

# ONE TIME EXIT SCHEME

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BANGALORE - 560 037

10ME74

## Seventh Semester B.E. Degree Examination, April 2018 Operations Research

Time: 3 hrs.

Max. Marks: 100

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

### PART - A

- 1 a. Define Operations Research. (02 Marks)  
 b. List any three advantages and limitations of Operation Research. (03 Marks)  
 c. A company makes vacuum cleaners and water purifiers. Each vacuum cleaner has a profit of Rs. 10/- and each water purifier has a profit of Rs.15/-. Each vacuum cleaner requires one labour hour and one run on special machine. Each water purifier requires one labour hour and two runs on special machine. For the scheduling period demand is such that atleast 10 vacuum cleaners and atmost 5 water purifiers are required. There are 20 labour hours and 20 machine runs available. Use graphical method of solution and find the maximum profit for the scheduling period. (15 Marks)

- 2 a. Solve the following LP problem using Big-M method:  
 Minimize  $z = 4x_1 + 8x_2 + 3x_3$   
 Subject to Constraints :  $x_1 + x_2 \geq 2$   
 $2x_1 + x_3 \geq 5$   
 $x_1, x_2, x_3 \geq 0$  (15 Marks)

- b. Write the dual of the given problem:  
 Maximize  $z = 2x_1 + x_2$   
 Subject to Constraints :  $x_1 + 2x_2 \leq 10$   
 $x_1 + x_2 \leq 6$   
 $x_1 + x_2 \leq 2$   
 $x_1 - 2x_2 \leq 1$   
 $x_1, x_2$  both  $\geq 0$  (05 Marks)

- 3 a. A company has four factories from which it ships its product units to four warehouses W<sub>1</sub>, W<sub>2</sub>, W<sub>3</sub> and W<sub>4</sub> which are the distribution centers. Transportation costs per unit between various combinations of factories and warehouses are as follows:

		To				Available
		W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	
From	F <sub>1</sub>	48	60	56	58	140
	F <sub>2</sub>	45	55	53	60	260
	F <sub>3</sub>	50	65	60	62	360
	F <sub>4</sub>	52	64	55	61	220
Required		200	320	250	210	

Find the transportation schedule which minimizes the distribution cost by using MODI method. Find the initial basic feasible solution by VAM. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 3 b. The owner of a small machine has four machinists available to assign to jobs for the day. Five jobs are offered with expected profit for each machinist on each job as follows:

	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

Find by using assignment method, the assignment of machinists to jobs that will result in a maximum profit. (10 Marks)

- 4 Find the optimum integer solution to the following all I.P.P..

Maximize  $z = x_1 + 2x_2$

Subject to constraint :  $2x_2 \leq 7$

$x_1 + x_2 \leq 7$

$2x_1 \leq 11$

$x_1 \geq 0, x_2 \geq 0$  and  $x_1, x_2$  are integers.

(20 Marks)

**PART - B**

- 5 a. The maintenance of a machine consists of ten jobs (activities). The precedence relationship of these jobs have been listed with the help of their node numbers.

JOB	1-2	2-3	2-4	3-5	3-6	4-6	4-7	5-8	6-8	7-8
Duration (Days)	2	3	5	4	1	6	2	8	7	4

Draw an arrow diagram for the project and calculate ES, EF, LS, LF, TS and FS. (14 Marks)

- b. Define the following :

- (i) Normal cost
- (ii) Crash cost
- (iii) Optimistic time
- (iv) Pessimistic time
- (v) Most likely time
- (vi) Critical path.

(06 Marks)

- 6 a. Explain a queuing discipline. (06 Marks)

- b. In a big CNC-machine shop, there is only one CNC-programmer to write the programs using G and M codes. Since the programmer's work varies in length, the programming rate is randomly distributed approximating a Poisson distribution with mean service rate of 7 programs per hour. The jobs for programming arrive at a rate of 4 per hour during the entire 8 hour work day. If the programmer is valued at Rs. 35 per hour. Determine the following :

- (i) Programmer utilization.
- (ii) The time in percentage that an arriving job for programming has to wait.
- (iii) Average system time.
- (iv) Average cost due to waiting on the part of the programmer.

(08 Marks)

- c. A small internet cafe has two computer terminals. The arrival rate of internet users in the cafe 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)

- 7 a. Explain different strategies in game theory. (04 Marks)  
 b. Solve the game graphically whose pay off matrix for player A is given in the table: (08 Marks)

		Player A			
		I	II	III	IV
Player B	I	2	2	3	-2
	II	4	3	2	6

- c. Using the concept of dominance, solve the following game: (08 Marks)

		Player B				
		I	II	III	IV	V
Player A	I	3	5	4	9	6
	II	5	6	3	7	8
	III	8	7	9	8	7
	IV	4	2	8	5	3

- 8 a. What do you mean by job sequencing? State the assumption made in solving sequencing problems. (04 Marks)  
 b. There are six jobs which are supposed to undergo processing on five machines A, B, C, D and E in the order ABCDE. The processing time in minutes is given in the following table. Determine the optimal sequence, minimum elapsed time and idle time of each machine. (16 Marks)

JOB	Machines				
	A	B	C	D	E
1	8	3	1	3	8
2	7	4	4	3	6
3	5	1	4	2	3
4	4	3	3	1	5
5	7	2	2	2	8
6	8	1	1	2	6