

Question Paper
Quantitative Methods (CFA530): January 2009

- Answer all 79 questions.
- Marks are indicated against each question.

Total Marks : 100

1. The value of x which satisfies the equation $\frac{x}{4} - \frac{x}{8} = x - 7$ is
- (a) 4
(b) 5
(c) 6
(d) 7
(e) 8.
- (1 mark) [<Answer>](#)
2. Which of the following is **false** regarding real numbers?
- (a) $a < b$ if and only if $(b - a) > 0$
(b) If $a < b$ and $b > c$ then $a < c$
(c) If $a < b$ then $(a + c) < (b + c)$
(d) If $a > b$ then $(-a) < (-b)$
(e) If $0 < a < b$ then $0 < \frac{1}{b} < \frac{1}{a}$.
- (1 mark) [<Answer>](#)
3. Ms. Maya requires returns of 20%. Alfa limited is offering a bond promising to pay 9 annual installments of Rs. 6,000 with the first payment due 1 year from now. How much Ms. Maya is willing to pay for it?
- (a) Rs.24,186
(b) Rs.34,681
(c) Rs.44,816
(d) Rs.54,618
(e) Rs.64,861.
- (1 mark) [<Answer>](#)
4. The demand function is given by $P = 1100 - 8Q$ and the total cost function by $C = 1200 + 70Q$. Let MR = Marginal Revenue and MC = Marginal Cost. For output $Q = 45$, what are the values of MR and MC?
- (a) MR = 340, MC = 70
(b) MR = 350, MC = 70
(c) MR = 360, MC = 50
(d) MR = 370, MC = 70
(e) MR = 380, MC = 70.
- (2marks) [<Answer>](#)
5. What are the roots of the equation $5x^2 - 10x - 15 = 0$?
- (a) 5 and -3
(b) 4 and -2
(c) 3 and -1
(d) 2 and -4
(e) 1 and -5.
- (1 mark)

6. The slope of the line passing through the points (4, 3) and (7, 2) is

[<Answer>](#)

- (a) -3
- (b) $-\frac{1}{3}$
- (c) $\frac{1}{3}$
- (d) 3
- (e) None of the above.

(1 mark)

7.

[<Answer>](#)

If $y = 3x^3 - 2x + 1$, then the value of $\frac{dy}{dx}$ at $x = 2$ will be equal to

- (a) 0
- (b) 1
- (c) 21
- (d) 34
- (e) 36.

(1 mark)

8. Find out the sum of the following series:

[<Answer>](#)

$$S = 4\left(\frac{1}{2}\right) + 4\left(\frac{1}{2}\right)^2 + 4\left(\frac{1}{2}\right)^3 + \dots \infty$$

- (a) 4
- (b) 2
- (c) 80
- (d) 0.25
- (e) $\frac{2}{\sqrt{-1}}$.

(1 mark)

9.

[<Answer>](#)

$$\lim_{t \rightarrow 0} \frac{2 - \sqrt{4 - t^2}}{t^2} =$$

- (a) $\frac{1}{4}$
- (b) $\frac{1}{2}$
- (c) 2
- (d) 4
- (e) $\sqrt{2}$.

(1 mark)

10. What is the value of $f'(x)$, if $f(x) = \frac{1-x}{2+x}$? [<Answer>](#)

- (a) $-\frac{3}{(2+x)^2}$
 (b) $-\frac{2}{(2+x)}$
 (c) $-\frac{2}{(2+x)^2}$
 (d) $-\frac{3}{(2+x)^3}$
 (e) $\frac{1}{(2+x)^2}$

(2marks)

11. Differentiate $y = \sqrt{13x^2 - 5x + 8}$. [<Answer>](#)

- (a) $\frac{26x+5}{2\sqrt{13x^2-5x+8}}$
 (b) $\frac{52x-5}{2\sqrt{13x^2-5x+8}}$
 (c) $\frac{26x-5}{2\sqrt{13x^2-5x}}$
 (d) $\frac{26x-5}{2\sqrt{13x^2-5x+8}}$
 (e) $\frac{26x-5}{2\sqrt{x^2-5x+8}}$

(1 mark)

12. The Marketing Manager of United Home Products Ltd., has collected the following data pertaining to the sales of one of the products of the company in the past few years: [<Answer>](#)

Year	Sales (thousand units)
2001	14
2002	26
2004	46
2005	57
2006	68
2007	80

Find out the approximate number of units of the product sold in the year 2003 using interpolation techniques.

