VPM's
DR VN BRIMS, Thane
Programme: PGDM (2014-16) Fourth Batch
Second Semester Examination December 2014

Subject	Quantitaive Techniques		
Roll No.		Marks	60 Marks
Total No. of Questions	7	Duration	3 Hours
Total No. of printed pages		Date	29.12.2014

Note: Q1 is compulsory and solve any FOUR from the remaining SIX questions.

Q1) 20 Marks (Compulsory)

***Q.1.a]* Multiple choice questions (Each Question carries 2 marks):**

Illustration: A company makes three models of desks, an executive model, an office model and a student model. Each desk spends time in the cabinet shop, the finishing shop and the crating shop as shown in the table:

Type of desk	Cabinet	Finishing	Crating	Profit/unit
Executive	2	3	2	40
Office	4	3	1	30
Student	3	2	4	20
Available Hours	100	160	80	

The total raw material available is enough only for 40 desks. The above information needs to formulated as Linear programming model to optimise the profits. If We consider X Y and Z as the numbers of units of each product variant to be produced, then

1. The objective function of the above illustration is

a. 100X+160Y+80Z
b. 40X+30Y+20Z
c. 100x+80y+160z
c. 20X+30Y+40Z

2. The objective function is of _____ type

a. Maximise
b. Minimise

3. The no.of constraints in the given information are _____

a. Four
b. Three
c. Two
d. Five

Illustration:

An organisation's HR manager wants to assign jobs to his employees. You are given the cost of performing different jobs by different persons.

1. The job-person marking (**) indicate that the individual involved cannot perform the particular job.

2. Any job that is not assigned to internal employees will be outsourced

Person	Jobs				
	J1	J2	J3	J4	J5
P1	27	18	**	20	21
P2	31	24	21	12	17
P3	20	17	20	**	16
P4	22	28	20	16	27

The above information was formulated into an assignment model by the manager to optimise the cost. He has encircled the assignment indicating the allocation of jobs to persons. Using this information answer the below given questions:

4. The above assignment model is a of _____ type

a. Unbalanced
b. Restrictive
c. Maximisation
d. Both a and b

5. The _____ job will be outsourced

a. J1
b. J3
c. J5
d. J4

Q.1.b] G limited, manufacturer of superior garden ornaments, is preparing its production budget for the coming period. The company makes four of ornaments, the data for which are as follows:

Product ⟶ / Particulars ↓	Pixie	Elf	Queen	King
Direct material	25	35	22	25
Variable OH	17	18	15	16
S.P.	111	98	122	326

Product ⟶	Labor hours required for each product			
Labor type ↓	Pixie	Elf	Queen	King
Unskilled	8	6	-	-
Semi-Skilled	-	-	10	10
Skilled	-	-	5	25

Fixed over heads amount to Rs.15000 per period. Each type of labor is paid Rs.5 per hour but because of the skills involved; an employee of one type cannot be used for work normally done by another type. The maximum hours available for each type of labor are:

Unskilled: 8000 Hours; **Semi-Skilled:** 20000 Hours; **Skilled**: 25000 Hours

There is an unlimited demand for all the products.

a. Formulate the given problem in the form of linear programming model so as to maximize the contribution of all the 4 products. (5 marks)
b. Write the dual of the formulated problem (5 marks)

Attempt Any FOUR from the Remaining SIX Questions

Q2) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a. Solve using solver addin: Max z = x1 + x2 + x3

STC

$3x1 + 2x2 + x3 \leq 3$
$2x1 + x2 + 2x3 \leq 2$

$x1, x2, x3 \geq 0$

b. Write Dual of the below LPP:
Maximise Z = 3x + 5y + 7z
stc,
$x + y + 3z \leq 10$
$4x - y + 2z \geq 15$
$x, y \geq 0$, z is unrestricted in sign

c. Max Z = 70x1 + 65x2 + 80x3 + 75x4

STC,

$4x1 + 4x2 + 3x3 + 7x4 \leq 90$
$6x1 + 3x2 + 5x3 + 4x4 \leq 120$
$5x1 + 2x2 + 3x3 + 3x4 \leq 60$
$6x1 + 5x2 + x3 + 2x4 \leq 100$

Run the above problem in solver and using sensitivity reports answer the following question: Will their be any change in the optimal solution to the above problem if the coefficient of X2 in the objective function is increased by 10 units ? So the new coefficient of X2 will be 75 instead of 65.

Q3) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) The following situation calls for assignment of a-truck-to-a-territory, what assignment would involve the lowest aggregate cost?

