Seventh Semester B.E. Degree Examination, June/July 2019
Operations Research

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Define operations research. Explain the applications of operations research. **(06 Marks)**

   b. Company produces two types of Hats. Each hat of the first type requires twice as much labour time as the second type. If all the hats are of the second type only, the company can produce a total of 500 hats a day. The market limits daily sales of the first and second type to 150 and 250 hats. Assuming that the profit per hat Rs.8 for type A and Rs. 5 for type B. Formulate the problem as a linear programming model in order to determine the number of hats to be produced of each type 80 as to maximize the profit. **(07 Marks)**

   c. Solve the LPP by graphical method :

   Maximize $Z = x_1 + x_2$

   Subject to $x_1 + 2x_2 \leq 2000$

   $x_1 + x_2 \leq 1500$

   $x_2 \leq 600$ and

   $x_1, x_2 \geq 0$. **(07 Marks)**

2 a. Define slack variable, surplus variable and artificial variable. **(06 Marks)**

   b. Solve the LPP by Simplex method :

   Maximize $Z = 3x_1 + 2x_2$

   Subject to the constraints $x_1 + x_2 \leq 4$,

   $x_1 - x_2 \leq 2$

   and $x_1, x_2 \geq 0$. **(14 Marks)**

3 a. Determine an initial basic feasible solution to the following transportation using NWCR.

	Destination				
	D_1	D_2	D_3	D_4	Supply
01	6	4	1	5	14
02	8	9	2	7	16
03	4	3	6	2	5
Demand	6	10	15	4	

(Origin)

(06 Marks)

   b. Solve the following transportation problem and check for optimality.

	Warehouses				
	W_1	W_2	W_3	W_4	Supply
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Requirement	5	8	7	14	

(Factories)

(14 Marks)

4 a. A company has 4 machines on which 3 jobs are to be done. Each job can be assigned only to one machine. The cost of each job on each machine is given in the table below. What are the job assignments that will minimize the cost, which machine will be idle? **(08 Marks)**

		Machines			
		W	X	Y	Z
	A	18	24	28	32
Jobs	B	8	13	17	19
	C	10	15	19	22

b. A salesman has to visit the cities A, B, C, D and E. the distance (in kms) between five cities are as follows :

		To				
		A	B	C	D	E
	A	∞	6	12	6	4
	B	6	∞	10	5	4
From	C	8	7	∞	11	3
	D	5	4	11	∞	5
	E	5	2	7	8	∞

If salesman starts from city 'A' and has to come back to city 'A', which route should he select to minimize the travel distance? **(12 Marks)**

PART – B

5 a. Brief the procedure for solving the sequencing of n-jobs on three machines. **(04 Marks)**
   b. What are the principle assumptions for sequenling problems? **(04 Marks)**
   c. Find the sequence that minimizes the total elapsed time required to complete the following tasks. **(12 Marks)**

| Tasks	Processing time (hrs)		
	Machines		
	A	B	C
1	8	5	4
2	10	6	9
3	6	2	8
4	7	3	6
5	11	4	5

6 a. Define : i) saddle point   ii) pure strategy
            iii) mixed strategy   iv) two person zero sum game. **(04 Marks)**
   b. Find the saddle point and hence solve the game : **(06 Marks)**

		Player B			
		B_1	B_2	B_3	B_4
	A_1	1	7	3	4
Player A	A_2	5	6	4	5
	A_3	7	2	0	3

c. Solve the following problem using dominance principle. **(10 Marks)**

		Player B			
		I	II	III	IV
	I	3	2	4	0
	II	3	4	2	4
Player A	III	4	2	4	0
	IV	0	4	0	8
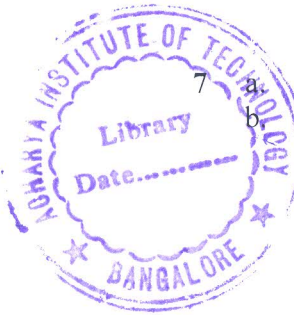
7   a. Brief the basic characteristic of a queuing system. (04 Marks)

b. A box office ticket window is being manned by a single server. Customer arrive to purchase tickets according to a Poisson input process with a mean rate of 30 per hour. The time required to serve a customer has an exponential distribution with a mean of 90 secs. Calculate :
i)   Mean queue length L
ii) Mean line length, L_q
iii) Mean waiting time in the system, W
iv) Mean waiting time in the line, W_q. (10 Marks)

c. In a railway marshalling yard, goods train arrive at a rate of 30 trains per day. Assuming arrival and service as per Poisson and exponential distributions and mean service time of 36 minutes. calculate :
i)   the mean queue size (including train being served)
ii) the probability that the queue size exceeds 10. (06 Marks)

8   a. What are the basic steps involved in PERT/CPM. (04 Marks)

b. A project has the following schedule.

Activity	Duration
1 – 2	2
1 – 3	2
1 – 4	2
2 – 5	4
3 – 6	5
3 – 7	8
4 – 7	4
5 – 8	2
6 – 8	4
7 – 9	5
8 – 9	3
9 – 10	4

i)   Draw the project network
ii) Calculate T_E and T_L
iii) Find the critical path
iv) Determine EST, EFT, LST, LFT and total float. (06 Marks)

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