- (a) 34 (thousand units)
 (b) 38 (thousand units)
 (c) 44 (thousand units)
 (d) 40 (thousand units)
 (e) 36 (thousand units).

(1 mark)

13. The variance of the data 8, 12, 14, 16, 18 is 14.8, then the variance of 10, 14, 16, 18 and 20 is [<Answer>](#)

- (a) 10.8
 (b) 14.8
 (c) 16.8
 (d) 18.8
 (e) 29.6.

(1 mark)

14. The standard deviation and the mean returns of 5 securities A, B, C, D and E are given below.

[<Answer>](#)

Security	A	B	C	D	E
Mean returns	12	24	18	36	42
Standard deviation	2	3	4	5	6

Which of the above securities is consistent?

- (a) A
- (b) B
- (c) C
- (d) D
- (e) E.

(1 mark)

15. Which of the following is considered as the **best** measure of dispersion?

[<Answer>](#)

- (a) Quartile deviation
- (b) Mean deviation
- (c) Range
- (d) Standard deviation
- (e) Interquartile range.

(1 mark)

16. Consider the following frequency distribution given below:

[<Answer>](#)

Interval	Frequency
0 – 10	26
10 – 20	47
20 – 30	33
30 – 40	16
40 – 50	22

The mode of frequency distribution is

- (a) 6
- (b) 10
- (c) 142
- (d) 16
- (e) 19.

(1 mark)

17. The Environmental Protection Agency took water samples from 10 different locations of the Ganges. These samples were tested in the laboratory and rated as to the amount of solid particles suspended in each sample. The results of the testing are given in the table below.

[<Answer>](#)

Sample	1	2	3	4	5	6	7	8	9	10
Pollution rating (ppm)	27.2	38.7	64.3	52.8	47.6	23.4	33.9	45.0	56.7	41.1

Arrange the data into an array from highest to lowest. And determine the number of samples having pollution content between 20.0 and 29.9, 30.0 and 39.9.

- (a) 2 and 2
- (b) 2 and 3
- (c) 3 and 4
- (d) 0 and 2
- (e) 0 and 3.

(2marks)

18. XYZ company runs a taxi service in a big city. It has its own filling station for fuel. The fuel consumption figures in kilometers per liter for the sixteen cars owned by the company were compiled as follows:

[<Answer>](#)

14.77	16.11	16.11	15.05	15.99	14.91	15.27	16.01
15.75	14.89	16.05	15.22	16.02	15.24	16.11	15.02

What is the median fuel consumption?

- (a) 15.51
- (b) 15.27
- (c) 15.75
- (d) 15.15
- (e) 15.72.

(1 mark)

19. Rate of change in frequency from one class to the next is **best** shown in

[<Answer>](#)

- (a) Raw data
- (b) Frequency polygon
- (c) Histogram
- (d) Data array
- (e) None of the above.

(1 mark)

20. In a factory, there are three machines used in the manufacturing of screws. The probability that Machine A turns out a defective is 0.15, Machine B turns out a defective is 0.1, Machine C turns out a defective is 0.2. A screw is picked at random and is found to be defective. What is the probability that it was produced by Machine A?

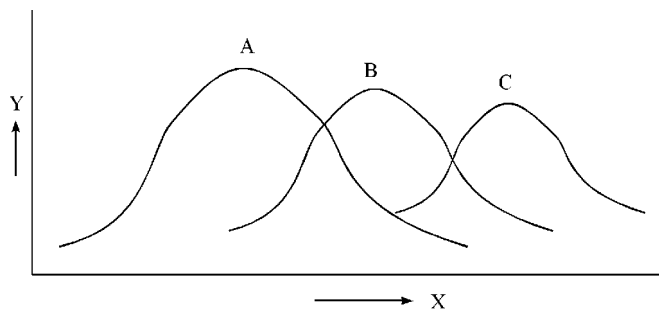
[<Answer>](#)

- (a) $\frac{1}{2}$
- (b) $\frac{1}{3}$
- (c) $\frac{1}{4}$
- (d) $\frac{1}{5}$
- (e) $\frac{1}{6}$

(1 mark)

21. Which of the curves has the largest mean?

[<Answer>](#)



- (a) Curve A
- (b) Curve B
- (c) Curve C
- (d) It will depend on the frequency distribution
- (e) It cannot be estimated from the figure.

