



Quantitative Techniques

Assessment of Fundamental Competencies
Model Paper

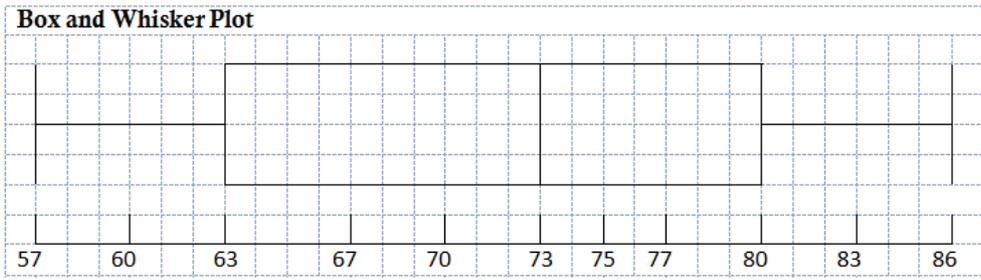
100 marks – 3 hours

Instructions to Candidates:

- (i) Select the most appropriate answer from the options available for each question.
- (ii) There will be no negative marking for incorrect replies.
- (iii) Use of calculator is allowed.

1. Identify the equation whose graph would be a straight line.
(a) $x^2 + y^2 = 16$ (b) $x^2 + 3y = 12$
(c) $4x + y^2 = 24$ (d) $4x + 3y = 18$ (01)
2. The concept of _____ is based on the common-sense notion that a rupee paid to you in the future is less valuable to you than a rupee paid today.
(a) present value (b) annuity (c) interest (d) purchasing power (01)
3. Which of the following are the factors of $8x^3 + 27y^3$?
(a) $(2x + 3y)(4x^2 - 9y^2 - 6xy)$ (b) $(2x + 3y)(4x^2 + 9y^2 - 6xy)$
(c) $(2x + 3y)(4x^2 - 9y^2 + 6xy)$ (d) $(2x + 3y)(4x^2 + 9y^2 + 6xy)$ (01)
4. Adeel saved x amount in January. Each month he saved Rs. 100 more than the previous month. If his total savings at the end of December stood at Rs. 16,200 how much did he save in January.
(a) 700 (b) 800 (c) 900 (d) 1,000 (01)
5. Which of the following is the equation of the straight line whose y-intercept and slope are -3 and -4 respectively?
(a) $-3x + y = -4$ (b) $x - 4y = -3$
(c) $-4x + y = -3$ (d) $4x + y = -3$ (01)
6. If X is the number of managers and Y is the number of non-managerial staff, which of the following inequalities expresses the constraint that the number of managers must be no more than 25% of the total number of staff?
(a) $4X \leq Y$ (b) $X \leq 4Y$ (c) $3X \leq Y$ (d) $X/4 \leq X + Y$ (01)
7. If cost of 4 chairs and 6 tables is Rs. 20,000:
(a) Cost of 5 chairs and 7 tables would be Rs. 19,000
(b) Cost of 3 chairs and 5 tables would be Rs. 21,000
(c) Cost of 2 chairs and 3 tables would be Rs. 10,000
(d) None of the above (01)
8. Sarah deposited Rs. 45,000 for 3 years. At the end of the term, she received interest of Rs. 7,500. The simple interest rate per annum was:
(a) 16.67% (b) 5.56% (c) 8.33% (d) 0.55% (01)
9. An investment of Rs. 10,000 at the rate of 4% per annum compounded quarterly will mature at the end of 5th year to:
(a) Rs. 12,911 (b) Rs. 12,202 (c) Rs. 12,167 (d) Rs. 12,000 (01)

