Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MBA – SEMESTER 02– • EXAMINATION – SUMMER 2016

Subject Code: 2820007 **Date: 20/05/2016**

Subject Name: QUANTITATIVE ANALYSIS-II (QA-II)

Time: 10.30 AM TO 01.30 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **06**

1. If the number of filled cells in a transportation table does not equal the number of rows plus the number of columns minus 1, then the problem is said to be
   A. unbalanced B degenerate
   C. optimal D maximization problem
2. A typical transportation problem has 4 sources and 3 destinations. How many constraints would there be in the linear program for this?
   A. 3 B 4
   C. 7 D 12
3. An LP problem has a bounded feasible region. If this problem has an equality (=) constraint, then
   A. this must be a minimization problem B the feasible region must consist of a line segment.
   C. the problem must be degenerate D the problem must have more than one optimal solution.
4. If a transportation problem has 4 sources and 5 destinations, the linear program for this will have
   A. 4 variables and 5 constraints B 5 variable and 4 constraints
   C. 9 variables and 20 constraints D 20 variables and 9 constraints
5. When simulating the Monte Carlo experiment, the average simulated demand over the long run should approximate the
   A. real demand B expected demand
   C. sample demand D Daily demand.
6. A company has one computer technician who is responsible for repairs on the company's 20 computers. As a computer breaks, the technician is called to make the repair. If the repairperson is busy, the machine must wait to be repaired. This is an example of
   A. a multichannel system B a finite population system
   C. a constant service rate system D a multiphase system

Q.1 (b) Define following: 1) Shadow Prices; 2) Unboundedness; 3) Binary variables; 4) Global optimum **04**

Q.1 (c) Write differences between Assignment Problem Vs Travelling salesman Problem **04**

Q.2 (a) Explain the concept of duality with suitable examples. **07**

(b) India Inc., manufactures two products used in the heavy equipment industry. Both products require manufacturing operations in two departments. The following are the production time(in hours) and profit contribution figures for the two products: **07**

		Labour Hours	
Product	Profit per Unit	Dept. A	Dept. B
1	Rs. 25	6	12
2	Rs. 20	8	10

For the coming production period, India Inc., has available a total of 900

OR

(b) With a view to improving the quality of customer services, a bank is interested in making an "assessment of the waiting time of its customers" coming to one of its branches located in a residential area. This branch has only one tellers' counter. The arrival rate of the customers and the service rate of the teller are given below: **07**

Time Between two consecutive arrivals of customers (In minutes)	**Probability**	**Service time by the teller (In minutes)**	**Probability**
3	0.17	3	0.10
4	0.25	4	0.30
5	0.25	5	0.40
6	0.20	6	0.15
7	0.13	7	0.05
Total	**1.00**	**Total**	**1.00**

You are required to simulate 10 arrivals of customers in the system starting from 11 AM and show the waiting time of the customers and idle time of the teller in the analysis table. Use of the following random numbers taking the pair of random numbers in two digits each for first trial and so on: (11,56), (23,72), (94,83), (83,02), (97, 99), (83,10), (93,34), (33,53), (49,94), (37,77); where first random number in the bracket is for arrival and second random number is for service. Compute probability that the teller is idle. Hence, **determine** average inter-arrival time (min) and average services time (min) using simulation technique. Also determine average.

Q.3 **(a)** Explain the concepts of single server queuing model specified by (M/M/1): (∞/FIFO) **07**

(b) Geraldine Shawhan is president of Shawhan File Works, a firm that manufactures two types of metal file cabinets. The demand for her two-drawer model is up to 600 cabinets per week; demand for a three drawer cabinet is limited to 400 per week. Shawhan File Works has a weekly operating capacity of 1,300 hours, with the two-drawer cabinet taking 1 hour to produce and the three-drawer cabinet requiring 2 hours. Each two-drawer model sold yields a $10 profit, and the profit for the large model is $15. Shawhan has listed the following goals in order of importance: **07**

1. Attain a profit as close to $11,000 as possible each week.
2. Avoid underutilization of the firm's production capacity.
3. Sell as many two- and three-drawer cabinets as the demand indicates.

Set this up as a goal programming problem.