(1 mark)

22. A movie theater charges Rs.8 for balcony, Rs.6 for first class and Rs.3.50 for second class. If 15% of its patrons buy balcony tickets, 45% buy first class tickets and the remaining buy second class tickets, how much would the box office expect to take in per 1000 patrons?

[<Answer>](#)

- (a) Rs. 17,500
- (b) Rs. 5,300
- (c) Rs. 4,300
- (d) Rs. 5,650
- (e) Rs. 2,345.

(1 mark)

[<Answer>](#)

23. The board of ABC company is considering some major policy changes that will affect the company's three divisions. The management was keen on getting the employees' opinion before going ahead with the changes. Meetings were held with groups of employees from the three divisions. The opinions of the employees are summarized in the table given below.

Opinion	Division		
	Textile	Garments	Finance
Strongly oppose	2	2	4
Slightly oppose	2	4	3
Neutral	3	3	5
Slightly support	2	3	2
Strongly support	6	3	1

An employee from one of the groups strongly opposes the policy changes. What is the probability that he is from the Finance division?

- (a) 4/45
- (b) 1/4
- (c) 4/15
- (d) 1/2
- (e) 3/4.

(1 mark)

[<Answer>](#)

24. If the marginal profit and marginal loss for stocking an additional car by a car dealer are Rs.10,000 and Rs. 2,000 respectively, then the probability of selling an additional car that will justify the stocking of that car should be at least

- (a) 0.1667
- (b) 0.2000
- (c) 0.2500
- (d) 0.5000
- (e) 0.6670.

(1 mark)

[<Answer>](#)

25. Consider the following profit table.

Plan	Probability	
	0.2	0.8
A	10	15
B	12	13

The expected pay-off under perfect information is

- (a) 12.5
- (b) 13.4
- (c) 13.5
- (d) 14.4
- (e) 15.0.

(1 mark)

[<Answer>](#)

26. Consider the following data about two securities A and B. The returns from the two securities are perfectly negatively correlated.

Particulars	Security A	Security B
Return (%)	7 or 11	13 or 5
Probability	0.5	0.5

We construct a portfolio of the two securities with proportions of A and B being 0.75 and 0.25 respectively. What is the portfolio risk as measured by its standard deviation?

- (a) 0.35
- (b) 0.50
- (c) 0.75
- (d) 0.80
- (e) 0.95.

(2marks)

27. The value of a variable X and its probability p is shown below

[<Answer>](#)

X	5.0	10.0	18.0	20.0
p	0.2	0.5	0.1	0.2

In a Monte Carlo simulation method, if a random number 37 is generated between the interval 1 – 100, the corresponding value of variable X will be

- (a) 5
- (b) 10
- (c) 15
- (d) 18
- (e) 9.

(1 mark)

28. An employer categorizes job applicants according to whether they have a University degree and whether they have had relevant work experience. In a large group of applicants, 70 percent have a degree with or without any work experience and 60 percent have work experience with or without a degree. 50 percent of the applicants have both a degree and relevant work experience.

[<Answer>](#)

What is the probability that a randomly selected job applicant has either a degree or relevant work experience?

- (a) 0.4
- (b) 0.7
- (c) 0.8
- (d) 0.2
- (e) 0.6.

(1 mark)

29. A portfolio manager A has been able to beat the market in four out of five periods, portfolio manager B has been able to beat the market in three out of four periods and portfolio manager C has been able to beat the market in two out of three periods. Assuming that the past performance of all the three portfolio managers will be repeated in future also, what is the probability of all the portfolio managers A, B and C beating the market index?

[<Answer>](#)

- (a) $\frac{1}{5}$
- (b) $\frac{2}{5}$
- (c) $\frac{4}{5}$
- (d) $\frac{3}{5}$
- (e) $\frac{1}{3}$.

(1 mark)

30. Box one contains 1 white and 999 red balls. Box two contains 1 red and 999 white balls. A ball is picked from a randomly selected box. If the ball is red, what is the probability that it came from Box one?

[<Answer>](#)

- (a) $\frac{1}{1,000}$
- (b) $\frac{999}{1,000}$
- (c) $\frac{1}{10}$
- (d) $\frac{9}{10}$
- (e) $\frac{1}{2}$.

