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Seventh Semester B.E. Degree Examination, June/July 2016
Operation Research

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.**
2. Use of Normal distributed table is permitted.

PART – A

- 1 a. What are the phases of OR? (06 Marks)
b. An animal feed company must produce exactly 200kg of a mixture consisting of ingredients x_1 and x_2 . The ingredients x_1 costs Rs 3 per kg and x_2 costs Rs 5 per kg. Not more than 80kg of x_1 can be used and atleast 60 kg of x_2 must be used. Find the minimum cost mixture. (14 Marks)

- 2 Solve the following LPP by using Big M method.

$$\begin{aligned} \text{Max. } Z &= x_1 + 2x_2 + 3x_3 - x_4 \\ \text{STC, } x_1 + 2x_2 + 3x_3 &= 15 \\ 2x_1 + x_2 + 5x_3 &= 20 \\ x_1 + 2x_2 + x_3 + x_4 &= 10 \\ x_1, x_2, x_3, x_4 &\geq 0. \end{aligned}$$

(20 Marks)

- 3 a. A company has a team of 4 sales men and there are four districts where the company wants to start its business. After taking into account the capabilities of the salesman and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as follows : (10 Marks)

		District			
		1	2	3	4
Salesman	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

Find the assignment of salesmen to various districts which will yield maximum profit.

- b. Determine the optimum distribution to minimize shipping costs. (10 Marks)

	A	B	C	D	E	Capacity
1	13	-	31	8	20	200
2	14	9	17	6	10	175
3	25	11	12	17	15	150
4	10	21	13	-	17	325
Requirement	110	90	120	230	160	

- 4 Solve the following mixed integer problem by the branch and bound technique.

$$\begin{aligned} \text{Maximize } Z &= x_1 + x_2 \\ \text{Subject to } 2x_1 + 5x_2 &\leq 16 \\ 6x_1 + 5x_2 &\leq 30 \\ x_2 &\geq 0, x_1 \geq 0 \text{ and integer.} \end{aligned}$$

(20 Marks)

PART – B

- 5 a. Define i) Dummy Activity ii) Burst event iii) Free float. (06 Marks)

b. A project has 7 activities. The relevant data is given below :

Activity	Dependence	Duration (days)		Cost (Rs)	
		Normal	Crash	Normal	Crash
A	-	7	5	500	900
B	A	4	2	400	600
C	A	5	5	500	500
D	A	6	4	800	1,000
E	B, C	7	4	700	1,000
F	C, D	5	2	800	1,400
G	E, F	6	4	800	1,600

The project Manager wishes to complete the project in the minimum possible time. However, he is not authorized to spend more than Rs 5000 on crashing. Suggest the least cost schedule. Assume that there is no indirect or utility cost. **(14 Marks)**

- 6 a. What are the characteristics of queuing system? **(04 Marks)**
 b. A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find i) Average number of customers in the system ii) Average number of customers in the queue iii) Average time a customer spends in the system iv) Average time a customer waits before being served. **(08 Marks)**
 c. A person repairing radios finds that the time spent on the radio sets has exponential distribution with mean 20 minutes. If the radios are repaired in the order in which they come in and their arrival is approximately Poisson with an average rate of 15 for 8 – hour day, what is the repair man’s expected idle time each day? How many jobs are ahead of the average set just brought in? **(08 Marks)**

- 7 a. Define i) Pure strategy ii) Mixed strategy iii) Pay off matrix. **(10 Marks)**
 b. Solve the following game :

$$\begin{bmatrix} -6 & 7 \\ 4 & -5 \\ -1 & -2 \\ -2 & 5 \\ 7 & -6 \end{bmatrix}$$

- c. Solve the following game by dominance principle. **(10 Marks)**

5	-10	9	0
6	7	8	1
8	7	15	1
3	4	-1	4

- 8 a. Six jobs A, B, C, D, E and F have arrived at one time to be processed on a single machine. Assuming that no new jobs arrive thereafter, determine **(08 Marks)**

Job :	A	B	C	D	E	F
Processing time (min)	7	6	8	4	3	5

- i) Optimal sequence as per SPT rule ii) Completion times of the jobs
 iii) Mean flow time iv) Average in-process inventory.
 b. Six jobs have to be processed in three machines A, B and C in the order ACB. Time taken in hrs by each job on each machine is indicated below.

Job	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆	
Processing time on hrs on machine	A	12	8	7	11	10	5
	B	7	10	9	6	10	4
	C	3	4	2	5	05	4

Determine the optimum sequence and Total elapsed time.

(12 Marks)