Truck	Territory				
	1	2	3	4	5
T1	200	190	180	190	110
T2	150	210	190	200	100
T3	80	90	200	90	70
T4	220	80	90	140	60
T5	170	110	90	150	40
T6	90	100	120	90	60
T7	120	200	130	80	60
T8	160	90	160	110	80

b) ABC company is engaged in manufacturing 5 brands of packed snacks. It is having 5 manufacturing setups, each capable of manufacturing any of its brands one at a time. The cost to make a brand on these setups vary according to the table below:-

	S1	S2	S3	S4	S5
B1	4	6	7	5	11
B2	7	3	6	9	5
B3	8	5	4	6	9
B4	9	12	7	11	10
B5	7	5	9	8	11

Assuming 5 setups are S1,S2,S3,S4,S5 and 5 brands are B1,B2,B3,B4,B5. find the optimum assignment of products on these setups resulting in the minimum cost.

c) Application of assignment model in business management

Q4) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) Dr. Strong is a dentist who schedules all her patients for 30-minutes appointments. She starts from 8.00 A.M and gives appointments at the interval of half an hour like 8.30 A.M, 9.00 A.M till 11.30 A.M. So in total only 8 Appointments.

Some of the patients take more or less than 30 minutes depending upon the type of dental work to be done. The following is the summary shows the various categories of work, their probabilities and the time actually needed to complete the work.

Category	Filling	Crowning	Cleaning	Extraction	Check-Up
Time Required in Minutes	45	60	15	45	15
Probability	0.40	0.15	0.15	0.10	0.20

Simulate the dentist's clinic for four hours morning shift and determine the average waiting time for the patients as well as the idle time of the doctor. Assume that all the patients show up at the clinic at their scheduled arrival time and are treated by Dr. Strong the moment he is done with the previous patient. Starting from 8.00 A.M use the following series of random numbers for each of the 30 minutes appointment.

40, 82, 11, 34, 25, 66, 17, 79.

b) The management of ABC Company is considering the question of marketing a new product. The fixed cost required in the project is Rs. 4000. Three factors are uncertain i.e. the selling price, variable cost and the annual sales volume. The product has a life of only one

year. The management has the data on these three factors as under:

Selling Price	Probability	Variable cost	Probability	Sales Volume	Probability
3	0.2	1	0.3	2000	0.3
4	0.5	2	0.6	3000	0.3
5	0.3	3	0.1	5000	0.4

Consider the following sequence of thirty random numbers:

22 17 68, 19 36 27, 16 77 23, 78 43 76,
03 28 28, 93 22 53, 78 76 58, 23 68 35,
23 68 35, 15 39 25, 58 71 96, 57 35 27,
48 50 86, 61 96 48

c) Application of Simulation techniques in business management

Q5) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) The manager of the flower shop promises its customers deliver within four hours on all flower orders. All flowers are purchased on the previous day and delivered to the customer by 8.00 am the next day morning. The daily demand for roses is as follows:

Dozen of Roses	70	80	90	100
Probability	0.1	0.2	0.4	0.3

The manager purchases roses for Rs.10 per dozen and sells them for Rs.30. All unsold roses are donated to a local hospital. How many dozen roses should he order each evening to maximise the profit. What is the that optimum profit amount.

b) A person has the choice of running a hot snack stall or an ice cream and cool drink shop at a certain holiday resort during the coming summer season. If the weather during the season is cool and rainy he can expect to make s profit of Rs.15000 and if it is warm he can expect to make a profit of only Rs.3000 by running a hot snack stall. On the other hand, if his choice is to run an ice cream and cool drink shop, he can expect to make a profit of Rs. 18000 if weather is warm and only Rs.3000 if the weather is cool and rainy. The meteorological authorities predict that there is a 40% chance of the weather being warm during the coming season. You are to advice him as to the choice between the two types of stalls. Base clearly your arguments on the expected value of the profit of the two courses of action.

c) Application of Decision making science in Business Management

Q6) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) A cement company has three factories which manufacture cament which is then transported to four distribution centres. The quantity of monthly production of each factory, the demand of each distribution centre and the associated transportation cost per quintal are given as folows:

Factories	Distribution Centre				Monthly Production
	W	X	Y	Z	
A	10	8	5	4	7000
B	7	9	15	8	8000
C	6	10	14	8	10000
Monthly demand	6000	6000	8000	5000	--------

Suggest an optimum transportation schedule for the above problem.

b) Find the optimal transportation cost for the below given transportation problem.

	D1	D2	D3	D4	D5	CAPACITY
O1	12	4	9	5	9	55
O2	8	1	6	6	7	45
O3	1	12	4	7	7	30
O4	10	15	6	9	1	50
REQUIREMENT	40	20	50	30	40	-------

c) Application of transportation model in Business Management

Q7) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

Write short notes:

a) Integer Programming
b) Transhipment Model
c) Shadow Price