

**QUANTITATIVE METHODS**

General:

The overall performance of the candidates was quite satisfactory. As compared to Statistics portion, candidates performed better in mathematics portion. However, it was evident that whereas most of them were well versed in the various procedures and calculations, conceptual understanding was lacking quite often. Wherever they were asked to interpret the result, the response was not very encouraging. This aspect of the subject must be emphasized in their teaching. Candidates are also advised that in questions where calculation in decimals is involved, they should take at least two and where the figure is very small, three and four significant digits in their calculations.

Question-wise comments are as under:

Q.1 This was an easy question and most of the candidates scored reasonably well. There were four parts to this question and each of them has been discussed below:

- (a) In this part, candidates generally scored well but a large number of them also made some very basic mistakes. For example, many considered  $\sqrt[3]{2}$  as square root of 2 or as cube root of  $\sqrt{2}$  instead of simply taking the cube root of 2. A few candidates took antilog of the variable x after finding its value. Another common mistake was of not taking (2x-2) in brackets on the left hand side of the equation. As a result, they multiplied log 3 by 2 instead of multiplying it with (2x-2).
- (b) In this part an expression was to be factorized by adding and subtracting the component which turned the given expression into a whole square. The resultant expression takes the form of difference of square formula i.e.  $a^2 - b^2$ . Many candidates found it difficult to solve. A common mistake was that the candidates added  $36x^2y^2$  without subtracting it from the given expression.
- (c) This proved to be a difficult question. Many candidates didn't attempt this part and many left it in the middle. A large number of candidates were unable to simplify the equation up to the value of variable x. Instead of simplifying the equation by canceling common items on each side, majority of the candidates attempted to solve it by removing the brackets which lead to a complicated expression in the end. This part could have been solved easily if in the first step, x was cancelled out both in the numerator and denominator of the right hand side of the equation. This simple step could have made the given equation quite simple but unfortunately a large number of candidates did not take this step and as a result the equation became complicated and they were lost in details.

(d) About half the candidates were able to solve this part and showed good understanding of arithmetic progression. Those who were unable to solve it till the end, committed the following mistakes:

- The last term i.e. '36' was substituted in place of 'n' and the value of 'n' i.e. '12' was taken as '1' i.e. the last term.
- Incorrect formulas were used.

Q.2 (a) This question had to be solved in two steps. Initially the compounded amount payable at the time of maturity was to be determined. Thereafter the monthly installment to be paid in the sinking fund was to be found. Majority of the candidates did it correctly and secured full marks. However, a number of mistakes were also witnessed in many answers, which have been narrated below:

- Some candidates missed the first part entirely and determined the amount of monthly installment by taking the amount of Rs. 500 million as the amount to be paid.
- Some candidates used the formula for determining the present value of the annuities instead of its future value.
- Some candidates did not divide interest rate by 12, hence used interest rate at 9% per month, instead of 0.75%.
- Some candidates did not convert 2.5 years into 30 months and took 'n' as equal to 2.5.
- A few candidates tried to write Rs.500 million in full and put incorrect number of zeros.
- Few candidates reached the right answer but did not express it in correct units.

(b) This question dealt with the effective and nominal interest rates. Majority of the candidates successfully solved it, except those who did not know the formula for determining effective rate of interest.

Q.3 (a) Most of the candidates who attempted this question were able to secure good marks in this part but only a few of them secured full marks. It was so because almost all candidates who applied the chain rule stopped at  $dy/dz=12x - 18$ . Very few candidates substituted the value of 'x' in terms of 'z' to get the value of  $dy/dz$  in terms of 'z'. Some of the candidates ignored instructions and did not solve the question by chain rule and lost all the marks.

(b) This part comprised of three sub-parts.

- (i) Majority of the candidates correctly obtained the marginal cost function. However, some of them calculated the derivative incorrectly e.g.  $1000/x$ ;  $+1000/x^2$ ; or  $-1000/x^{1/2}$  etc.

- (ii) A large number of candidates were able to compute the total cost of producing 10 units of calculators correctly. However, some candidates incorrectly used the marginal cost function instead of total cost function, to determine the cost and could not gain any mark.
- (iii) The exact cost of producing 100<sup>th</sup> unit can be computed by finding the difference between the total cost of producing 100 units and the total cost of producing 99 units, through total cost function. Similar result will also be obtained if  $x = 99.5$  is applied in the marginal cost function. The cost of 100<sup>th</sup> unit can also be approximated by substituting  $x = 99$  or  $x = 100$  in the marginal cost function. Both these methods have been given in the books and were treated as correct. However, some candidates calculated the total cost of 100 units instead of the cost of 100<sup>th</sup> unit and could not secure any marks.
- (c) In this part, a linear equation was to be established, given the data of two points on the line in the form of quantity and price. Very few candidates understood the question and majority of them could not even identify as to which variable is independent and which one is dependent. The equation could easily have been derived by using the formula for slope.

Q.4 In this question most of the candidates performed well and used various methods of matrices to solve the given equations. The simplest method is the use of Cramer's rule and majority of them successfully applied this rule. Others used inverse matrix method or Gauss Jordan method. Although some candidates did loose few marks in the computations but majority had the concepts of matrices, therefore this was a high scoring question. Some of the common mistakes were of the following types:

- incorrect calculation of determinant and matrix of co-factors;
- inability to determine the adjoint matrix correctly; and
- taking the matrix of co-factors as the adjoint matrix rather than taking its transpose.