(2marks)

31. In a test of ANOVA, the estimate of the population variance based on the variance among the sample means is 6.724 and the estimate of the population variance based on the variance within samples is 2.248. What is the F-ratio for this test? [<Answer>](#)
- (a) 0.3344
 (b) 0.6666
 (c) 2.9911
 (d) 4.4766
 (e) 8.9722. (1 mark)
32. The possible number of samples of size 5 taken from a population of 10 elements is [<Answer>](#)
- (a) 2
 (b) 5
 (c) 10
 (d) 252
 (e) 3628800. (1 mark)
33. You are a project manager for a construction project. After analyzing the requirements for completing the project, you find that it would take an average of 80 weeks to finish. The completion time is normally distributed with a standard deviation of 9 weeks. The probability of completing the project in 95 weeks or less is: [<Answer>](#)
- (a) 0.4525
 (b) 0.0475
 (c) 0.9525
 (d) 0.0952
 (e) Cannot be determined from the information given. (1 mark)
34. In a sampling technique, the first element is randomly selected and thereafter all other elements are selected based on a predetermined plan. This sampling technique can be described as [<Answer>](#)
- (a) Simple random sampling
 (b) Stratified random sampling
 (c) Systematic random sampling
 (d) Cluster sampling
 (e) Judgmental sampling. (1 mark)
35. X_1 is a normal variable with mean 25 and standard deviation 3. X_2 is another normal variable with mean 50 and standard deviation 4. If X_1 and X_2 are independent then $P(X_2 - X_1 \geq 30)$ would equal to [<Answer>](#)
- (a) $P(Z \geq 10/25)$
 (b) $P(Z \geq 10/5)$
 (c) $P(Z \geq 1)$
 (d) $P(Z \geq 7)$
 (e) $P(Z \geq 10)$. (1 mark)
36. A machine is producing ball bearings with diameter of 0.5 inches. It is known that the standard deviation of the ball bearings is 0.005 inches. A sample of 100 ball bearings is selected and their average diameter is found to be 0.498 inches. The standard error of the mean is [<Answer>](#)
- (a) 0.0001
 (b) 0.0002
 (c) 0.0003
 (d) 0.0004
 (e) 0.0005. (1 mark)

37. A random sample of size 9 is selected from a symmetrical population with a unique mode. The sample mean and standard deviation are 150 and 25 respectively. What is the 95% confidence interval in which the population's mean (μ) will lie? [<Answer>](#)
- (a) (120.78, 149.22)
 (b) (125.78, 159.22)
 (c) (130.78, 169.22)
 (d) (135.78, 179.22)
 (e) (140.78, 189.22). (2marks)
38. If a hypothesis is tested at a significance level of 10% then it means that [<Answer>](#)
- (a) There is 10% probability that the null hypothesis will be rejected though it is true
 (b) There is 10% probability that the null hypothesis will be false
 (c) There is 10% probability that the null hypothesis will be true
 (d) There is 90% probability that the alternative hypothesis will be false
 (e) There is 90% probability that the alternative hypothesis will be true. (1 mark)
39. A sample analysis of examination results of 200 MBAs was made. It was found that 46 students have failed, 68 secured a third division, 62 secured a second division and rest were placed in the first division. An analyst wants to test whether these figures are commensurate with the general examination results which is in the ratio of 2: 3: 3: 2, for the various categories (in the same order as above) respectively. Which of the following conclusions can be drawn from the given data, at a significance level of 5%? [<Answer>](#)
- (a) There is no difference between the MBA results and general examination results
 (b) There is a significant difference between the MBA results and general examination results
 (c) The number of first divisions in MBA results are more than the general examinations results
 (d) The number of failed students are less in the MBA results than the general examinations results
 (e) No conclusion can be drawn, as the data is insufficient. (2marks)
40. In statistics, the collection of all the elements under study is called as [<Answer>](#)
- (a) Domain
 (b) Population
 (c) Range
 (d) Central pool
 (e) Collection. (1 mark)
41. Each day, the Indian Customs Service has historically intercepted about Rs. 28 million in contraband goods being smuggled into the country, with a standard deviation of Rs. 16 million per day. On 64 randomly chosen days in 1992, the Indian Customs Service intercepted an average of Rs. 30.3 million in contraband goods. The Customs Commissioner wants to test at a significance level of 5% whether the smuggling has increased above its historic level. [<Answer>](#)
- What is the value of the appropriate test statistic for the above test?
- (a) 0.95
 (b) 1.15
 (c) 1.35
 (d) 1.65
 (e) 1.95. (1 mark)
42. Which of the following statement(s) is/are **true** regarding estimation? [<Answer>](#)
- I. If an estimate of a population parameter is given by a single value, then the estimate is called an interval estimate.
 II. If an estimate of a population parameter is given by two distinct numbers between which the parameter may be considered to lie, then the estimate is called a point estimate.
 III. The interval estimate indicates the accuracy (or precision) of an estimate.
- (a) Only (I) above
 (b) Only (II) above
 (c) Only (III) above
 (d) Both (I) and (II) above
 (e) All (I), (II) and (III) above. (1 mark)

