Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI • EXAMINATION – SUMMER 2013

Subject Code: 161601 **Date: 03-06-2013**
Subject Name: Modeling Simulation and Operation Research
Time: 10.30 am - 01.00 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 **a.** Sales manager of ABC Corporation is thinking of assigning exactly one of the **07**
five districts to a salesman from a team of five salesmen. His objective is to
maximize the sum of the total profit earned by them. The following matrix of past
records is taken as the base for decision-making.
PROFIT ó MATRIX

District \ Salesman	1	2	3	4
A	800	800	900	950
B	900	950	1000	950
C	1100	1000	1100	1000
D	1000	850	1200	1100
E	950	900	900	1000

You are required to make the assignment.

b. You are given a sequence of activities in the following table. Using the data given **07**
in the table, prepare a network diagram. Find the critical path.

Activity	Immediate Predecessor Activity/Activities	Duration (Days)
A	-----	5
B	-------	8
C	A	3
D	A , B	4
E	C	7
F	E , D	5
G	D	12
H	D	5
I	F , G	5
J	H, I	2

Q.2 a. A bakery item store gets a supply of fresh loaves in the early morning. He keeps a record of 25 days of the number of loaves received and sold each day. Simulate this for a further period of 6 days. You are required to generate a complete record of units received and sold each day. **07**

Day	1	2	3	4	5	6	7	8	9	10	11	12	13
Receipt	11	10	9	9	11	12	9	11	12	9	8	9	10
Sold	10	10	8	8	9	11	9	10	11	9	8	8	9

You are required to use the following random numbers.(The first six of the numbers for first run and the remaining six for the second run.)

Random Numbers: 22   09   12   67   89   47   55   56   02   34   56   35

b. The inter arrival rate of customers at a gas-station, following a Poisson distribution, is 12 per hour. The inter-service rate, following Poisson distribution, averages to 3 minutes / customer. Answer the following questions. **07**

1) What is the traffic intensity of the system?

2) What is the probability that a new entrant gets immediate service?

3) How many customers are there in the system?

OR

b. Explain the followings. **07**

(1) Systematic procedure to problem solving by an operation research team.

(2) Degeneracy and cycling in linear programming problem

Q.3 a. A researcher studying the ..Q.øtheory at a counter of a railway station has concluded that the inter-arrival rate at a desk is 3 minutes while the inter-service , both following poisson distribution, is 2 minutes. Answer the following questions using the given facts. **07**

1) What is the average waiting time of a customer in the system?

2) How many customers are there waiting in the queue?

3) The management is ready to start a new counter if the average waiting time in the system is

8 minutes; find the arrival rate (per hour) of the customers.

b. Solve the following transportation problem using Vogelløs Approximation Method. **07**

Transportation rate/ unit ---Matrix

To From	D1	D2	D3	D4	Available Units
F1	10	9	11	10	200
F2	12	10	8	7	60
F3	8	9	11	12	40
Demand	100	50	60	40	

[D stands for destination. F stands for factory.]

OR

Q.3 **a.** Find X_1 and X_2 so as to maximize $Z = 3X_1 + 5 X_2$, subject to the following constraints. **07**

$X_1 + X_2 \leq 2$, $4X_1 + 5X_2 \geq 20$, with X_1 and $X_2 \geq 0$. Make your comment on the solution.

b. Write the dual of the problem and solve the dual. Find X_1 and X_2 so as to maximize $Z = 3X_1 + 5 X_2$ subject to the following constraints. **07**

$X_1 + X_2 \leq 2$, $4X_1 + 5X_2 \geq 20$, with X_1 and $X_2 \geq 0$. Make your comment on the solution.

Q.4 **a.** Solve the transportation problem using ÷Least Cost Method (Matrix Minima Method)ø and **07**

÷North óWest corner Ruleø and find the difference in the final answer of the costs.

TO / FROM	D1	D2	D3	D4
F1	12	15	10	9
F2	9	12	11	10
F3	10	10	7	12
DEMAND	100	150	50	150

[D STANDS FOR DESTINATION AND F STANDS FOR MANUFACTURING UNIT]

b. A machine costs Rs. 10,000. The following table shows the scrap value of the machine at the end of different years and its maintenance cost up to the end of the given year. You are required to find the economical year of replacement. **07**

YEAR	Maintenance cost	Scrap value
1	500	5000
2	500	4500
3	600	3500
4	650	3000
5	700	2500
6	800	2500

OR

Q.4 **a.** Give salient features of primal and dual problem of linear programming problem and write the dual of the following problem. [Do not solve the dual.] **07**

Maximize $z = 2X_1 + X_3$ subject to the following constraints.

$X_1 + X_2 + X_3 \geq 4$, $X_2 + 2 X_3 = 6$, $X_1 -- 2X_3 \leq 5$ with $X_2 \geq 0$ and X_1 and X_3 unrestricted in sign.

b. Akshar Chem. Pvt. Ltd. has installed 10,000 light bulbs in the factory. The manager of the purchase department has studied the past record that is given in the table below. Individual cost of replacing a bulb is Rs. 1.00 while group replacement of all the bulbs costs Rs.0.35 per bulb. You are required to advise him an optimal policy that minimizes cost on the company. [In the case of your advising for the group replacement, suggest the proper period also.]   **07**

Week	1	2	3	4	5
Probability of failure during the week	0.03	0.07	0.20	0.40	0.15

Q.5 a. Five cities A, B, C, D, and E are inter-connected by rail lines. The matrix given below shows the distance from one city to another city. You are required to find the shortest route, beginning from any city, which goes to every remaining city and terminates in the city of origin. [You may draw the network.]   **07**

DISTANCE MATRIX

CITY \ CITY	A	B	C	D
A	----	6	8	7
B	6	----	10	12
C	8	10	-----	13
D	7	12	13	----
E	10	11	10	12

b. Using the information given below, design the Pert network diagram. Find the duration and standard deviation of the critical path.   **07**

ACTIVITY (I ó J)	OPTIMISTIC TIME (DAYS)	NORMAL TIME (DAYS)	PESSIMISTIC TIME (DAYS)
1-2	2	5	14
1-3	1	2	3
2-3	3	4	11
2-4	2	5	8
3-4	6	7	14
3-5	1	2	3
3-7	3	4	11
4-5	0	0	0
4-6	5	7	15
5-7	6	7	14
6-7	3	4	11

OR

Q.5 a. Power Corporation manufactures two-wheelers powered by either a system of **07** photocell units or run on battery system. The circumstance like short supply of raw material, power cut, and extreme cold weather conditions, is liable to variation in the production. The units produced at the end of a day are transported to the warehouse by a specially designed lorry having a capacity to carry 50 two-wheelers. A track of last 100 days record of production is as follows. Simulate this for next 6 days. Generate a report showing the status of two-wheelers.[Either empty space left in the lorry or some two-wheelers left-over on premises of the factory or balance on both sides. Use the random numbers 23 67 79 98 07 56]

Production	Days
48	12
49	15
50	35
51	25
52	08
53	05

b. Write notes on the following topics.(1) Assignment Algorithm (2) Differences between CPM and PERT.

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