The Institute of Chartered Accountants of Pakistan

Quantitative Methods

Foundation Examinations – Autumn 2010 | August 31, 2010
Module A | 100 marks – 3 hours

Q.1 (a) Companies A and B earned profits of Rs. 600,000 and Rs. 1,320,000 respectively during 2009. It is estimated that future annual profit would increase @ 8% and 5% respectively. In which year, the profit of both companies would be equal? ***(05 marks)***

(b) Given that $8x^2 - 2xy - 3y^2 = 0$; express 'y' in terms of 'x'. ***(03 marks)***

Q.2 Mr. Hamid plans to invest equal annual amounts in a bank for five years starting from January 1, 2011 in order to have the following amounts available with him:

- Rs. 1.0 million for the marriage of his daughter on January 01, 2018.
- Education expenses of his son consisting of four annual payments of Rs. 240,000 commencing from January 1, 2019.

If the bank agrees to pay interest @ 10% per annum compounded annually, calculate the amount of annual deposits which he would be required to invest. ***(08 marks)***

Q.3 (a) If $y = \dfrac{e^{2x}}{\sqrt{2x+1}}$, show that $\dfrac{dy}{dx} = \dfrac{y^3(4x+1)}{e^{4x}}$ ***(07 marks)***

(b) Find out the coordinates of the relative maxima, minima and point of inflexion of the following function:

$$y = \frac{1}{3}x^3 - 2x^2 + 3x - 9$$ ***(10 marks)***

Q.4 Stable Limited manufactures two models of refrigerators. Deluxe Model requires 14 hours of Department A and 40 hours of Department B. Standard Model requires 7 hours of Department A and 30 hours of Department B. Each month, a maximum of 2100 hours are available in Department A and 8400 hours in Department B. The company makes a profit of Rs 5,000 on each Deluxe Model and Rs 4,000 on each Standard Model.

(a) Construct the set of constraints and the objective function for profit maximization.
(b) Draw the graph and identify the feasible region, clearly indicating its boundaries.
(c) How many refrigerators of each model should the company manufacture per day to maximize its profit? ***(09 marks)***

Q.5 (a) Express the following system of equations in matrix form and determine their solution, if any, using matrix algebra.

$$\begin{aligned} 2x + 5y - z &= 20 \\ -3x - 2y + 7z &= 40 \\ -x + 3y + 6z &= 30 \end{aligned}$$ ***(04 marks)***

(P.T.O.)

(b) If $M = \begin{bmatrix} 2 & -3 \\ 6 & 5 \end{bmatrix}$; $N = \begin{bmatrix} -9 & 4 \\ -3 & 5 \end{bmatrix}$ and $aM + bN = \begin{bmatrix} 61 & -44 \\ 63 & 15 \end{bmatrix}$ where 'a' and 'b' are constants, find the values of 'a' and 'b'. ***(04 marks)***

Q.6 (a) The following data represents the number of cancer patients admitted in a hospital over the last 14 years:

105, 60, 90, 110, 95, 140, 80, 70, 130, 90, 120, 75, 115, 85

(i) Find out the five numbers summary.
(ii) Draw a labelled box and whisker plot and define its skewness. ***(07 marks)***

(b) The following results were obtained in an IQ test taken by 50 boys and 60 girls:

Boys	**Girls**
$\sum x_1 = 4{,}910$	$\sum x_2 = 5{,}676$
$\sum x_1^{\,2} = 483{,}515$	$\sum x_2^{\,2} = 537{,}481$

Find the 90% confidence interval for the difference between the IQ of boys and girls. ***(07 marks)***

Q.7 (a) If the current year's weighted index is 5% higher than the base year and Fisher's Ideal Index Number is 250, find out the Laspeyre's Price Index Number and Paasche's Price Index Number. ***(04 marks)***

(b) The quantities sold by T&P Limited during the past seven months are as follows:

Product x	11	20	04	zero	18	07	16
Product y	15	02	32	35	05	28	10

(i) Determine the regression equation for product y on x.
(ii) Calculate the coefficient of correlation and determination and interpret the results. ***(12 marks)***

Q.8 (a) Arshad's journey from home to office takes a mean time of 21 minutes, with a standard deviation of 2.5 minutes. His journey back home takes a mean time of 28 minutes with a standard deviation of 5.5 minutes. Find the mean and standard deviation of the time taken by him on his two-way journey. ***(04 marks)***

(b) Out of every 4,000 shirts made at a garment factory, 22 are defective. Using Poisson distribution, find the probability that a lot of 300 shirts contain:

(i) more than 3 defective shirts
(ii) less than 2 defective shirts ***(07 marks)***

Q.9 Find out the probability that a random sample of size 36, selected with replacement, from the population 3, 5, 1, 7, 3, 6, 2, 4, 5, 2 will yield a sample mean greater than 3.2 but less than 4.5. ***(09 marks)***

(THE END)