10. An amount of Rs. 5,000 was invested at compound interest of 5% per annum. The amount would be doubled in approximately:
 (a) 20 years (b) 17 years
 (c) 14 years (d) Cannot be computed (01)
11. An interest rate of 12% per annum compounding monthly is equivalent to an effective interest rate of:
 (a) 11.32% per annum (b) 12.39% per annum
 (c) 12.68% per annum (d) 11.57% per annum (01)
12. What is the present value of a perpetuity of Rs. 1,500 per annum, for an investor whose expected rate of return is 12 percent per annum?
 (a) Rs. 18,000 (b) Rs. 13,500 (c) Rs. 11,400 (d) Rs. 12,500 (01)
13. For Rs. 1,000 you can purchase a 5-year ordinary annuity which will pay you an yearly amount of Rs. 263.80 for 5 years. What is the annual interest rate on this investment to the nearest whole percentage point?
 (a) 8 percent (b) 9 percent (c) 10 percent (d) 11 percent (01)
14. You are considering borrowing Rs. 100,000 for 5 years at compound interest of 9 percent per annum. The loan agreement calls for 5 equal annual payments, to be paid at the end of each year. (Payments include both principal and interest.) Determine the amount of annual payment.
 (a) Rs. 36,000.00 (b) Rs. 30,866.87 (c) Rs. 25,709.25 (d) Rs. 24,333.33 (01)
15. What is the cumulative discount factor related to annual cash flows of Rs. 60,000 in year 1, 2 and 4 assuming that the discount rate is 10% and all cash flows accrue at the end of the year?
 (a) 2.4869 (b) 2.4186 (c) 2.7355 (d) 2.2608 (01)
16. The function $f(x) = -6x^2 + 9x + 25$ has:
 (a) a maxima at $x = 1$ and a minima at $x = 3/4$
 (b) a maxima at $x = 3$ and a minima at $x = 1$
 (c) no minima but a maxima at $x = 3/4$
 (d) a maxima at $x = 1$ but no minima (01)
17. Find $f''(x)$ for $f(x) = -4x^6 + 5x^2$
 (a) $24x^5 - 10$ (b) $-24x^5 + 10x$ (c) $-120x^4 + 10$ (d) $120x^4 - 10$ (01)
18. Which of the following is the derivative of $\frac{x+1}{x-1}$?
 (a) $\frac{-2}{(x-1)(x+1)}$ (b) $\frac{2}{x^2-1}$
 (c) $\frac{2}{(x-1)^2}$ (d) $\frac{-2}{(x-1)^2}$ (01)
19. Which of the following statement is correct?
 (a) A bend in a curve where the curve changes from concave upwards to concave downwards or vice versa is the point of inflexion
 (b) The value of the second derivative must be zero at point of inflexion
 (c) Point of inflexion does not have to be a turning point
 (d) All of the above (01)
20. The first order derivative of x^3e^{10x} is:
 (a) $(3 + 10x)x^2e^{10x}$ (b) $(3x^2 + 10)x^2e^{10x}$
 (c) $(3 + 10x)x^2e^{10}$ (d) $(3 + 10x)xe^{10x}$ (01)

21. Which of the following statements about Matrices is correct?
 (a) A matrix can consist of any number of rows and columns
 (b) The values of a matrix are normally enclosed within brackets
 (c) The value at the intersection of a row and column is referred to as data item
 (d) All of the above (01)
22. If the dimension of a matrix A is 3 x 4 and the dimension of another matrix B is 4 x 1, then the dimension of BA is:
 (a) 3 x 4 (b) 1 x 3 (c) 4 x 3 (d) does not exist (01)
23. If $A = \begin{pmatrix} -5 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \end{pmatrix}$, then $2A + 3B$ is equal to:
 (a) $\begin{pmatrix} -10 & 4 \end{pmatrix}$ (b) $\begin{pmatrix} -10 & 0 \end{pmatrix}$ (c) $\begin{pmatrix} -20 & 0 \end{pmatrix}$ (d) $\begin{pmatrix} -7 & 4 \end{pmatrix}$ (01)
24. The determinant of $\begin{pmatrix} 1 & 5 & 4 \\ -2 & 3 & -1 \\ 2 & -1 & 5 \end{pmatrix}$ is:
 (a) 58 (b) 38 (c) 22 (d) -62 (01)
25. Which of the following statements about non-singular matrices is correct?
 (a) $\det A^{-1} = \det A$ (b) $\det A^{-1} = \frac{1}{\det A}$
 (c) $\begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix} = \begin{pmatrix} a & d & g \\ b & e & h \\ c & f & i \end{pmatrix}$ (d) $\begin{pmatrix} 2 & 4 & 6 \\ 8 & 10 & 12 \\ 14 & 16 & 18 \end{pmatrix} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \begin{pmatrix} 2 \\ 2 \\ 2 \end{pmatrix}$ (01)
26. 
 In the above Box and Whisker Plot:
 (a) Value of Whisker is 73.
 (b) Whisker is the area of the box.
 (c) Whisker is the parameter of the box.
 (d) Whiskers are the lines drawn from each end of the box to the maximum and minimum lines. (01)
27. The semi inter-quartile range of the following data set is:
 14, 23, 9, 12, 21, 18, 8
 (a) 8 to 23 (b) 12 (c) 9 (d) 6 (01)
28. What is the variance of the following data set?
 23, 17, 14, 62, 19
 (a) 314.8 (b) 31.48 (c) 39.67 (d) 17.74 (01)
29. A national achievement test is administered annually to 3rd graders. The test has a mean score of 100 and a standard deviation of 15. If Jane's z-score is 1.20, what was her score on the test?
 (a) 82 (b) 88 (c) 112 (d) 118 (01)
30. The co-efficient of variation of 3 numbers i.e. x, x+4 and x+11 is y. The value of y would:
 (a) increase with the increase in the value of x
 (b) decrease with the increase in the value of x
 (c) remain the same irrespective of the value of x
 (d) any of the above is possible (01)

