[This question paper contains 6 printed pages.]

Sr. No. of Question Paper : 2568 **Roll No.....**

Unique Paper Code : 101332

Name of the Course : BBS

Name of the Paper : Quantitative Techniques for Management

Semester : III (November/December 2013)

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **5** questions.
3. Questions No. **1** is compulsory.
4. **All** questions carry equal marks.
5. Answer all parts of a question together.
6. Show your workings clearly.

1. (a) A firm produces three products A, B and C. It uses two type of raw material I and II of which 5,000 and 7,500 units available. The raw material requirements per unit of the products are given below :

Raw Material	Requirement per unit of product		
	A	B	C
I	3	4	5
II	5	3	5

The labour time for each unit of product A is twice that of product B and three times that of product C. The entire labour force of the firm can produce the equivalent of 3,000 units. The minimum demand of the three products is 600, 650 and 500 units respectively.

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(i) Formulate the problem, as a linear programming problem, and

(ii) Determine the number of units of each product which will maximize the profit. (4,6)

(b) Obtain the dual of the following linear programming problem :

Minimize $z = 2x_1 + 3x_2 + 4x_3$

subject to the constraints :

$$2x_1 + 3x_2 + 5x_3 \geq 2$$

$$3x_1 + x_2 + 7x_3 = 3$$

$$x_1 + 4x_2 + 6x_3 \leq 5$$

$x_1, x_2 \geq 0$ and x_3 is unrestricted. (5)

2. (a) Given the following transportation problem :

	Destinations				
Origin	Dl	D2	D3	D4	Available
S1	23	27	16	18	30
S2	12	17	20	51	40
S3	22	28	12	32	53
Requirement	22	35	25	41	

Cell entries are unit transportation cost.

(i) Formulate the problem as a linear programming problem.

(ii) Find the optimum transportation schedule and the minimum transportation cost. (3,6)

(b) Following is the pay-off matrix for player A

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

Using dominance property, obtain the optimal strategies for both the players and determine the value of the game. (6)

3. (a) Consider a vendor who sells a weekly magazine for Rs. 10 and purchases the same for Rs. 8. At the end of week, the unsold copies are disposed off for Rs. 3 each. According to past experience, the weekly demand for the magazine is between 70 and 75 copies. Assuming that the orders can be placed only once during the week construct a payoff and opportunity loss matrix for the vendor. (5)

(b) The owner of a small machine shop 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 the assignment of machinists to jobs that will result in a maximum profit. Which job should be declined ? (6)

(c) Determine if the following initial basic feasible solution to the transportation matrix given below is optimal solution or not ? Support your answer with reasons –

Initial basic feasible solution : $X_{11} = 4; X_{12} = 2; X_{22} = 4; X_{23} = 4; X_{33} = 4; X_{34} = 6$

	D_1	D_2	D_3	D_4
O_1	1	2	3	4
O_3	4	3	2	0
O_3	0	2	2	1

(4)

4. (a) A small project consisting of eight activities has the following characteristics :

TIME ESTIMATES (IN WEEKS)

Activity	Most optimistic Time (in weeks)	Most likely time (in weeks)	Most pessimistic Time (in weeks)
1-2	3	3	3
2-3	3	6	9
2-4	2	4	6
3-5	4	6	8
4-6	4	6	8
5-6	0	0	0
5-7	3	4	5
6-7	2	5	8

(i) Draw the PERT network for the project. (3)

(ii) Determine the critical path and variance for each activity. (4)

(iii) If a, 23-week deadline is imposed, what is the probability that the project will be finished within the time limit ? (3)

The table of area under the normal curve at selected values is as follows :

Z	:	1.90	1.91	1.92	1.93	1.94
Area	:	0.9713	0.9719	0.9726	0.9732	0.9738

(b) Solve the 2×2 game graphically :

		Player B		
Player A	3	−3	4	
	−1	1	−3	

(5)

5. (a) Using artificial variable technique solve the following linear programming problem –