43. Consider the following sample of paired observations:

[<Answer>](#)

X	3	4	7	6	5
Y	15	12	10	11	13

The covariance between X and Y is

- (a) - 2.75
- (b) - 2.20
- (c) - 1.75
- (d) 1.75
- (e) 3.75.

(2marks)

44. The following data pertains to 3 variables – X_1 , X_2 and X_3 . Where X_1 is the dependent variable and X_2 and X_3 are independent variables.

[<Answer>](#)

$$r_{12} = 0.8196; r_{13} = 0.7698; r_{23} = 0.7984.$$

What percentage of the variation in X_1 can be explained by the multiple regression equation in terms of X_2 and X_3 ?

- (a) 70.80
- (b) 65.37
- (c) 61.21
- (d) 54.75
- (e) 50.20.

(2marks)

45. In a multiple regression with n observations and k independent variables, the standard error of estimate is calculated using the number of degrees of freedom as

[<Answer>](#)

- (a) $n - 2$
- (b) $n - k$
- (c) $n - k - 1$
- (d) $n - k + 1$
- (e) $n + k - 1$.

(1 mark)

46. A regression relationship has been established between two variables, X and Y, in which X is the independent variable. The coefficient of correlation between X and Y is 0.60 approximately. What percentage of the variation in Y is not explained by the regression relationship?

[<Answer>](#)

- (a) 0%
- (b) 19%
- (c) 34%
- (d) 64%
- (e) 81%.

(1 mark)

47. For a regression relationship, the ratio of the regression sum of squares to the error sum of squares is 3 : 2.

[<Answer>](#)

What is the coefficient of determination for the regression relationship?

- (a) 0.40
- (b) 0.16
- (c) 0.36
- (d) 0.60
- (e) 0.81.

(1 mark)

48. For a simple regression equation the following results were obtained:

[<Answer>](#)

$$\text{If } X = 10, \hat{Y} = 55$$

$$\text{If } X = 15, \hat{Y} = 75$$

Where X is the independent variable and $\hat{Y}$ is the estimated value of the dependent variable Y .

$$\sum X = 60 \quad \sum X^2 = 645$$

Number of observations = 6

What is the value of $\sum XY$?

- (a) 900
- (b) 225
- (c) 3,480
- (d) 2,025
- (e) 3,025.

(2marks)

49. A multiple regression relationship contains two independent variables. The standard error of estimate is 4.8. Error sum of squares = 576.

[<Answer>](#)

What is the number of data points?

- (a) 24
- (b) 25
- (c) 26
- (d) 27
- (e) 28.

(2marks)

50. Ten companies are ranked on the basis of their profits (Rs. Crore) and working capital (Rs. Crore). The data are shown in the table given below.

[<Answer>](#)

Company	Profit (x_i)	Working Capital (y_i)
1	5	4
2	2	1
3	7	10
4	1	3
5	6	9
6	9	7
7	3	5
8	4	6
9	10	8
10	8	2

Calculate the Rank correlation coefficient (R) to get a better measure of the strength of association between them.

- (a) 0.17
- (b) 0.25
- (c) 0.54
- (d) 0.78
- (e) 0.46.

(2marks)

51. In which of the following conditions will the error sum of squares for a simple regression relationship be zero?

[<Answer>](#)

- (a) Correlation coefficient = 0
- (b) $-1 < \text{Correlation coefficient} < 0$
- (c) $0 < \text{Correlation coefficient} < 1$
- (d) Correlation coefficient = 0.75
- (e) $|\text{Correlation coefficient}| = 1$.

(1 mark)

52. In a p-chart, if $n = 60$ and $\bar{p} = 0.33$, the value of Upper Control Limit (UCL) will be given by

[<Answer>](#)

- (a) 0.347
- (b) 0.368
- (c) 0.391
- (d) 0.451
- (e) 0.512.