31. Which of the following is the graphical presentation of a frequency distribution?
 (a) Pie Chart (b) Frequency polygon
 (c) Histogram (d) Both (b) and (c) (01)
32. Determine the quartile deviation on the basis of following information:
 $Q_1 = 8.5, Q_2 = 13, Q_3 = 16$
 (a) 12.25 (b) 2.25 (c) 1.50 (d) 3.75 (01)
33. Data extracted from a sales report regarding daily sales achieved by two sales representative Ali and Salman, is as follows:
 Ali : mean = 6250 and standard deviation = 250
 Salman : mean = 7500 and standard deviation = 375
 Which sales representative is more consistent?
 (a) Ali, because he has a smaller coefficient of variation
 (b) Ali, because he has a higher coefficient of variation
 (c) Salman, because he has a higher coefficient of variation
 (d) Salman, because he has a lesser coefficient of variation (01)
34. Fisher's price index can also be determined by computing:
 (a) arithmetic mean of Laspeyre and Paasche price indices
 (b) geometric mean of Laspeyre and Paasche price indices
 (c) harmonic mean of Laspeyre and Paasche price indices
 (d) weighted average of Laspeyre and Paasche price indices (01)
35. An ogive is:
 (a) a chart showing a linear relationship
 (b) a chart showing a non-linear relationship
 (c) a graph of cumulative frequency distribution
 (d) a graph of frequency distribution (01)
36. Which of the following is a possible value for correlation coefficient?
 (a) -1.5 (b) 0 (c) +1.5 (d) none of the above (01)
37. Two persons A and B tasted 4 different brands of coffee and ranked them in order of preference as follows:

Brand	Ranks given by		A - B	$(A - B)^2$
	A	B		
B-1	4	3	1	1
B-2	2	1	1	1
B-3	1	2	-1	1
B-4	3	4	-1	1
	10	10	0	4

Spearman's Coefficient of Rank Correlation in the above case is:

- (a) 0.40 (b) 0.60 (c) 0.93 (d) -0.40 (01)
38. Which of the following statements about Spearman's Coefficient of Rank Correlation is **NOT** correct:
 (a) It can co-relate two or more set of rankings
 (b) It applies only when no ties exist
 (c) Both (a) and (b)
 (d) None of the above (01)
39. In a T20 cricket match between Falcon Club (FC) and Eagle Club (EC), the probability of a win by (FC) is 0.4. In a series of five T20 matches, the probability that FC would win exactly two matches is:
 (a) 65.44% (b) 34.56% (c) 66.30% (d) 33.70% (01)

