The Institute of Chartered Accountants of Pakistan

Quantitative Methods

Foundation Examination
Spring 2014
Module A

4 March 2014
100 marks - 3 hours
Additional reading time - 15 minutes

Q.1 (a) The ratio of boys to girls in a school is 7:6. If the number of boys and girls in the school increases by 10% and 15% respectively in one year, the number of boys will exceed the number of girls by 120. What is the total number of students in the school? **(04)**

(b) Factorize the following expression to its simplest form:

$$x^4 - 22x^2y^2 + 9y^4$$ **(02)**

(c) The equation: $y = -50{,}000x + 1{,}000{,}000$, represents the value of a car after x years.
(i) Find the slope of the line and interpret its meaning.
(ii) Find the y-intercept and explain what it represents. **(03)**

Q.2 (a) Saad is to retire after 10 years. He wants to have sufficient money to be able to withdraw Rs. 6 million, 12 years from now, for his son's higher education and Rs. 100,000 per month for household expenses for a period of 15 years after his retirement.

Saad intends to invest all his money in a bank which offers a guaranteed return of 9% compounded monthly. His present savings amount to Rs. 2 million and he expects to receive Rs. 8 million when he retires after 10 years. He also plans to make monthly contributions in the above account until the date of his retirement.

Determine the amount that Saad should deposit in the above bank account each month in order to be able to withdraw the desired amounts. **(09)**

(b) Rashid wants to invest Rs. 1,500,000 for one year. Bank A has offered simple interest @ 10% per annum, whereas Bank B has offered interest @ 8% per annum compounded half yearly.

Rashid believes that investment in Bank A is risky and therefore he prefers to invest in Bank B. However, as he wants to earn interest of at least Rs. 140,000, he would also have to invest some of the amount in Bank A.

Determine the minimum amount that he will have to invest in Bank A to achieve the above objective. **(04)**

Q.3 (a) If $y = ln(2e^{5x} + 5e^{3x} - 16)$ find:

(i) $\frac{dy}{dx}$ and
(ii) the exact value of the co-ordinates of the point where $\frac{dy}{dx} = 5$. **(06)**

(b) Find maxima, minima and point of inflexion (if any) of the following function:

$$y = 3x^4 - 16x^3 + 24x^2 - 5$$ **(06)**

Q.4 (a) A departmental store has three outlets. During a certain week, it sold 1 unit of product x, 6 units of product y and 1 unit of product z at the first outlet; 5 units of product x, 6 units of product y and 4 units of product z at the second outlet; and 3 units of product x, 1 unit of product y and 8 units of product z at the third outlet. Total profit generated by each outlet from these three products was Rs. 2,500, Rs. 5,200 and Rs. 2,900 respectively.

Calculate the profit per unit of product x, y and z using Cramer's Rule. **(08)**

(b) A company manufactures two types of stereo systems M and N. Each unit of system M requires 3 worker-hours for process A and 2 worker-hours for process B while each unit of system N requires 4 worker-hours for process A and 6 worker-hours for process B.

Available skilled labour allows for a maximum of 480 worker-hours per week for process A and 540 worker-hours per week for process B.

How many units of each type of stereo systems may be produced to maximise the profit, if the profit on each unit of M and N is Rs. 2,000 and Rs. 5,000 respectively? **(08)**

Q.5 (a) The following data depicts ages (in years) of persons applying for new membership in a club:

18	15	47	23	23	26	41	19	26	37	28	29	46	49	23	32
43	34	18	24	29	39	21	35	28	34	22	20	44	27	36	30

(i) On the basis of the above data prepare:
- group frequency distribution and cumulative frequency distribution using seven class intervals. **(04)**
- cumulative frequency polygon. **(03)**

(ii) Calculate the median and mode for the above frequency distribution. **(04)**

(b) A consignment of 12 refurbished laptops contains 3 defective units. If 4 laptops are randomly chosen for inspection, what is the probability that at least 2 of them will be defective? **(03)**

Q.6 Below is the list of averages of batsmen (rounded to whole number) in ODI and Test matches.

Batsman	A	B	C	D	E	F	G	H	I	J
ODI Average	33	42	31	46	36	35	24	39	40	45
Test Average	44	50	38	42	31	44	31	35	41	49

(a) Draw a Scatter diagram for the above data. **(02)**
(b) Find the coefficient of correlation for averages in ODI and Test matches and interpret your result. **(06)**
(c) Calculate the probable error of co-efficient of correlation and interpret your result. **(03)**

Q.7 (a) Research shows that an outbreak of new virus is causing fatalities in 3 out of every 10 patients affected by the virus. If 12 patients are admitted in a hospital affected with the virus, calculate the probability that:

(i) All patients will survive.
(ii) At least ten patients will survive.
(iii) At most ten patients will survive. **(08)**

(b) The life of a light bulb is normally distributed with standard deviation of 100 hours. The probability that the life of a bulb selected at random would exceed 3,200 hours is 0.0228.

What is the probability that the life of a light bulb selected at random would **not** be less than 2,800 hours? **(06)**

Q.8 (a) A company has purchased a new machinery. The machine was tested for 40 days and its mean production was found to be 985 units per day with standard deviation of 30 units.

(i) Construct a 95% confidence interval for the mean production of the population.
(ii) Determine the size of the sample which would be needed in order to assert with 99% confidence that the error in the determination of production capacity does not exceed 10 units. **(06)**

(b) A university has two campuses. Two batches of 60 students from each campus were surveyed. Batch A had 15 counts of 85% marks or above, whereas Batch B had 10 counts of 85% or above.

(i) Construct a point estimate for difference between the counts of Batch A and B. **(02)**
(ii) Calculate the standard deviation of the difference of the above population proportion. **(03)**

(THE END)