Max $z = x_1 + 2x_2 + 3x_3$

Subject to-

$$x_1 - x_2 + x_3 \geq 4$$

$$x_1 + x_2 + 2x_3 \leq 8$$

$$x_1 - x_3 \geq 2;$$

$$x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0$$

(7)

(b) Write a short note on **any four** of the following :

(i) Unbalanced assignment problem

(ii) Slack and surplus variables in Simplex

(iii) Various types of floats in networks

(iv) Payoff table

(v) Simulation

(4×2=8)

6. The following table gives data on normal time-cost and crash time-cost for a project

Activity	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (days)	Cost (Rs.)
1-2	6	600	4	1000
1-3	4	600	2	2000
2-4	5	500	3	1500
2-5	3	450	1	650
3-4	6	900	4	2000
4-6	8	800	4	3000
5-6	4	400	2	1000
6-7	3	450	2	800

The indirect cost per day is Rs. 100.

(i) Draw the network and identify the critical path. (4)

(ii) What is the normal project duration and associated costs ? (3)

(iii) Crash the relevant activities systematically and determine the optimum project completion time and cost. (8)

Paper No. 302 Dec 2012

[This question paper contains 6 printed pages.]

Sr. No. of Question Paper : 1139 **Roll No.....**

Unique Paper Code : 101332

Name of the Paper : Quantitative Techniques in Management

Name of the Course : Bachelor of Business Studies

Semester : III

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** questions carry equal marks.
3. Attempt **five** questions in all. Question No. **1** is compulsory.
4. Use of non-scientific calculator is allowed.
5. Answer parts of a question together. Show your workings clearly.

1. Attempt any **5** of the following :

   (a) How does the simplex algorithm indicate that :

   (i) there is an alternate optimal solution ?

   (ii) the problem has unbounded optimal solution ?

   (iii) The problem has no feasible solution ?

   (b) A producer of boats has estimated the following distribution of demand for a particular kind of boat :

No. demanded :	0	1	2	3	4	5	6
Probability :	0.14	0.27	0.27	0.18	0.09	0.04	0.01

   Each boat cost him Rs. 7,000 and he sells them for Rs. 10,000 each. Any

P.T.O.

boat that is left unsold at the end of the season must be disposed off for Rs. 6,000 each. How many boats should be in stock so as to maximize his expected profit ?

(c) What are the three time estimates used in the context of PERT ? How is the expected duration of a project and its standard deviation calculated ?

(d) Describe the maximin and minimax principles of game theory.

(e) What do you mean by Markov processes ? In what ways does Markov analysis help a manager in decision making ?

(f) Differentiate between a binding and a redundant constraint. Does a redundant constraint affect the optimal solution to an LPP ? (5*3 marks)

2. A chemical company produces two compounds A and B. the following table gives the units of ingredients C and D per kg. of compounds A and B as well as minimum requirements of C and D and cost per kg. of A and B.

		Compound		Minimum Requirement
		A	B	
Ingredient	C	1	2	80
	D	3	1	75
Cost per kg.		4	6	

(a) Formulate the above as an LPP. (2)

(b) Using the simplex method, find the quantities of A and B which would give a supply of C and D at minimum cost. (7)

(c) Write the dual to the above problem. (2)

(d) What is the shadow price for the ingredients C and D ? (2)

(e) Verify the objective function value of the primal and the dual. (2)

3. (a) A manufacturer wants to ship 8 loads of his product as shown below. The matrix gives the mileage from the origin O to the destination D.

Origin	Destination			Availability
	A	B	C	
X	50	30	220	1
Y	90	45	170	3
Z	50	200	50	4
Requirement	3	3	2	

Shipping costs are Rs. 10 per load per mile. Use Vogel's Approximation Method to find the initial basic feasible solution. Also determine the most cost effective shipping schedule that should be used. (8)

(b) A company plans to assign 5 salesmen to 5 districts in which it operates. Estimates of sales revenue in thousands of rupees for each salesman in different districts are given in the following table. Determine the placement of the salesmen if the objective is to maximize the expected sales revenue.

