

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**MBA Semester –II Examination Dec. - 2011****Subject code: 820007****Date: 21/12/2011****Subject Name: Research Methodology and Operations Research (RM&OR)****Time: 10.30 am – 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 (a) A company assembles and sells two versions of a certain product, the Basic **07**

model and the Deluxe model. To make either model requires certain inputs, as well as processing time using one of Process 1 or Process 2. The details are as follows. The Basic model sells for \$25. To make a unit of the Basic model, 1 unit of raw material and 2 hours of Process 1 time are needed; The Deluxe model sells for \$45. To make a unit of the Deluxe model, you start with a completed Basic model, and augment it using 2 additional units of raw material and 2 hours of Process 2 time. There are 1300 hours of Process 1 time available, at an operating cost of \$10 for each hour used. As for Process 2 time, there are 500 hours available, and it costs the company \$12 for each hour of Process 2 usage. Raw material is available from two sources. It can be purchased from an external supplier at a cost of \$6/unit; or it can be produced on site from recycled materials the company has on hand. It takes one half-hour of Process 1 time to make a unit of raw material this way. The company believes it can sell all the Basic and Deluxe models it makes. Naturally, its goal is to set a production schedule for the next production run in a way that will maximize its net profit. Formulate a linear programming problem. Be sure to explain, *precisely*, the meaning or interpretation of each variable you introduce. (Do not solve)

(b) Solve the following problem graphically, and determine the amounts of **07**
ingredients XA and XB that will go into each bag. Also indicate which are binding constraints and non binding constraints?

MINIMIZE $Z = 4XA + 5XB$ (the cost in dollars of a 10 kg bag),
subject to the constraints

- i) $0.25XA + 0.40XB > 3$;
- ii) $0.10XA + 0.06XB > 0.7$;
- iii) $0.04XA + 0.05XB < 0.5$
- iv) $XA + XB < 10$
and $XA, XB \geq 0$

Q.2 (a) Write the steps involved in research process? Explain with one hypothetical **07**
example?**(b)** What is primary and secondary data? Write its advantages and **07**
disadvantages?**OR****(b)** Solve the following Travelling salesman problem: **07**

	A	B	C	D	E
A	∞	10	3	6	9
B	5	∞	5	4	2
C	4	9	∞	7	8
D	7	1	3	∞	4
E	3	2	6	5	∞

- Q.3 (a)** Write short notes on the following: **07**
- Null Hypothesis
 - Type I and Type II error
 - Power of the Test

- (b)** Write dual to the following primal problem: **07**

$$\text{Min } Z = 8x_1 + 6x_2$$

subject to:

$$4x_1 + 2x_2 \geq 20$$

$$-6x_1 + 4x_2 \leq 12$$

$$x_1 + x_2 = 6$$

$$x_1, x_2 \geq 0$$

OR

- Q.3 (a)** What is parametric and non parametric test? Explain with one example from each? **07**

- (b)** For the transportation simplex worksheet below, where the goal is to minimize a cost, use any of the IBFS method to find an initial basic feasible solution. Find the Optimal solution by using u-v method? **07**

Source	P	Q	R	S	Supply
A	40	45	35	36	300
B	48	50	52	46	200
C	43	44	55	50	400
D	44	50	40	30	400
Demand	250	300	350	400	

- Q.4 (a)** ABC Company produces two products, chandeliers and fans. Both these products require process involving wiring and assembly. It takes about 2 hours to wire each chandelier and 3 hours to wire a ceiling fan. Final assembly of chandeliers and fans requires 6 and 5 hours respectively. The production capability is such that only 12 hours of wiring time and 30 hours of assembly time are available. If each chandelier nets the firm Rs. 700 and Rs. 600 respectively. Formulate the above as a goal programming problem with following goals: **07**

Priority 1: Produce at least 4 chandeliers and 3 fans.

Priority 2: Limit overtime in the assembly department to 10 hours and in the wiring department to 6 hours

Priority 3: maximize profit

- (b)** Shah owns a rental property that needs some repairs quickly. Four areas need repair, and he has obtained estimates from five contractors for the jobs. Each of the areas of work will be given to a different person since the work has to be completed very quickly. The estimates (including taxes) were as follows: **07**

	Contractor				
Repairs to	Arvind	Bharat	Charles	Darpan	Eman
Floors	377	329	338	370	354
Plumbing	434	331	442	347	418
Roofing	333	285	389	304	336
Walls	292	264	296	285	311

Shah wants to see all four repair jobs completed at the lowest possible total cost. Use the "Hungarian Method" algorithm to solve this problem.

OR

- Q.4 (a)** Vladimir Pushkin, Russian athlete who frequently visits the US, is allowed to return with a limited number of consumer items not generally available in Russia. The items, which he carries in a small knapsack, cannot exceed a weight of 25 Kilograms (5,000 grams). Once home, Vlad sells his booty at highly inflated prices. His four most popular items are denim jeans, silk **07**

shirts, portable CD players, and heavy metal music CD's. If he brings any CD Players, he needs to bring back at least twice that many Music CDs (or what is there to play?). About half of his customers want silk shirts with their jeans so Vlad needs to satisfy this demand. Finally, Russian customs gets suspicious if a traveler brings in too many of electronic products, so Vlad limits the number of CD Players he carries to three. The weight (in grams) and profit (in Rubles) of these items are shown in the table here:

	Weight	Profit
Jeans	1500	2000
Silk Shirts	500	1250
CD Player	900	1500
Music CD	250	750

Formulate an integer program for Vlad that will select a mix of items for him to take home that will maximize his profits.

- Q.4 (b)** The manufacturer of a sports car wants to estimate the proportion of people in a given income bracket who are interested in the model. The company wants to know the population proportion p to within 0.10 with 99% confidence. The company records indicate that the proportion p may be around 0.25. What is the minimum required sample size for this survey? **07**

- Q.5 (a)** Explain the questionnaire design process with different steps involved in it? **07**
(b) How should a research report be organized? Explain. **07**

OR

- Q.5 (a)** Going from Ahmedabad to Delhi there are 10 possible roads that Each one can take. Each road can be considered a branch in the shortest-route problem. Determine the best way to get from Ahmedabad (node 1) to Delhi (node 8) that will minimize total distance travelled. All distances are travelled are in hundreds of kilometers) **07**

Branch	Start Node	End Node	Distance(in hundreds kms)
Branch 1	1	2	3
Branch 2	1	3	2
Branch 3	2	4	3
Branch 4	3	5	3
Branch 5	4	5	1
Branch 6	4	6	4
Branch 7	5	7	2
Branch 8	6	7	2
Branch 9	6	8	3
Branch 10	7	8	6

- (b)** A tourist car operator finds that the past few months the car's use has varied so much that the cost of maintaining the car has varied considerably. During the past 200 days the demand for the car fluctuated as below. **07**

Trips per week	Frequency
0	16
1	24
2	30
3	60
4	40
5	30

Using the following random numbers and simulate the demand for a 10 week period. (82, 95, 18, 96, 20, 84, 56, 11, 52, 03)
