CRASH COURSE

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

Time: 3 hrs.   Max. Marks:100

**Note: *Answer any FIVE full questions, selecting
atleast TWO questions from each part.***

PART – A

1 a. What is meant by a linear programming problem?   **(02 Marks)**
   b. List the phases of operations research.   **(03 Marks)**
   c. A chemical company has two bottling plants situated at two cities A and B. Each plant produces 3 types of chemicals : type–I, type–II, type –III. The number of bottles produced per day is as follows :

Chemical type	Plant at cities	
	A	B
I	1500	1500
II	3000	1000
III	2000	5000

A market survey indicates that there will be a demand of 20,000 bottles of type – I chemical, 40,000 bottles of type – II chemical and 44,000 bottles of types – III chemical. The operating cost per day of the plants A and B are Rs. 600 and Rs. 400 respectively. for how many days each plant should run in the month of may so as to have a minimum production cost, while still meeting the market demand. obtain the solution by graphical method.
                                                                       (15 Marks)

2 a. Use two–phase simplex method to solve the following LPP :
      Minimize $z = -2x_1 - x_2$
      Subject to $x_1 + x_2 \geq 2$
             $x_1 + x_2 \leq 4$
             $x_1, x_2 \geq 0.$ **(12 Marks)**
   b. Write the dual of the given problem :
      Maximize $Z = 2x_1 + x_2$
      Subject to $x_1 + 2x_2 \geq 10$
             $x_1 + x_2 \leq 6$
             $x_1 + x_2 \leq 2$
             $x_1 - 2x_2 \leq 1$
             x_1, x_2 both $\geq 0.$ **(08 Marks)**

3 a. What do you mean by degeneracy in transportation problem? (02 Marks)

b. Find eh initial basic feasible solution to the given transportation problem using North – West corner rule. (06 Marks)

	D	E	F	G	Supply
A	3	7	6	4	5
B	2	4	3	2	2
C	4	3	8	5	3
	3	3	2	2	

c. A company has four factories from which it ships its product units to four warehouses W_1, W_2, W_3 and W_4 which are the distribution centers. Transportation costs per unit between various combinations of factories and warehouses are as follows :

	W_1	W_2	W_3	W_4	Available
F_1	48	60	56	58	140
F_2	45	55	53	60	260
F_3	50	65	60	62	360
F_4	52	64	55	61	220
Required	200	320	250	210	

Find the transportation schedule which minimizes the distribution cost. (12 Marks)

4 a. A company has five machines that are used for four jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table :

Job	A	B	C	D	E
1	5	7	11	6	7
2	8	5	5	6	5
3	6	7	10	7	3
4	10	4	8	2	4

Determine the optimal assignment. (10 Marks)

b. Solve the following travelling salesman problem :

	1	2	3	4
1	∞	4	9	5
2	6	∞	4	8
3	9	4	∞	9
4	5	8	9	∞

(10 Marks)

PART – B

5 a. A machine shop has one shearing, one punching and one deburring machine. Time in minutes for shearing punching and deburring operations are given for each job. Determine the order in which the jobs are to be processed in order to minimize the total time required to process all the jobs. Find the total time required to process all the jobs and idle time of each machine. (14 Marks)

Job	Shearing time	Punching time	Deburring time
1	40	50	80
2	20	60	100
3	80	20	60
4	50	30	70
5	60	40	110

b. Give the step by step graphical procedure of solving 2jobs – n machines problem. (06 Marks)

6 a. Solve the following game : (04 Marks)

Player B

$$\text{Player A} \begin{bmatrix} 3 & 3 & 1 \\ -2 & -4 & -3 \\ 2 & 5 & -1 \end{bmatrix}$$

b. Solve the following (2 ×3) game graphically : (08 Marks)

Player B

1 2 3

$$\begin{matrix} \text{Player} & 1 \\ \text{A} & 2 \end{matrix} \begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix}$$

c. Solve the following game by using dominance property.

$$\begin{bmatrix} 4 & 3 & 0 & 2 & 1 & 1 \\ 4 & 3 & 7 & 3 & 2 & 2 \\ 4 & 3 & 7 & -5 & 6 & 2 \\ 4 & 3 & 4 & -1 & 2 & 2 \\ 4 & 3 & 3 & -2 & 2 & 2 \end{bmatrix}.$$

(08 Marks)

7 a. List the important characteristics of queuing model. (02 Marks)
   b. Arrivals at a public telephone both are considered to be Poisson with an average time of 8 minutes between one arrival and the ally distributed with a mean value of 2 minutes :
   i) What will be the probability that a person arriving at the both will have to wait
   ii) Determine the average queue length that is formed time to time
   iii) The telephone department is interested to install a second both if convened that an arrival would expect to have to wait atleast 5 minutes for phone. Determine the increase in flow of arrivals which will justify a second booth. (12 Marks)
   c. A small internet café has tow computer terminals the arrival rate of internet users in the café is 10 users per hour. Each user spends 10 minutes on the computer. The arrival and service process follow exponential distribution. What is the probability that both computers are free? (06 Marks)

8 a. A robot building firm plans the following project. Draw the network and find the critical path (08 Marks)

Project activity	Immediate predecessor	Activity duration (days)
Design a new robot	—	20
Build prototype units	a	10
Test prototypes	b	8
Estimate material costs	a	11
Refine robot design	c, d	7
Demonstrate robot	e	6
Estimate labor costs	d	12
Prepare proposal	e	13
Deliver proposal to customer	g, h	5

b. The following table gives the activities of a construction project and other data :

Activity	Normal		Crash	
1 – 2	6	50	4	80
1 – 3	5	80	3	150
2 – 4	5	60	2	90
2 – 5	8	100	6	300
3 – 4	5	140	2	200
4 – 5	2	60	1	80

If the indirect cost is Rs. 20 per day, crash the activities to find the minimum duration of the project and the project cost associated. (12 Marks)

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