Expected Sales Data

Salesman	District D1	D2	D3	D4	D5
S1	40	46	48	48	36
S2	48	32	36	29	44
S3	49	35	41	38	45
S4	30	46	49	44	44
S5	37	41	48	43	47

(7)

4. The following table gives data on normal time and cost, and crash time and cost for a project.

Activity	Duration (in weeks)		Total Cost (Rs.)	
	Normal	Crash	Normal	Crash
1-2	3	2	300	450
2-3	3	3	75	75
2-4	5	3	200	300
2-5	4	4	120	120
3-4	4	1	100	190
4-6	3	2	90	130
5-6	3	1	60	110

(i) Draw the network diagram. (2)

(ii) Find out the critical path and the normal project duration. (4)

(iii) Find out the total float associated with each activity. (4)

(iv) If the indirect costs are Rs. 100 per week, find out the optimum duration by crashing and the corresponding project costs. (4)

(v) With the crash duration indicated, what could be the least project completion time if cost are ignored ? (1)

5. (a) Two firms are competing for business under the conditions so that one firm's gain is another firm's loss. Firm A's pay-off matrix is given below :

		Firm B		
		No. Advertising	Medium Advertising	Heavy Advertising
Firm A	No Advertising	10	5	–2
	Medium Advertising	13	12	15
	Heavy Advertising	16	14	10

Suggest optimum strategies for the two firms and the net outcome thereof. (7)

(b) In a certain market, only two brands of lipsticks, A and B, are sold. Given that a lady last purchased lipstick A, there is 80% chance that she would buy the same brand in the next purchase, while if a lady purchased brand B, there is 90% chance that her next purchase would be brand B. using this information, develop the transition probability matrix. Also, calculate :

(i) The probability that if a customer is currently a brand A purchaser, she will purchase brand B two purchases from now;

(ii) The probability that if a customer is a brand B purchaser, she will purchase brand A three periods from now;

(iii) The probability that three periods from now, a customer shall buy brand B, given that the market share of the two brands is as follows: Brand A-70%, Brand B-30%;

(iv) The steady state probabilities. (8)

6. (a) A manufacturer produces three products X, Y, Z. The three products are each processed through three production operations with time constraints and then stored. The problem has been formulated as :

$$\text{Max } z = 32x_1 + 35x_2 + 45x_3$$

Subject to the constraints :

$2x_1 + 3x_2 + 2x_3 \leq 120$ (Operation 1, hour)

$4x_1 + 3x_2 + x_3 \leq 160$ (Operation 2, hour)

$3x_1 + 2x_2 + 4x_3 \leq 100$ (Operation 3, hour)

$x_1 + x_2 + x_3 \leq 40$ (Storage , ft^2)

$x_1, x_2, x_3 \geq 0$

The final optimal simplex table is given below :

C_B	x_B	Solution Values	x_1	x_2	x_3	s_1	s_2	s_3	s_4
0	s_1	10	-1/2	0	0	1	0	½	-4
0	s_2	60	2	0	0	0	1	1	-5
45	x_3	10	½	0	1	0	0	½	-1
35	x_2	30	½	1	0	0	0	-1/2	2
	(z_j-c_j)	1500	8	0	0	0	0	5	25

On the basis of the above information, answer the following questions :

(i) Is the solution feasible ?

(ii) Illustrate the optimal solution.

(iii) Does it have multiple optimal solutions ?

(iv) Is the above solution degenerate ?

(v) If at all the company decides to produce X, then by what minimal amount should its price be increased ? (5x1 mark)

(b) Write short notes on any **2** :

(i) Managerial significance of sensitivity analysis.

(ii) Monte Carlo Simulation.

(iii) Explain the terms saddle point, pure strategy and mixed strategy in the context of game theory. (2x5marks)

[This question paper contains 10 printed pages.]

9391 *Your Roll No.* .....

BBS / III Sem. – 2011

BUSINESS STUDIES – Paper 302

Quantitative Techniques for Management

Time : 3 hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **five** *questions in all.*
Question No. **1** *is compulsory.*
All rough work must be shown along with the answer. Parts of a question must be answered together.

