DDE/I/COM/II/13

M.Com. Part-I Examination, 2013

QUANTITATIVE TECHNIQUES FOR MANAGERIAL DECISIONS

PAPER – II

Full Marks : 100

Time : 4 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

Write the answers to questions of each Half in separate books

[FIRST HALF]

(*Business Statistics*)

[*Marks* : 50]

Answer **Q. No. 1** and any **two** from the rest

1. Answer any *four* questions from the following : 5×4

(*a*) What is 'Scatter diagram' ? How would you find the nature of relationship between two variables using scatter diagram ?

(*b*) Distinguish between 'interpolation' and 'extrapolation'. Write Newton's forward formula for interpolating an unknown entry.

(*c*) For linear regression y on x, show that $TSS = ESS + RSS$.

(*d*) If u is a function of x and given that

$$u_0 + u_8 = 56, \quad u_2 + u_6 = 32$$
$$u_1 + u_7 = 42, \quad u_3 + u_5 = 26$$

Find the value of u_4.

(*e*) Write the essential features of Trend (T) and seasonal (S) components in Time series analysis.

(*f*) Show that Fishers Index number formula lies between Laspeyer's and Paaschees Price Index formulae.

(*g*) Test the consistency of the data given below :

Case I : $(AB) = 200$, $(A) = 300$, $(\alpha) = 200$, $(B) = 250$, $(\alpha\beta) = 150$, $(N) = 500$

Case II : $(AB) = 250$, $(A) = 150$, $(\alpha B) = 1000$, $(\alpha\beta) = 600$, $(\beta) = 500$, $(N) = 1750$

(*h*) Eighty-eight residents of an Indian city, who were interviewed during a sample survey, are classified below according to their smoking and tea drinking habits. Calculate Yule's co-efficient of Association and comment on its value.

	Smokers	Non-Smokers
Tea-Drinkers	40	33
Non-tea Drinkers	3	12

2. (*a*) Fit a parabolic trend equation from the following data :

Year	: 2008	2009	2010	2011	2012
Sales (₹ '000)	: 50	60	90	70	80

(*b*) From the following information calculate seasonal indices using Average method :

	Sale of cold drinks			
Year/Quarters	I	II	III	IV
2009	5	30	20	4
2010	8	40	20	6
2011	6	40	30	6

8 + 7

3. (*a*) What is Index Number ?

(*b*) Distinguish between Price Index and Quantity Index.

(*c*) With the help of following data show that Fisher's Price index number satisfies both the time reversal and the factor reversal tests :

	2010		2012	
Commodity	Price (₹)	Quantity (Tons)	Price (₹)	Quantity (Tons)
A	6	50	10	56
B	2	100	2	120
C	4	60	6	60
D	10	30	12	24
E	8	40	12	36

(*d*) Explain how the base year of an index number is chosen. 2 + 3 + 8 + 2

4. (*a*) Show that Pearson's product-moment correlation coefficient '*r*' can not exceed 1 numerically.

(*b*) Indicate whether each of the following statements is *true* or *false* :

(*i*) The lines of regression always pass through the point $(\bar{x}, \bar{y})$;

(*ii*) The two regression lines are mutually perpendicular if two variables are independent;

(*iii*) If the simple correlation coefficient between two variables is zero, they are independent of each other;

(*iv*) If correlation coefficient between two variables is unity, the two regression lines coincide;

(*v*) The smaller is the angle between two regression lines, the smaller is the degree of association between the variables.

(c) (i) If $r_{12} = 0{\cdot}5$, $r_{23} = 0{\cdot}45$ and $r_{31} = 0{\cdot}3$ calculate $r_{13{\cdot}2}$

(ii) Show that

$$R^2_{1{\cdot}23} = r^2_{12} + r^2_{13}, \text{ if } r_{23} = 0. \qquad 5 + 5 + 5$$

5. (a) Clearly make a distinction between 'random causes' and 'assignable causes' of variations in quality. Why is it necessary to make such distinction ?

(b) A new machine is installed to fill aluminium cans with mixed dry fruits. The machine is set to fill 40 grams of dry fruits in each can. The weight of the can is 5 grams, so that the total weight is 45 grams. A quality control inspector takes a sample of 5 filled cans every hour and records the weights.

