CRASH COURSE

Seventh Semester B.E. Degree Examination, May 2017
Operations Research

Time: 3 hrs.   Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting*
atleast TWO questions from each part.
2. Normal distribution tables are permitted.

PART – A

1   a.   Define operations research and list out scope of operation research.   **(05 Marks)**

     b.   The standard weight of a special purpose brick is 5 kg and it contains two basic ingredients B_1 and B_2. B_1 costs Rs. 5/kg and B_2 costs Rs. 8/kg strength considerations dictate that the brick contains not more than 4 kg of B_1 and a minimum of 2 kg of B_2. Since the demand for the product is likely to be related to the price of the brick, find graphically the minimum cost of the brick satisfying the above conditions.   **(15 Marks)**

2   Use two phase simplex method to
Maximize $Z = 5x_1 - 4x_2 + 3x_3$
Subject to $2x_1 + x_2 - 6x_3 = 20$
               $6x_1 + 5x_2 + 10x_3 \le 76$
               $8x_1 - 3x_2 + 6x_3 \le 50$
               $x_1, x_2, x_3 \ge 0$.   **(20 Marks)**

3   a.   ABC manufacturing company wishes to develop a monthly production schedule for the next three months. Depending upon the sales commitments, the company can either keep the production constant allowing fluctuations in inventory, or inventories can be maintained at constant level, with fluctuating production. Fluctuating production necessitates in working overtime, the cost of which is estimated to be double the normal production cost of Rs. 12 per unit. Fluctuating inventories result in inventory carrying cost of Rs. 2/unit per month. If the company fails to full-fill its sales commitment it incurs a shortage cost of Rs. 4 per unit per month. The production capacities for the next three months are shown below :

Production Capacity			
Month	Regular	Overtime	sales
1	50	30	60
2	50	0	123
3	60	50	40

       Determine the optimal production schedule.   **(14 Marks)**

     b.   Define :   i) Fesible solution   ii) optimal solution   iii) degenerate basic feasible solution.   **(06 Marks)**

4   Solve the following integer linear programming problem by using gomory technique.
Maximize $Z = -4x_1 + 5x_2$
Subject to $-3x_1 + 3x_2 \le 6$
            $2x_1 + 4x_2 \le 12$
               x_1, x_2 are non – negative integers.   **(20 Marks)**

PART – B

5 a. Draw a network to represent the project and find the minimum time of completion of the project and find critical path.

Task	A	B	C	D	E	F	G	H	I
Time in days	8	10	8	10	16	17	18	14	9

The precedence relationships are :
A < D ; A < E ; B < F ; D < F ; C < G ; C < H ; F < I ; G < I.   (10 Marks)

   b. The time estimates (in weeks) for the activities of a PERT network are given :

Activity	1 – 2	1 – 3	1 – 4	2 – 5	3 – 5	4 – 6	5 – 6
t_0	1	1	2	1	2	2	3
t_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

   i) Draw the project network and calculate expected project duration
   ii) What is the probability that the project will be completed at least 4 weeks earlier than expected time?   (10 Marks)

6 a. Customers arrive at a sales counter managed by a single person, according to Poisson's process with a mean rate of 20 per hour. The time required to serve a customer has an exponential distribution with mean of 100 seconds. Find,
   i)   Average waiting time of a customer in the system
   ii) Probability that a customer will have to wait for at least 10 minutes in the system
   iii) What time on an average, the sales counter cashier is idle?
   iv) If the service can be speeded upto 80 seconds what will be the effect on probability that a customer will have to wait for at least 10 minutes?   (10 Marks)

   b. An emergency ward of a private hospital can handle only one patient at a time, 96 patients arrive in a day on an average. It takes on an average 10 minutes to give treatment to a patient. The cost of treatment is Rs. 200 per patient for 10 minutes. The cost increases at Rs. 20 per minute of time reduced. How much amount should be budgeted by the clinic to reduce the queue size to half?   (10 Marks)

7 a. Explain in brief maximin and minimax strategies.   (04 Marks)

   b. Solve the following game :   (08 Marks)

	B_1	B_2	B_3	B_4
A_1	2	2	3	–1
A_2	4	3	2	6

   c. Solve the following by using Dominance principle.   (08 Marks)

	B_1	B_2	B_3	B_4
A_1	3	2	4	0
A_2	2	4	3	4
A_3	4	2	4	0
A_4	0	4	0	8

8 a. What are the assumptions made in sequencing problems?   (06 Marks)

   b. Determine the optimal sequence, minimum elapsed time and idle time for each machine :

Job	Processing times in hrs			
	M_1	M_2	M_3	M_4
1	7	15	14	21
2	11	18	18	6
3	2	13	11	16
4	14	4	27	14
5	18	11	32	16

(14 Marks)

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