1. (a) Consider the following LPP

Maximise $Z = 10x_1 + 20x_2$

Subject to constraint

$$2x_1 + 4x_2 \leq b_1$$

$$x_1 + 5x_2 \leq b_2$$

And

$$x_1, x_2 \geq 0$$

The following optimal Table corresponding to specific values of b_1 and b_2 :

P.T.O.

Optimal Table

		C_j	10	20	0	0
C_B	Basic variable	b	X_1	X_2	S_1	S_2
10	X_1	10/3	1	A	5/6	–2/3
20	X_2	7/3	0	1	–1/6	B
	Z_j	80	C	20	D	0
		Δ_j	0	0	E	0

Where S_1 and S_2 is the slack variable ? Determine the followings :

(i) The Right-hand-side values, b_1 and b_2.

(ii) The elements A, B, C, D, E.

(iii) What happens when inequality will be changed ($\geq$ instead of $\leq$) in both the constraint, discuss the Nature of New LPP; In this which type of difficulty will you face while solving this new L.P.P. by simplex method.

(2+5+3=10)

(b) Construct the DUAL of the following problem :

Maximise $Z = 7x_1 + 5x_2 - 2x_3$

Subject to

$$x_1 + x_2 + 3x_3 = 10$$
$$2x_1 - x_2 + 3x_3 \leq 16$$
$$3x_1 + x_2 - 2x_3 \geq 0$$

and

$x_1, x_2 \geq 0$, x_3 unrestricted in sign

(5)

2. (a) The captain of a cricket team has to allot 5 middle batting positions to 5 batsmen. The Average Runs scored by each batsmen at these positions are as follows :

Batsman	Batting Positions				
	I	II	III	IV	V
A	40	40	35	25	50
B	42	30	16	25	27
C	50	48	40	60	50
D	20	19	20	18	25
E	58	60	59	55	53

(i) Find the assignment of batsmen to positions, which would give the Maximum Number of Runs.

(ii) If another batsmen 'F' with the following Average runs in batting positions as given below :

Batting Position :	I	II	III	IV	V
Average Runs :	45	52	38	50	49

is Added to the team, should he be included to play in team ? If so, who will be replaced by him ?

(5+3=8)

P.T.O.

(b) Sumit Enterprise has 3 Factories at locations A, B, and C which supplies 3 warehouses located at D, E and F. Monthly Factory capacities are 10, 80 and 15 units, respectively. Monthly warehouse requirements are 75, 20 and 50 units, respectively. Unit shipping costs (in Rs.) are given here :

Factory	Warehouse		
	D	E	F
A	5	1	7
B	6	4	6
C	3	2	5

The penalty costs for not satisfying demand at warehouse D, E and F are Rs. 5, Rs. 3, and Rs. 2 per unit respectively. Determine the optimal distribution for Sumit, using any of the known algorithms. (7)

3. (a) The following table gives data on normal time-cost and crash time-cost for a project.

Activity	Normal		Crash	
	Time (days)	Cost Rs.	Time (days)	Cost Rs.
1 – 2	6	600	4	1000
1 – 3	4	600	2	2000
2 – 4	5	500	3	1500
2 – 5	3	450	1	650
3 – 4	6	900	4	2000
4 – 6	8	800	4	3000
5 – 6	4	400	2	1000
6 – 7	3	450	2	800

The indirect cost per day is Rs. 100.

(i) Draw the Network and identify the critical path.

(ii) What are the Normal Project duration and associated cost ?

(iii) Crash the relevant activities systematically and determine the optimum project completion time and cost. (4+2+4=10)

(b) A Small Project consists of 7 activities for which the relevant data are given below :

Activity	Preceding Activities	Activity duration (days)
A	—	4
B	—	7
C	—	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

Draw the Network and find the Project completion time. (5)

4. (a) The manager of a Flower Shop Promises delivery within Four hours on all Flower orders. The Flowers are purchased on the previous day and delivered to the manager by 8:00 A.M., the next morning.