Sample	Weight of cans				
	1	2	3	4	5
1	45	47	46	45	47
2	43	44	44	43	46
3	45	48	47	50	45
4	42	43	44	43	43

Construct a control chart for mean ($\bar{x}$) and check whether the process is in control.

$$\left[\text{Given : } \begin{array}{l} \text{For } n=5, \quad A_2 = 0{\cdot}577 \\ \text{For } n=4, \quad A_2 = 0{\cdot}729 \end{array}\right] \qquad 6 + 9$$

[SECOND HALF]

(*Quantitative Techniques for Managerial Decisions*)

[*Marks* : 50]

Answer **Q. No. 6** and any **two** from the rest

6. Answer any *four* questions from the following : 5×4

(a) How can you test the Basic Feasible Solution of a transportation problem ? Indicate the steps to be taken to convert a non-basic feasible solution to a basic feasible solution. $2 + 3$

(b) Find the dual of the following LPP : 5

$$\begin{array}{ll} \text{Maximize} & Z = cx \\ \text{Subject to} & Ax \le b \\ & x \ge 0. \end{array}$$

What is the advantage of duality ?

(*c*) Describe transportation problem. Is transportation problem an LPP ? 5

(*d*) While applying assignment technique what principle is followed for zero crossing in situation when there is no single zero in any row or column ? Will you change that principle for zero selection in similar situation ? 5

(*e*) What is crashing in network analysis ? What principles are to be followed in crashing ? Does the same principle work in relaxation ? 5

(*f*) Define inventory. What is EOQ model ? What do you mean by set up cost and holding cost ? 5

(*g*) What do you understand by (*i*) queue discipline, and (*ii*) queue input ? 5

(*h*) What is an artificial variable ? What strategy would you follow to drive it out of the simplex method of solving a LPP ? 5

7. (*a*) At a certain Petrol Pump, customers arrive in a Poisson process with an average time of 5 minutes between intervals. The time intervals between services at the Petrol Pump follow exponential distribution and as such the mean time taken to service a unit is 2 minutes. On the basis of this information you are to answer the following :

(*i*) What would be the expected average queue length ?

(*ii*) How long, on an average, does a customer wait in the queue ?

(*iii*) By how much should the flow of customers be increased to justify the opening of a second service point if the management is willing to open the same provided the customer has to wait for 5 minutes for the service ?

(*b*) A company needs 80,000 units of a particular component every year. The unit price for the component is Rs. 50. The ordering cost is estimated at Rs. 200 per order and the annual

holding cost is estimated to be 10% of the value of average inventory.

(*i*) What should be the optimal size of an order ?

(*ii*) Calculate the optimum total inventory cost.

(*iii*) If the price of the component is raised by Rs. 10 per unit, what will be the impact of such price hike on order size ? 7 + 8

8. (*a*) Three products are produced using three resources. The quantity of resources available, the unit consumption of these resources for production of different products, and the profit per unit sale of the products are indicated by the table below :

		Products			
		X	*Y*	*Z*	
Resources	*A*	1	2	1	≤ 11
	B	1	1	1	≤ 9
	C	2	1	1	≤ 12
Profit		3	2	4	

Find an optimum production programme using simplex method.

(*b*) What is 'Shadow Price' as used in linear programming problem ? 12 + 3

9. From the following available data find the missing figures, find different types of floats for the activities, and determine optimum project schedule considering indirect cost of Rs. 50 per day : 15

Activities	Precedence Relationship	Normal		Crash		Slope (Rs./Day)
		Duration (Days)	Cost (Rs.)	Duration (Days)	Cost (Rs.)	
A	—	3	50	2	100	?
B	—	6	140	?	260	60
C	—	2	25	1	50	25
D	*A*	?	100	3	180	40
E	*C*	2	80	2	80	—
F	*A, D*	7	?	5	175	30
G	*B, D, E*	4	100	2	?	75

10. (*a*) A salesman has to visit cities A, B, C, D, and E for which the cost matrix is given below :

	A	B	C	D	E
A	∞	3	6	8	2
B	7	∞	4	9	3
C	7	8	∞	5	8
D	13	5	7	∞	6
E	2	4	3	9	∞

Find a routing for the salesman so as to cover the visit of all the cities at a minimum cost without travelling any city twice in the cycle.

(*b*) Compare and contrast CPM and PERT as these are used in Network analysis. 12 + 3