



## Quantitative Methods

Foundation Examinations  
Autumn 2012  
Module A

4 September 2012  
100 marks – 3 hours  
Additional reading time – 15 minutes

- Q.1 (a) Sadiq has recently been appointed as an accountant in XYZ Ltd. He intends to set aside an amount of Rs. 10,000 from his salary received in the first month which would be increased by Rs. 500 in each of the subsequent months.

You are required to determine the number of months it would take for his aggregate savings to exceed Rs. 500,000. *(08 marks)*

- (b) ABC Model School earned a net income of Rs. 2 million per annum during 2011 whereas the cost incurred on each student was 60% of the fee charged by the school. Compute the net profit for the year 2015 if it is projected that the number of students would increase by 5% per annum whereas the fee charged and the cost incurred per student would increase each year by 10% and 6% respectively. *(06 marks)*

- Q.2 (a) An amount of Rs. 20,000 is due in three months. What is the present value if it includes simple interest @ 8%? *(02 marks)*

- (b) Amin deposited Rs. 25,000 every six months in a fund earning interest at 6% compounded semi annually. The first deposit was made when he was 48 years of age and the last deposit was made when he was 55 and at that time the entire amount was invested in another fund which yielded 8% per annum. How much amount will he have in the fund, when he retires at the age of 60 years? *(06 marks)*

- (c) The population of a country increases at the rate of 3% per annum. How many years will it take to double itself? *(04 marks)*

- Q.3 (a) The cost and price functions for  $x$  units of a product per month are:

$$C(x) = \frac{1}{9}x^2 + 6x + 200 \quad \text{and}$$

$$P(x) = \frac{1}{2}(850 - x)$$

You are required to calculate:

- (i) The number of units that should be produced per month to maximize the profit.  
(ii) Price per unit.  
(iii) Maximum profit per month. *(07 marks)*

- (b) If  $y = xe^y$ , then show that:

$$\frac{dy}{dx} = \frac{y}{x(1-y)}$$

*(05 marks)*

- Q.4 (a) Solve the following set of equations using Cramer's Rule:

$$x + y - z = 4$$

$$2x + z = 7$$

$$3x - 2y = 5$$

*(08 marks)*

- (b) Plot the following inequalities on graph and identify the feasible region:  
 $x, y \geq 1$ ;  $x, y \leq 4$  and  $x \geq y$  (04 marks)

- Q.5 (a) A sample survey conducted by an organization obtained the following data on the average number of times that persons in the various age groups visit a physician each year:

Age group (years)	Number of persons in the sample	Mean number of visits
Less than 5	50	2.1
5 — 20	115	1.6
21 — 60	155	2.6
61 and over	90	3.5

Calculate the mean number of visits to the physician. (03 marks)

- (b) Draw a box plot for the following data:  
 83, 63, 65, 70, 57, 66, 86, 75, 72, 64, 70, 60, 67, 78, 62

Explain whether the data is positively skewed or negatively skewed. (07 marks)

- Q.6 The following table presents the mean height of children by their age:

Age in months (x)	18	19	20	21	22	23	24	25	26	27	28	29
Height in inches (y)	30.0	30.3	30.7	30.8	31.0	31.4	31.5	31.9	32.0	32.2	32.6	32.9

- (a) Establish the least square regression line of y on x. (06 marks)  
 (b) Compute the co-efficient of correlation and co-efficient of determination and interpret your result. (05 marks)  
 (c) Explain whether it would be appropriate to predict the mean height of a person of 20 years of age by using regression line obtained in (a) above. (02 marks)

- Q.7 (a) A company owns two machines. Machine A produces red toys whereas machine B produces blue toys. Defective units produced by machine A and B average 25% and 30% respectively and their daily production is 20 and 30 units respectively.

If the daily production is mixed and three toys are selected at random, without replacement, find the probability that the first toy is a defective unit, the second toy is not defective whereas the third toy is defective and of blue colour. (05 marks)

- (b) The average number of traffic accidents on a certain section of highway is two per week. Assuming that the number of accidents follows a Poisson Distribution, find the probability of at most 3 accidents on this section of highway during a two week period. (05 marks)

- Q.8 (a) A television channel has claimed that on average a teenager spends 7 hours each month on viewing its entertainment programs.

An advertising agency wants to carry out a survey to assess the reasonableness of the above claim. Determine the size of the sample which would be needed in order to assert with 99% confidence that the error in the above claim does not exceed 30 minutes. Assume that  $\sigma = 3.2$  hours. (03 marks)

- (b) A researcher wants to test on the basis of a random sample of size  $n = 7$ , whether the fat contents of a certain kind of processed food does not exceed 30%. What would he conclude at the 0.01 level of significance, if the sample values (in percentages) are 31.5, 30.3, 31.1, 30.7, 29.9, 29.6 and 31.8. **(09 marks)**

Q.9 The maximum speed limit on a busy road is 60 km/h. Congestion results in much slower actual speeds. A random sample of 57 vehicles gave an average speed of 23.2 km/h with a standard deviation of 0.3 km/h.

- (a) Determine the point estimate of the standard deviation of the population.  
(b) Estimate the standard error of the mean.  
(c) What are the upper and lower limits of the confidence interval for the mean speed, given a confidence level of 95%? **(05 marks)**

**(THE END)**