



September 8, 2009

QUANTITATIVE METHODS

(MARKS 100)

Module A

(3 hours)

- Q.1 (a) If $x^{2y} = (\sqrt{x})^{2y^2+2}$, find the value of y . **(03)**
- (b) Factorize the expression $16x^4 + 4x^2y^2 + y^4$. **(03)**
- (c) On August 1, 2009 a supplier increased the price of a product by 25%. On August 15, 2009, he decreased the price by 16%. If the price of the product on August 15, 2009 is Rs. 63, what was the price on July 31, 2009. **(02)**
- Q.2 (a) A line passes through the point (3, 5) and has same values of x-intercept and y-intercept. Find the equation of the line. **(03)**
- (b) A shopkeeper sold goods worth Rs. 3.0 million during 2008. If he is able to increase his sale by 15% annually, determine the year in which he would achieve annual sale of Rs. 25 million. **(05)**
- Q.3 (a) A promissory note of Rs. 200,000 carries simple interest of 8% per annum. The note is payable at the end of 2 years. The holder of the note got it discounted 6 months before the maturity date and received an amount of Rs. 221,797. Compute the discount rate. **(05)**
- (b) Shiraz acquired a new car worth Rs. 850,000 through a leasing company. He made a down payment of Rs. 200,000 and has agreed to pay the remaining amount in 10 equal semi-annual installments. The leasing company will charge interest @ 19% per annum, over the lease term. You are required to find:
- (i) Amount of semi-annual installment.
- (ii) Total amount of interest that Shiraz will pay, over the term of the lease. **(05)**
- Q.4 (a) The average cost function of a product is as follows:

$$A(x) = 0.01x^2 - 30\sqrt{x} + 300 + \frac{60}{x}$$
 You are required to find the number of units at which the marginal cost will be minimum. **(06)**
- (b) If $y = \frac{(x-1)(x+2)}{\sqrt{x}}$, show that:
- $$\frac{dy}{dx} = \left(\frac{3x^2 + x + 2}{2x^2} \right) \sqrt{x}$$
- (04)**

(2)

- Q.5 (a) Using matrix algebra, find the value of 'a', if $|A| = 0$ for the following set of equations:

$$4x + 3y - z = 5$$

$$x - 2y + z = 4$$

$$ax + 12y - 5z = 1$$

(03)

- (b) A pharmaceutical company has developed a formula to prepare a herbal medicine. The medicine can be produced by using either product X or product Y or a combination of both. From each milligram (mg) of X it can extract one unit of iron and two units of calcium and from each mg of Y it can extract one unit of iron and one unit of calcium. Each tablet of the medicine is required to contain:

- 5 to 7 units of iron
- 8 to 10 units of calcium

The cost of X is Rs. 6 per mg whereas Y costs Rs. 4 per mg.

You are required to:

- (i) Construct the set of constraints and the objective function for cost minimization.
- (ii) Draw the graph and identify the feasible region, clearly indicating its boundaries.
- (iii) How many mg of each product should be used to produce the tablets at the lowest cost?

(11)

- Q.6 (a) The following data represents the average monthly take-home salary of the employees of an organization:

Year	2005	2006	2007	2008
Pay (Rs.)	12,350	13,500	14,800	16,500
Price Index	110.1	122.3	137.6	160.2

- (i) Compute the real wages for each of the above years.
- (ii) Compute the amount of pay needed in 2008 to provide buying power equal to that enjoyed in 2006.

(03)

- (b) The following data relates to salaries of the employees of a reputed cement manufacturing company:

Salary (Rs in thousands)	Number of Employees
10 up to 20	120
20 up to 30	175
30 up to 40	100
40 up to 50	80
50 up to 60	44
60 up to 70	25
70 up to 80	17

- (i) Draw a frequency polygon representing the above data.
- (ii) Assuming that the mean and standard deviation of salaries of another company is Rs. 36,544 and Rs. 8,982 respectively, determine which company's salaries are more evenly distributed.

(09)

- Q.7 (a) Following data shows the marks obtained by 11 students in Mathematics and Physics:

Mathematics	27	73	34	25	64	91	70	62	55	48	59
Physics	67	62	41	21	74	85	66	49	55	44	68

Find the Spearman's rank correlation coefficient for the above data and interpret your result.

(08)

- (b) In order to determine the relationship between experience of its employees and their respective output, a company has gathered the following data:

Experience in years	2	4	6	8	10	12	14	16	18	20
Output in %	30	35	44	43	46	50	45	48	39	34

- (i) Determine the regression equation for **output** on **experience**.
(ii) Describe the apparent relationship between experience and output.
(iii) Predict the output of a 13 year experienced employee, using the regression equation.

(09)

- Q.8 (a) During a T20 cricket match Naeem scored 47 runs in six overs with the help of five fours, four sixes and three singles. If a TV Channel were to show two of his scoring shots during its News Update and the shots were to be selected on random basis, find the probability of either of the following:

- (i) On both the shots Naeem had scored different runs.
(ii) On one of the shots he had hit a six.

(05)

- (b) The PABX system of Saleem Industries receives an average of two calls in every three minutes. Assuming an approximate Poisson distribution, what is the probability that five or more calls will be received during a period of nine minutes?

(06)

- Q.9 (a) A cigarette manufacturer claims that the amount of nicotine in each cigarette is 7.5 mg. A random sample of 40 cigarettes was tested and found to have a mean nicotine content of 7.67 mg with a standard deviation of 0.6 mg. Test the manufacturer's claim at 5% level of significance.

(05)

- (b) A random sample of 20 boys was taken to estimate the 98% confidence interval for the mean weight of boys aged between 14 and 15 years. The 98% confidence interval was found to be $45.5 \text{ kg} < \mu < 51.3 \text{ kg}$. Find the sample mean and sample variance.

(05)**(THE END)**