportation cost is lowest.

Plant	Markets				Capacity
	S1	S2	S3	S4	
F1	4	6	8	13	50
F2	13	11	10	8	70
F3	14	4	10	13	30
F4	9	11	13	8	50
Total	25	35	105	20	

OR

- 4 The captain of a cricket team has to allot five middle-order batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows:

Batsmen	Batting positions				
	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

Find the assignment of batsmen to position that would give the maximum number of runs for the team.

- 5 A workstation has six jobs waiting to be processed. They arrived at the end of day 0 and it is now the beginning of day I. It is now time zero. Times are expressed in terms of days.

Job	Time Since Job Arrived	Processing Time	Due Date
A	12	8	24
B	7	2	11
C	18	6	31
D	5	12	25
E	6	7	8
F	19	5	6

Use the information in the above table, what sequence would you use if you want to minimize the make span of the jobs.

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OR

- 6 Solve the game graphically and find the optimum strategies for each of the player.

Player - A	Player - B	
	1	-3
	3	5
	-1	6
	4	1
	2	2
	-5	0

- 7 A crew of mechanics at the department of transportation garage make minor repairs to snowplows during the winter. The snowplows break down at an average rate of 4 vehicles per day and breakdowns are distributed according to the Poisson distribution. The mechanic can service an average of 7 vehicles per day with a repair time distribution that approximates a negative exponential distribution. Assume an 8 hour day. Find out various characteristics of the queue-such as waiting time in the queue/system, average queue length/system length and idle time for the service.

OR

- 8 In railway marshalling yard, goods trains arrive at the rate of 30 trains per day. Assuming that inter-arrival time and service time distribution follows an exponential distribution with an average of 30 minutes, calculate the following:
- The mean queue size.
 - The probability that queue size exceeds 10.
 - If the input of train increases to an average of 33 per day, what will be the changes in (a) and (b)?

- 9 New age power solutions limited provides electrical generator services [of 5 KVA, 10 KVA, 25 KVA capacities] on lease basis or daily rentals to apartments, industrial activities, public meetings, marriage halls etc. As the maintenance cost increases rapidly the company replaces generators periodically. The purchase price of a 5 KVA generator is INR 2,50,000. Annual maintenance and repairs cost and resale value are detailed in the following table.

Year	1	2	3	4	5	6	7	8
Resale value (INR)	150000	120000	100000	75000	50000	50000	50000	25000
Maintenance & repairs cost (INR)	20000	25000	30000	40000	50000	75000	100000	125000

Assuming that there is no time value for money, determine the optimal replacement policy.

OR

- 10 In a youth hostel there are 100 rooms, each room is fitted with a tube light. The bulbs are replaced when they fail individually and group replacement is also done at regular intervals. The probability of failure of tube lights for the four quarters is given below:

Q_1	Q_2	Q_3	Q_4
0.15	0.20	0.50	0.15

Cost of individual replacement is INR 125/- , whereas for group replacement, the cost is INR 30/- suggest a suitable replacement policy.

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SECTION – B
(Compulsory Question)

01 X 10 = 10 Marks

11

Case study:

Find out the critical path for the project, whose activities, precedence relation and durations are given below. Find out mean project completion time and estimated standard deviation in completing the project.

- (a) Find out the probability of the project takes more than 30 weeks to complete.
(b) Find out the probability of the project gets completed fewer than 21 weeks.

S.No	Activity	Precedence relationship	Duration – [in weeks]		
			Optimistic	Normal	Pessimistic
1	A	-	1	3	5
2	B	A	1	2	3
3	C	A	2	5	8
4	D	A, B	1	4	7
5	E	C	2	2	2
6	F	D, E	1	5	9
7	G	B	2	6	10
8	H	D	3	6	15
9	I	G, H	1	2	3
10	J	F, H	2	5	8
11	K	G	4	9	14
12	L	K	1	2	3
13	M	L	13	2	3
14	N	I, J	4	5	6