40. A regression equation $Y = a + bX$ is used to forecast the value of Y for a given value of X . Which of the following increase the reliability of the forecast?
- A correlation coefficient numerically close to 1
 - Use of a large sample to calculate the regression equation
 - Forecasting for values of X outside the range of those used in the sample
 - Both (a) and (b) will increase the reliability of the forecast
- (01)**
41. A national consumer magazine reported the following correlations:
- Correlation between car weight and car reliability is -0.40.
 - Correlation between car weight and annual maintenance cost is 0.7.
- Which of the following statement are true?
- Heavier cars tend to be less reliable.
 - Heavier cars tend to cost more to maintain.
 - Car weight is related more strongly to reliability than to maintenance cost.
 - Both (a) and (b) are true.
- (01)**
42. If a coin is tossed five times, the probability of:
- five heads is equal to the probability of five tails
 - five heads is equal to the probability of zero tail
 - five heads is equal to the probability of zero head
 - all of the above
- (01)**
43. The average number of traffic accidents on a certain section of highway is two per week. Assuming that the number of accidents follow a Poisson Distribution, find the probability of 3 accidents on this section of highway during a two week period.
- 19.5%
 - 80.5%
 - 43.2%
 - 56.8%
- (01)**
44. The probability of an event is 0.01. Which of the following statements is correct?
- The event is unlikely to occur
 - We would expect the event to occur about 10 percent of the time
 - The event cannot occur
 - None of the above
- (01)**
45. A firm installed two machines U and V on 1 August 2013. The probability that the machines will break down during the first year of operations is 0.2 and 0.1 respectively. The probability that any one of the two machines will break down during first year is :
- 0.02
 - 0.26
 - 0.28
 - cannot be computed
- (01)**
46. What is the standard error of the mean if the sample size, sample mean and sample standard deviation are 7, 8 and 4.2 respectively?
- 2.65
 - 5.80
 - 2.05
 - 1.59
- (01)**
47. If the sample mean of a data set is 15 and the sample standard deviation is 9, what percent of the data would you expect to fall between 6 and 24, assuming that the data distribution is fairly symmetric?
- 68.3%
 - 81.5%
 - 95.0%
 - 99.7%
- (01)**
48. In a normally distributed population, at 95% confidence level:
- 1 out of 20 samples would have a mean falling outside 1.96 standard deviations from the population mean in a two-tailed test.
 - 1 out of 20 samples would have a mean above 1.65 standard deviations from the population mean in a one-tailed test.
 - 1 out of 20 samples would have a mean below 1.65 standard deviations from the population mean in a one-tailed test.
 - All of the above.
- (01)**

49. If a null hypothesis is rejected whereas the right decision was to accept the null hypothesis, it is:
- (a) a Type I error (b) a Type II error
(c) a Type III error (d) either a Type I or II error (01)
50. Which of the following would be a reason to use a t-test instead of a z-test?
- (a) The standard deviation of the population is unknown.
(b) The null hypothesis involves a continuous variable.
(c) The sample size is large (greater than 40).
(d) Both (a) and (c) (01)
51. If $\log xy = 0.9$ and $\log x/y = 0.5$, then $\log x^2\sqrt{y}$ will be
- (a) 0.14 (b) 1.4 (c) 1.5 (d) 0.45 (02)
52. Shiraz borrowed Rs. 120,000 for eight months at 15% simple interest. The annual rate of interest, compounded monthly, which would result in the payment of the same amount of interest, will be:
- (a) 11.20 (b) 12.26 (c) 13.20 (d) 14.38 (02)
53. A manufacturer produces two products P and Q which must pass through the same processes in the departments A and B having weekly production capacities of 240 hours and 100 hours respectively. Product P needs 4 hours in department A and 2 hours in department B. Product Q requires 3 hours in department A and 1 hour in department B. Profit per unit of product P and Q are Rs. 700 and Rs. 500 respectively.
- The manufacturer wants to maximize the profit within the given sets of limitations. The objective function and all the constraints for the above problem are:
- (a) $Z = 100p + 240q$
 $4p + 3q \leq 700$
 $2p + q \leq 500$
 $p \geq 0$ and $q \geq 0$
- (b) $Z = 700p + 500q$
 $4p + 3q \leq 240$
 $2p + q \leq 100$
 $p \geq 0$ and $q \geq 0$
- (c) $Z = 700p + 500q$
 $4p + 2q \leq 240$
 $3p + q \leq 100$
 $p \geq 0$ and $q \geq 0$
- (d) $Z = 500p + 700q$
 $4p + 3q \leq 100$
 $2p + q \leq 240$
 $p \geq 0$ and $q \geq 0$ (02)
54. Find the point(s) of inflexion for $f(x) = x^5 - 15x^3$
- (a) +3 (b) 0
(c) -3 (d) No point of inflexion (02)
55. The inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 0 \end{pmatrix}$ is:
- (a) $A^{-1} = \begin{pmatrix} 0 & -3 \\ -2 & 1 \end{pmatrix}$ (b) $A^{-1} = \begin{pmatrix} -1/6 & -1/2 \\ -1/3 & 0 \end{pmatrix}$
(c) $A^{-1} = \begin{pmatrix} -1 & -3 \\ -2 & 0 \end{pmatrix}$ (d) $A^{-1} = \begin{pmatrix} 0 & 1/2 \\ 1/3 & -1/6 \end{pmatrix}$ (02)
56. Complete the following table by inserting values representing a chain index:

Year	2010	2011	2012	2013
Value	50	60	69	76
Chain Index		?	?	?

- (a) 120,138 and 152 respectively (b) 120,115 and 110 respectively
(c) 120, 115 and 127 respectively (d) 100,115 and 110 respectively (02)

57. What will be the 95% confidence interval for the proportion of defective units in a large shipment when 200 units were found defective in a random sample of 1000 units?
- (a) $0.1994 \leq \mu \leq 0.2006$ (b) $0.1997 \leq \mu \leq 0.2003$
 (c) $0.1792 \leq \mu \leq 0.2208$ (d) $0.1752 \leq \mu \leq 0.2248$ (02)

58. Consider the following stem-and-leaf display:

3	8
4	-
5	6
6	0 1 3 3 5 5 9
7	0 2 4 6 7 7 8
8	5 9
9	0 0 1 5 6
10	3 6

Which of the following statement is correct?

- (a) The lower quartile, upper quartile and median are 38, 106 and 76 while a total of 25 observations have been made.
 (b) The lower quartile, upper quartile and median are 64, 90 and 76 while a total of 25 observations have been made.
 (c) The lower quartile, upper quartile and median are 64, 90 and 75 while a total of 26 observations have been made.
 (d) The lower quartile, upper quartile and median are 38, 106 and 75 while a total of 26 observations have been made. (02)
59. A box contains 10 items, 3 of which are defective. If 4 are selected at random, without replacement, find the probability that at least 2 are defective.
 (a) 70% (b) 66.67% (c) 30% (d) 33.33% (02)
60. What will be the correlation coefficient if $\sum x = 12$, $\sum y = 42$, $\sum x^2 = 46$, $\sum y^2 = 542$, $\sum xy = 157$ and $n = 4$?
 (a) -0.98 (b) 0.26 (c) 0.98 (d) 0.008 (02)
61. A manufacturer produced 1200 units of a product in the first week. He wishes to plan his production and is considering the following options.
 Option 1: Increase production by 80 units each week.
 Option 2: Increase production by 5% each week
- Total production of first 20 weeks will be:
 (a) 2,720 units using option 1 (b) 3,032 units using option 1
 (c) 39,200 units using option 2 (d) 39,679 units using option 2 (03)
62. In a linear programming problem, the constraints are as follows:
 $x \geq 0$
 $y \geq 150$
 $x + y \leq 450$
 $4x + y \leq 600$
- What is the maximum possible value of the objective function, $x + 3y$, given these constraints?
 (a) 1250 (b) 1350 (c) 562.5 (d) 1800 (03)
63. Imran deposited Rs. 3,000 per month (at the start of the month) into a saving account for 10 months. If the bank offers 6% interest compounded monthly, the total amount Imran would have saved at the end of three years would be:
 (a) Rs. 30,838 (b) Rs. 34,759
 (c) Rs. 35,107 (d) Rs. 34,586 (03)

64. The cost of manufacturing x units of a product consists of the following:
 Labour Rs. $0.03x^2$; Material Rs. $220x$; Overheads Rs. $50,000$

The demand function of the same product is $D(x) = 500 - 0.04x$.

