



Quantitative Methods

Foundation Examination
Autumn 2011
Module A

6 September 2011
100 marks – 3 hours
Additional reading time – 15 minutes

(All questions are compulsory)

- Q.1 (a) During annual clearance sale, Independent Departmental Store (IDS) reduced the prices of a product Z by 20%. 40% of the sale of Z was made during the clearance sale and the profit earned thereon was 25% of cost. Find the profit percentage (on cost) which IDS earned on product Z during the whole year. *(05 marks)*
- (b) The cost of production of a product in rupees is: $C = 15x + 9,750$ where x is the number of items produced. If selling price of each item is Rs. 30, find the sales quantity at which there would be no profit or loss. *(03 marks)*
- (c) Find the value of x if, $\ln 3 + 2\ln x = \ln(x + 2)$ *(04 marks)*
- Q.2 (a) Bashir has chosen to receive a pocket money of Rs. 1,200 per week. He was also offered an alternative by which he would have received Re. 1 on the first day of the week, Rs. 3 on the second day, Rs. 9 on the third day and so on. Has he taken a wise decision? *(04 marks)*
- (b) Shiraz borrowed Rs. 120,000 for eight months at 15% simple interest. Compute the annual rate of interest, compounded monthly, which would result in the payment of the same amount of interest. *(05 marks)*
- Q.3 (a) If $y = \frac{u}{u+1}$ and $u = 5x^2 - 1$, find dy/dx at $x = 2$ *(05 marks)*
- (b) The cost of manufacturing x units of a product consists of the following:
Labour Rs. $0.03x^2$; Material Rs. $220x$; Overheads Rs. 50,000
The demand function of the same product is $D(x) = 500 - 0.04x$
- Required:**
- (i) Revenue function and the marginal revenue function.
(ii) Profit function and the quantity at which profit is maximised.
(iii) Unit price corresponding to maximum profit. *(08 marks)*
- Q.4 A company has two plants, P_1 and P_2 in two different cities. Each plant manufactures two products x and y . Daily production of P_1 is 50 units of x and 30 units of y . P_2 produces 20 units of x and 15 units of y per day. Each unit of x requires 40 hours of operational, 10 hours of technical and 5 hours of managerial staff. While each unit of y requires 50 hours of operational, 12 hours of technical and 7 hours of managerial staff.
- Required:**
- (a) Construct a matrix P depicting the relationship between plants and products and a matrix S depicting the relationship between products and various categories of staff as described above. *(02 marks)*
- (b) (i) Using the matrices constructed in part (a), compute the matrix $R = PS$.
(ii) Based on matrix R, determine the number of total hours worked by each category of staff, at each plant. *(08 marks)*

Q.5 Solve the following set of inequalities by graphical method and find the feasible region:
 $x + y \geq 8$; $2x + y \geq 12$; $x + y \leq 10$; $x \geq 0$ and $y \geq 0$ (06 marks)

Q.6 (a) A survey of 316 randomly selected patients in a hospital, produced the following data:

Hospital stays (in days)	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27
Frequency (patients)	06	12	110	103	42	25	13	04	01

Required:

- (i) Calculate the mean and standard deviation of the above data. (04 marks)
 (ii) Based on Chebyshev's theorem, determine the minimum number of patients who would stay between 3 to 19 days if 6,000 patients are admitted to the hospital in a year. (03 marks)

(b) The following data represents the prices and consumption of fuel related products:

Commodity	Prices per litre (Rs.)		Quantity in millions of litres	
	2005	2010	2005	2010
Diesel	30	90	150	200
Petrol	55	85	200	240
Kerosine	15	55	40	30
CNG	25	50	100	250

Calculate the price indices of Laspeyre, Paasche and Fisher, for the year 2010. (06 marks)

Q.7 (a) A box contains 10 items, 3 of which are defective. If 4 are selected at random, without replacement, find the probability that at least 2 are defective. (04 marks)

(b) In a T20 cricket match between Falcon Club (FC) and Eagle Club (EC), the probability to win by (FC) is 0.4. In a series of five T20 matches, find the probability that FC would win:

- (i) Exactly two matches. (ii) At least two matches. (iii) Less than four matches. (06 marks)

Q.8 The following data shows the height and weight of eight men working in an organisation who were selected at random:

Height (cm)	150	155	161	166	170	174	182	190
Weight (kg)	60	63	67	70	72	74	76	78

Required:

- (a) Determine the regression equation of weight over height and interpret your result. (07 marks)
 (b) Determine the coefficient of correlation and coefficient of determination and interpret your result. (05 marks)

Q.9 (a) The following data pertains to a sample taken from a normal population:
 5, 10, 8, 11, 12, 6, 15, 13, 10

Required:

- (i) Find the point estimate for the population mean. (03 marks)
 (ii) Construct 95% confidence interval for population mean and interpret your result. (06 marks)

(b) A manufacturer claims that after using an automatic bottling plant, the average quantity in each bottle produced on its plant is 250 ml. A random sample of 25 bottles showed a mean quantity of 242 ml with a standard deviation of 18 ml. Test the manufacturer's claim using a significance level of 0.05. (06 marks)

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