OR

Q.3 **(a)** A tailor specializes in ladies' dresses. The number of customers approaching to the tailor appears to be Poisson distributed with mean of 6 customers per hour. The tailor attends the customers on first come first serve basis and the customers wait if the need be. The tailor can attend the **07**

customers at an average rate of 10 per hour with the service time be exponentially distributed. Find (i) the utilization factor, (ii) probability that the system is idle, (iii) the average time that the tailor is free on a 10-hour working day, (iv) the probability associated with the number of customers; 0 through 3, in the system, (v) expected (average) number of customers in the shop & expected number of customers waiting for tailor's service, (vi) how much time a customer expect to spend in the queue and in the shop? (vii) Probability that there are more than 3 customers in the shop.

(b) Consider the following LP: Min 2A+2B stc 1A + 3B ≤ 12; 3A+1B ≥13; 1A-1B = 3 and A,B≥0. i) Show the feasible region; ii) What are the extreme points of the feasible region; iii) Find the optimal solution using the graphical solution procedure **07**

Q.4 **(a)** Compare the similarities and differences of linear and goal programming. **07**

(b) A repairman is to be hired by a company to repair machines that breakdown. Number of breakdown follows Poisson distribution with an average rate of four per hour. The cost of non-productive machine time is Rs. 90 per hour. The company has the option of choosing either a fast or a slow repairman. The fast repairman charges Rs. 70 per hour and will repair machines at an average rate of 7 machines per hour, while the slow repairman charges Rs. 50 per hour and will repair at the rate of 6 per hour. Determine who should be hired. **07**

OR

Q.4 **(a)** What are the advantages and disadvantages of Simulation? **07**

(b) Grey Construction would like to determine the least expensive way of connecting houses it is building with cable TV. It has identified 11 possible branches or routes that could be used to connect the houses. The cost in hundreds of dollars and the branches are summarized in the following table. What is the least expensive way to run cable to the houses? **07**

Branch	Start Node	End Node	Cost($100s)
Branch 1	1	2	5
Branch 2	1	3	6
Branch 3	1	4	6
Branch 4	1	5	5
Branch 5	2	6	7
Branch 6	3	7	5
Branch 7	4	7	7
Branch 8	5	8	4
Branch 9	6	7	1
Branch 10	7	9	6
Branch 11	8	9	2

Q.5 XYZ tobacco company purchases and stores in warehouses located in following four cities: **14**

Warehouse	**A**	**B**	**C**	**D**
Capacity (tones)	90	50	80	60

The warehouses supply tobacco cigarette companies in three cities that have the following demand:

Cigarette Company	**Bharat**	**Janta**	**Red Lamp**
Demand (tones)	120	100	110

The following railroad shipping costs (in hundred rupees) per ton have been determined:

Warehouse Location	Bharat	Janta	Badal ram
A	∞	10	5
B	12	9	4
C	7	3	11
D	9	5	7

Because of railroad construction, shipments are temporarily prohibited from warehouse at city A to Bharat Cigarette Company. (a) Find the optimum distribution for XYZ Tobacco Company and (b) Are there multiple optimum solutions? If yes, identify them.

OR

Q.5 Suppose Mr. Pavan Kumar is production manager in a manufacturing company. He has the problem of deciding optimal product mix for the next month. The company manufactures two products Resistors and Capacitors which yield unit contribution of Rs. 100 and Rs. 40 respectively. The company has three facilities (resources) with availability of 1000 kg of raw material & 900 hrs on machine for the next month. Also 5 workers can work for 5 hrs a day for 20 days in coming month. It is known that there is sufficient demand of the products so that all the units produced will be sold away. Mr. Pavan Kumar collected the relevant data carefully and wants to solve the problem as Linear Programming model. The relevant data is as shown in the following table: **14**

Resources	Product		Resource Availability
	Resistors	Capacitors	
Raw Material	5	2	1000 kg
Machine Capacity	1	2	900 hrs
Workers Availability	1	2	500hrs
Profit (Rs.) →	100	40	

Answer the following questions with justification:

1) Solve the problem using Graphical to determine the optimum product mix of capacitors and resistors for the next month. Also determiner corresponding optimum achievable profit due to sells of Resistors and Capacitors. Which facilities are fully utilized and which resources are left unused at the optimal stage?

2) Are there alternate (multiple) optimal solutions available to Mr. Pavan Kumar? If so suggest another solution.

3) Obtain the dual of above problem. Explain the relationship between optimum solution of given problem and dual LPP. Hence determine the optimum solution of dual problem.

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