Q.5 (a) In this part of the question, objective function and constraints inequalities were to be established. Majority of the candidates successfully constructed these, but very few mentioned the inequalities of  $x \geq 0$  and  $y \geq 0$ . Some candidates did make the inequalities with correct coefficients but with incorrect signs and vice versa.

(b) In this part most of the candidates plotted the lines properly and correctly identified the corner points. However, some candidates did not shade the feasible region properly and some candidates extended the plotted lines in 2<sup>nd</sup> and 4<sup>th</sup> quadrants and thus violated the inequalities.

- (c) Candidates scored well in this part but in some cases, non-clarity of concepts was visible as candidates were not able to correctly differentiate between units within and outside the feasible region.

Q.6 (a) In this question the candidates were supposed to draw a histogram from the given data. Most of the candidates were successfully able to do so. Some of the errors made by the candidates were as follows:

- The diagram was not labeled at all or was not labeled completely;
- Class boundaries were not properly identified; and
- There were gaps between the bars.

(b) In this part, a stem and leaf diagram was to be drawn. However, it appeared that most of the candidates did not even have the concept of stem and leaf diagram and were unable to attempt this question. Those who did attempt, generally got it right, except that some of them did not arrange the values in ascending order.

(c) Overall scoring was very low in this part. Very few candidates were able to grasp the real requirement of the question and thus majority of them failed to find the change in real wages. It appears that most of the candidates did not have clear concept of consumer price index (CPI) due to which they did not even calculate the % change in CPI. Some of them calculated the change in CPI but did not complete the question. Very few candidates were able to get full marks.

Q.7 (a) Most of the candidates were able to draw the scattered diagram correctly and got full marks.

(b) The candidates were generally able to correctly calculate coefficient of correlation 'r' except those who applied incorrect formula or made computational errors. Some candidates showed two values of 'r' i.e. a positive as well as a negative one. Such candidates must understand that while calculating the square root of the denominator in the formula, only the positive root should be considered. Otherwise two values of 'r' would emerge which is never possible practically.

(c) Candidates were required to calculate the co-efficient of determination in this part. Majority of them calculated it correctly. However, some candidates ignored the easy way of calculating square of 'r' and instead applied the full formula i.e. that of ' $r^2$ '. As a result, they wasted a lot of their precious time.

(d) In this part, the result of the first three parts was required to be interpreted. Interpretation requires complete understanding of the concepts, which seemed to be lacking. Most of the answers were partly correct but completely correct interpretations were rare. The response by the students is discussed hereunder:

- In case of scatter diagram most of the candidates correctly interpreted that the relationship was negative, however, majority of them failed to infer that the relationship was 'linear' as well.
- In respect of part (b) some of the candidates did not specify that 'r' is highly negative, though they did mention that it is negative.
- In respect of part (c) a number of candidates successfully interpreted that the value of co-efficient of determination shows that the correlation is very high and signifies that 93.6% variation in 'y' is due to variation in 'x' and vice versa while the remaining 6.4% variation is due to other factors or variables.

- Q.8 (a) In this part candidates were generally unable to comprehend that in the given scenario there could be two situations which may be termed as successful events i.e. either machine U breaks down and machine V continues to work properly through out the year or vice versa. They were supposed to find the probability of each of the two events by using the multiplicative law for independent events. The two probabilities should then have been added to arrive at the required answer.
- (b) Very few of the candidates were able to comprehend that 40% of the students took statistics without mathematics and 12% of the students took statistics with mathematics, therefore, 52% (40% + 12%) of the students took statistics either with or without mathematics.

Therefore, the probability of selecting a student who had also taken mathematics, from the statistics class was simply  $\frac{12}{52}$  or 0.231.

- Q.9 (a) (i) Most of the candidates who knew the formula performed well. The mistakes were mostly computational. However, some instances of lack of conceptual understanding were also visible as some candidates were not able to differentiate between probability of 'eight or more than eight' and 'eight or less than eight'.
- (ii) With the exception of some of the very weak students, the candidates performed exceptionally well in this part.
- (iii) This part also had good results. The most common mistake was the use of incorrect formula for standard deviation as some candidates did not put square root ( $\sqrt{\quad}$ ) in the formula and lost marks.

- (b) This was a question related to normal distribution curve ( $Z$ ). This was an easy question but success rate was low. Some candidates failed to use the normal distribution table correctly. Majority failed to identify the point, the area below which is 33% of the total area under the normal curve. This point lies on the left half side of the curve and thus  $Z$  value was negative. This point was missed by majority of the candidates.

- Q.10 (a) The most common mistake was that candidates used the formula

$$z = \frac{x - \mu}{\sigma}$$

instead of using  $z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$  as it was a case of sampling distribution of mean.

Candidates are advised to focus on learning the basic principles and concepts, to understand the difference between similar looking situations.

- (b) In this part, the result was satisfactory and many candidates were able to achieve good marks. However, some of the common mistakes were as under:
- z-distribution was used instead of t-distribution. The candidates must know that when the sample size is small (less than 30) and standard distribution of the population is not provided, t-distribution has to be used.
  - A one tailed test was used instead of a two tailed test. Consequently, the alternate hypothesis was also incorrectly stated.
  - Some of the candidates were unable to read the t-table correctly and got incorrect values.
  - In some cases, the candidates got totally confused and ended up determining the confidence interval.

**(THE END)**