The revenue function, marginal revenue function and profit function would be:

- (a) Marginal Revenue Function = $500x - 0.04x^2$
 Revenue Function = $500 - 0.08x$
 Profit function = $(500x - 0.08x) - (0.03x^2 + 220x + 50,000)$
- (b) Marginal Revenue Function = $500x - 0.04x^2$
 Revenue Function = $500 - 0.8x$
 Profit function = $(500 - 0.08x) - (0.03x^2 + 220x - 50,000)$
- (c) Marginal Revenue Function = $500 - 0.08x$
 Revenue Function = $500x - 0.04x^2$
 Profit function = $(500x - 0.04x^2) - (0.03x^2 + 220x + 50,000)$
- (d) Marginal Revenue Function = $500x - 0.08x$
 Revenue Function = $500x - 0.04x^2$
 Profit function = $(500 - 0.04x^2) - (0.03x^2 + 220x - 50,000)$ (03)

65. Consider the following set of equations:

(i) $x + y + z = 2$ (ii) $2x + y + 3z = 17$ (iii) $3x + 2y + 4z = -3$

If we represent the above set of equations in matrix form then Adj A will be:

- (a) $\text{Adj A} = \begin{pmatrix} -2 & -2 & 2 \\ -1 & 1 & -1 \\ 1 & 1 & -1 \end{pmatrix}$ (b) $\text{Adj A} = \begin{pmatrix} -2 & -2 & 2 \\ 1 & 1 & -1 \\ 1 & 1 & -1 \end{pmatrix}$
- (c) $\text{Adj A} = \begin{pmatrix} 2 & 2 & 2 \\ -1 & 1 & -1 \\ -1 & 1 & -1 \end{pmatrix}$ (d) $\text{Adj A} = \begin{pmatrix} -2 & 2 & 2 \\ -1 & 1 & 1 \\ 1 & 1 & -1 \end{pmatrix}$ (03)

66. Following data has been gathered from a survey:

Commodity	Price (Rs.)		Quantity (kg)
	2011	2012	2011
Alpha	75	80	270
Beta	45	41	124
Gamma	21	20	130

What is the Paasche's Price Index for the year 2012, if Fisher's Price Index for the year 2012 is 105.7%?

- (a) 102.54% (b) 99.46% (c) 108.96% (d) 114.56% (03)

67. Age distribution of employees in Young Corporation is as follows:

Age in years	22-26	26-30	30-34	34-38	38-42	42-46	46-50
No. of employees	6	10	8	5	7	1	3

The coefficient of variation of age of employees is:

- (a) 68.94% (b) 20.90% (c) 145.06% (d) none of the above (03)

68. A machine produces 10% defective bolts. 400 bolts produced by the machine are randomly selected. What is the probability that defective bolts are between 35 and 40 (both inclusive)?

- (a) 17.88% (b) 53.19% (c) 35.31% (d) 64.69% (03)

69. A company is building a model in order to forecast total costs based on the level of output. The following data is available for last eight months.

Months	Output	Costs (Rs. in 000)
January	16	17
February	20	24
March	23	26
April	25	30
May	25	28
June	19	23
July	16	20
August	12	16
	156	184

Using the above data, calculate the value of 'a' for the equation $Y = a + bX$

- (a) $a = 2.6136$ (b) $a = 1.0455$ (c) $a = -2.6455$ (d) $a = -1.0455$ (03)
70. The maximum speed limit on a busy road is 60 km/h. However, a random sample of 57 vehicles taken during rush hours, gave an average speed of 23.2 km/h with a standard deviation of 0.3 km/h.

The upper and lower limits of the confidence interval for the mean speed, given a confidence level of 95% is:

- (a) 38.320 and -38.240 respectively (b) 45.518 and -45.432 respectively
 (c) 23.655 and 23.135 respectively (d) 23.278 and 23.122 respectively (03)

(THE END)