Total No. of Questions : 10]

SEAT No. :

P3883

[Total No. of Pages : 7

[5561]-539

B.E. (Mechanical)

OPERATION RESEARCH

(2015 Pattern) (Semester-I) (Elective-II) (402045C)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 Q9 or Q10.***
2) ***Answers in One answer Books.***
3) ***Figures to the right indicates full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Discuss the scientific method in operation research. **[4]**

b) A department of a company has five employees with five jobs to be performed. The time (in hrs.) that each man takes to perform each job is given in the effictiveness matrix.

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man hours? **[6]**

OR

P.T.O.

Q2) a) Solve the game whose payoff matrix is given below: **[6]**

		Player B			
		B1	B2	B3	B4
Player A	A1	3	2	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

b) Discuss different types of Decision making environments. **[4]**

Q3) a) Find the initial basic feasible solution using Vogel's approximation method. **[6]**

	W_1	W_2	W_3	W_4	Availability
F1	19	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Requirement	5	8	7	14	

b) What do you mean by the term Pure strategies and mixed strategies in the game theory. **[4]**

OR

Q4) A pharmaceutical company is producing a single product and it selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in another five cities not having any agency of the company. The company placed with a problem of deciding on how to assign the exisisting agencies to dispatch the product to needy cities in such a way that the travelling distance in minimized. The distance between the surplus and deficit cities in km is given below. **[10]**

	Deficit Cities				
	P	Q	R	S	T
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	13

Q5) a) A small project involved 7 activities and their times estimates are listed in the following table. Activities are identified by their begining (i) and ending (j) node numbers. **[12]**

Activities (i-j)	Estimated Duration (Weeks)		
	Optimistic	Most likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

i) Draw the network diagram of the activities in the projects.

ii) Find expected duration and variance for each activity. What is the expected project length.

iii) Calculate the variance and standard deviation of the project length. What is the probability that the project will be completed:

1) At least 4 weeks earlier than expected time.

2) No more than 4 weeks later than expected time.

Given:

Z (0-Z)	1.33
Probability	0.4082

b) What is looping and Dangling errors in the network. **[4]**

OR

Q6) a) A dentist scheduled all his patients for 30 minute appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probability and time actually needed to complete the work: **[12]**

Category of service	Time required in Minute	Probability
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Check up	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8:00 a.m. Use the following sequence of random numbers to simulate the above problem.

Random Numbers: 40, 82, 11, 34, 25, 66, 17, 79.

b) Explain the significance of CPM and PERT. **[4]**

Q7) a) A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below:**[10]**

Book	1	2	3	4	5	6	7
Printing Press (Hours)	20	90	80	20	120	15	65
Binding time (Hours)	25	60	75	30	90	35	50

Decide the optimum sequence of processing book in order to minimize the total time required to bring out all the books.

b) Draw the sketch of queuing system and explain various components of it. **[6]**

OR

Q8) a) Arrivals at telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone calls is assumed to be distributed exponentially, with a mean of 3 minutes. **[10]**

i) What is the probability that a person arriving at the booth will have to wait?

ii) The telephone department will install a second booth when convinced that an arrival would expect waiting time at least 3 minutes for phone call. By how much should the flow of arrivals increase in order to justify a second booth?

iii) What is the average length of the queue that forms from time to time?

iv) What is the probability that it will take a customer more than 10 minutes altogether to wait for the phone and complete his call?

b) Explain Johnson's procedure for scheduling "n" jobs on two machines M1 and M2. **[6]**

Q9) a) Solve the following integer LP problem using branch and bound method: **[12]**

Minimize $Z = 3X_1 + 2.5\ X_2$

Subject to constrain

i) $X_1 + 2X_2 \geq 20$

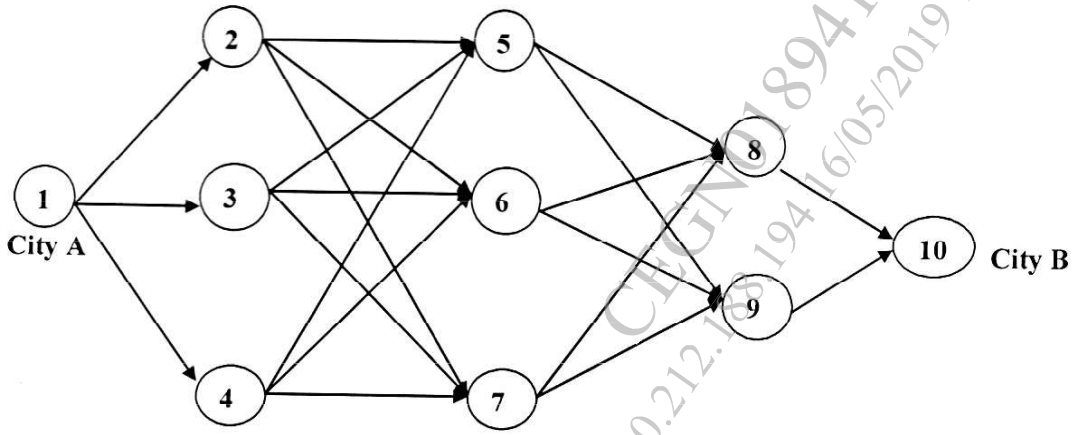
ii) $3X_1 + 2X_2 \geq 50$

iii) $X_1, X_2 \geq 0$ and integers

b) Explain in brief Dynamic programming (DP) model. **[6]**

OR

Q10)a) A salesman located in a city A decided to travel to city B. He knew the distances of alternative routes form city A to city B. He then drew a highway network map as shown in following figure. The city of origin A, is city 1. The destination city B is city 10. Other cities through which the salesman will have to pass through are numbered 2 to 9. The arrow respresentating routes between cities and distance in kilometers are located on each route. The salesman problem is to find the shortest route that covers all the selected cities from A to B. The time for each activity is given in the table. (Solve by using Dynamic programming). **[12]**



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

b) Explain methodolgy used in cutting plane method. **[6]**