Manager's daily demand for roses is as follows :

Roses (in dozens) :	7	8	9	10
Probability :	0.1	0.2	0.4	0.3

The manager purchases roses for Rs. 10 per dozens and sells them for Rs. 30. All unsold roses are donated to a local hospital. How many dozens of roses should the manager order each evening to maximise its projects ? What is the optimum Expected Profit ? (5)

(b) A and B play a game in which each has three coins : a 5 paise, 10 paise, 20 paise coin. Each player select a coin without the knowledge of the other's choice, If the sum of the coins is an odd amount, A win B's coin, if the sum is Even, B win A's coin.

Find the best strategy for each player and the value of the game. (5)

(c) A salesman makes all sales in three cities X, Y and Z only. It is known that he visits each city on

a weekly basis and never visit the same city in successive weeks. If he visit city X in a given week, then he visit city Z in the next week. However, if he visit city either Y or Z, he is twice as likely to visit city X than other city.

(i) Obtain the transition Probability Matrix.

(ii) Determine the proportionate visits by him to each of the cities in the long run.

(2+3=5)

5. (a) A Corporation is considering the possible investment opportunities. The following Table presents information about the investment (in Rs. thousand) profits :

Project	Present value of Expected Return	Capital Required (year-wise) by Projects		
		Year 1	Year 2	Year 3
1	650	700	550	400
2	700	850	550	350
3	225	300	150	100
4	250	350	200	—
Capital Available for investment		1200	700	400

in addition, Projects 1 and 2 are mutually exclusive and Project 4 is contingent on the Prior acceptance of Project 3 only.

Formulate an integer Programming model to determine which Projects should be accepted and which should be rejected to maximise the present value from accepted Project. (5)

(b) The following Table lists the Jobs of a project with their time estimates :

Job (i–j)	t_0 (in days)	t_m (in days)	t_p (in days)
1 – 2	3	6	15
1 – 6	2	5	14
2 – 3	6	12	30
2 – 4	2	5	8
3 – 5	5	11	17
4 – 5	3	6	15
5 – 8	1	4	7
6 – 7	3	9	27
7 – 8	4	19	28

(i) Draw the Project Network.

(ii) What is the approximate Probability that the Jobs on the critical path will be completed by the due date of 42 days.

The table of Area of the Normal curve at selected values is as follows :

Z :	1.1	1.2	1.3
Area :	0.3643	0.3849	0.4032

(3+3=6)

(c) From the following 'two – person, zero-sum's game, find the optimal strategies for the two players and value of the game.

		Player B		
		B_1	B_2	B_3
Player A	A_1	5	9	3
	A_2	6	–12	–11
	A_3	8	16	10

If saddle point exists, determine it using the principle of dominance. (4)

6. (a) In Sensitivity Analysis, if the Right-hand-side constant of a constraint of an LPP is changed, within the range of validity of the shadow prices for the relevant resources, and the problem is Re-solved, the new optimal solution would have the same basic variables & the value of objective function. Do you agree ? Explain. (4)

(b) Study the question carefully and give the appropriate answer.

P.T.O.

(i) A degenerate basic feasible solution in a transportation problem exists if and only if some partial sum of availabilities (row) is equal to a partial sum of requirements (column). Then what is the number of Basic Feasible Solutions ?

(ii) If a constant is added to every element of a row and/or a column of the cost matrix of an assignment problem the resulting assignment problem has the optimum solution as the original problem and vice-versa ? Comment. (2+2=4)

(c) Write a short note on the followings :

(i) Total Float

(ii) Free Float

(iii) Independent Float (3)

(d) Explain the steps involved in Monte-Carlo Simulation. (4)

7. (a) Write short notes on :

(i) Difference between PERT and CPM

(ii) Phases of the simulation process

(iii) Classical EOQ Model (3×3=9)

(b) Solve the following problem using Simplex method

$$\text{Max } Z = 2x_1 + 3x_2$$

$$\text{S.t.} \quad 2x_1 + x_2 \leq 4$$

$$x_1 + 2x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

(6)