

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 Mention various/applications in operations research.
- (OR)
- 2 A financial advisor at Delhi investments has identified two companies that are likely candidates for a takeover in the near future. Eastern cable is a leading manufacturing of flexible cable systems used in the construction industry and ComSwitch is a new firm specializing in digital switching systems. Eastern cable is currently trading for Rs.40/ per share and ComSwitch is for Rs.25 per share. If the takeover occurs, the financial advisor estimates that the price of Eastern cable will go to Rs.55 per share and ComSwitch will go to Rs.43 per share. Also, it is found that ComSwitch high risk share. Assume that a client has indicated a willingness to invest a maximum of Rs.50,000 in the two companies. The client wants to invest at least Rs.15,000 in Eastern cable and at least Rs.10,000 in ComSwitch. Due to high risk associated with ComSwitch, the financial advisor recommended that at most Rs.25,000 should be invested in ComSwitch.
- (a) Formulate a linear programming model for the investment decision faced the client.
- (b) Find the optimal solution through graphical method.
- 3 Solve the following transportation problem by Vogel's approximation method where the unit transportation costs demand and supplies are summarized below and check whether the solution is optimum?

		Marks				Supply
		M1	M2	M3	M4	
Factory	Factory 1	6	1	9	3	70
	Factory 2	11	5	2	8	55
	Factory 3	10	12	4	7	70
	Demand	85	35	50	45	

(OR)

- 4 A company has 5 jobs to be done on five machines. Any job can be done on any machine. The costs of doing the jobs on different machines are given below. Assign the jobs for different machines so as to minimize the total cost.

Jobs	Machines				
	A	B	C	D	E
1	13	8	16	18	19
2	9	15	24	9	12
3	12	9	4	4	4
4	6	12	10	8	13
5	15	17	18	12	20

- 5 Consider the following problem in which six jobs must each be processed on two machines starting with machine 1 and then going to machine 2. The following processing times and due dates are in hours.

Job	Machine 1	Machine 2	Due Date
A	7	5	15
B	3	8	18
C	1	8	11
D	2	7	6
E	3	1	23
F	9	4	19

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

(OR)

- 6 Solve the following 2 X 3 game graphically.

		Player-B		
		B1	B2	B3
A's strategy	A1	1	3	11
	A2	8	5	2

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- 7 Lenny, a graduate research assistant “moonlights” at the short order counter in the student union snack bar in the evenings. He is the only one on duty at the counter during the hours he works. Arrivals to the counter seem to follow the Poisson distribution with a mean of 8 per hour. Each customer is served one at a time and the service time follows an exponential distribution with a mean of 5 minutes. 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 Customer arrivals at an ATM follow Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean five minutes. The space in front of the door including the person withdrawing can accommodate a maximum of three people. Others can wait outside this space.
- (a) What is the probability that a person arriving at the ATM will go the space in front of the ATM.
- (b) What is the probability that an arriving customer will have to wait outside the indicated space?

- 9 Fast N Safe Intercity travels operating Volvo buses has a practice of operating brand new buses to attract business and executive class customers. To maintain its policy, the company spends huge amount on maintenance of buses and also replaces it periodically. The initial purchase price of bus is INR 50,00,000. The details regarding resale value and repairs costs are given in the following table.

Year	1	2	3	4	5	6	7
Resale value (INR)	3500000	3100000	2800000	2300000	1900000	1500000	1000000
Repairs (INR)	200000	400000	800000	850000	900000	1200000	1400000

When the buses should be replaced?

(OR)

- 10 Electronic equipment has a large number of integrated circuit chips (IC chips). The following mortality rates of IC chips have been observed and recorded below:

Period	Failure tenure (in hours)	Probability of failure
1	0 - 100	0.08
2	101 - 200	0.16
3	201 - 300	0.45
4	301 - 400	0.22
5	400 - 500	0.09

If the IC chips are replaced as groups, the cost of replacement is INR 20 per IC chip. It is proposed to replace all IC chips at fixed intervals of time, whether or not they have failed, and also to continue replacement as the chips fail. Replacement of IC chips can be done individually at the cost of INR 70 per IC chip. How frequently the IC chip should be replaced?

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.

- (a) Find out mean project completion time and estimated standard deviation in completing the project.
- (b) Find out the probability of the project takes more than 27 weeks to complete.
- (c) Find out the probability of the project gets completed fewer than 22 weeks.

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