(1 mark)

53. Consider the data given below.

[<Answer>](#)

Particulars	Attitude Towards Social Legislation		
	Support	Neutral	Oppose
Occupation			
Blue collar worker	25	21	30
White collar worker	26	30	28
Professionals	29	25	30

The expected frequency for the cell (white collar, neutral) is

- (a) 26.16
- (b) 28.54
- (c) 30.21
- (d) 31.24
- (e) 32.64.

(1 mark)

54. Consider the following data regarding the sales projections of a new product.

[<Answer>](#)

State of Economy	Sales (Rs. crore)		
	Low Promotion	Moderate Promotion	High Promotion
Boom	29	33	48
Moderate Growth	25	28	35
Slow Growth	22	26	29
Recession	15	20	22

The degrees of freedom in the above data is

- (a) 3
- (b) 4
- (c) 5
- (d) 6
- (e) None of the above.

(1 mark)

55. Each of 20 lots of rubber belts contains 2000 rubber belts. The numbers of defective rubber belts in these lots are as follows:

[<Answer>](#)

405	418	324	332	292	340	282	300	320	296
397	434	294	324	220	460	258	226	460	190

The value of central line for the p-chart for the fraction of defectives is

- (a) 0.1621
- (b) 0.1632
- (c) 0.1643
- (d) 0.1652
- (e) 0.1662.

(1 mark)

56. A study compared the effects of four 1-month point-of-purchase promotions on sales. The unit sales for five stores using all four promotions in different months follow:

[<Answer>](#)

Free samples	78	87	81	89	85
One-pack gift	94	91	87	90	88
Rupees off	74	78	70	82	76
Refund by mail	79	83	78	69	81

A test of ANOVA has to be performed.

What is the estimated population variance using the variance between the sample means?

- (a) 194
- (b) 196
- (c) 198
- (d) 200
- (e) 202.

(2marks)

57. A production manager feels that the output rate of experienced employees is surely greater than that of new employees, but he does not expect the variability in output rate to differ for the two groups. In previous output studies, it has been shown that the average output per hour for new employees at this particular type of work is 20 units with a variance of 56 units squared. For a sample of 25 employees with 5 years' experience, the average output per hour for this same type of work is 30 units, with a variance of 28 units squared. The manager wants to test whether the variability in output differs at the two experience levels.

[<Answer>](#)

Find the value of the test statistic for the above test.

- (a) 8
- (b) 9
- (c) 10
- (d) 11
- (e) 12.

(2marks)

58. Three training methods were compared to see if they led to similar productivity after training. The following are productivity measures for individuals trained by each method.

[<Answer>](#)

Method 1	46	41	51	39	53
Method 2	59	43	47	51	40
Method 3	42	38	45	42	53

It is to be tested whether the three training methods lead to the same mean productivity.

What is the critical value for the appropriate statistical test at a significance level of 5%?

- (a) 2.87
- (b) 3.89
- (c) 4.43
- (d) 4.77
- (e) 5.29.

(2marks)

59. The composite price index of a basket of goods was 310 in 2006 and 334 in 2008. If both the indices were computed from a base of 100 in 2000, how much did the general price level rise between 2006 and 2008?

[<Answer>](#)

- (a) 5.18%
- (b) 6.56%
- (c) 7.74%
- (d) 17.86%
- (e) 19.52%.

(1 mark)

60. An hotelier found that the total number of bookings during 2007 was 10,000. The seasonal index during the second quarter was found to be 155. Then the number of rooms that will be booked during second quarter in 2008 will be

[<Answer>](#)

- (a) 8,735
- (b) 7,853
- (c) 5,837
- (d) 3,875
- (e) 2,222.

(1 mark)

61. The quality manager of the bottling plant of a cola major wants to ensure that the quantity of soft drinks in the bottles is as printed on the label of the bottle. He takes the samples of ten bottles every day and plots a control chart for the mean quantity of beverage in the bottle. Towards the end of the week he observes that the observations are within the control limits but there are jumps in the level around which the observations vary. Which of the following inferences is **most** appropriate?

[<Answer>](#)

- (a) The variations have been reduced to a great extent
- (b) The means of two different populations are being observed
- (c) The process mean has been shifting
- (d) The process is out of control
- (e) None of the above.

(1 mark)

62. A food grains merchant wants to know the overall change in prices of the commodities he deals in. He provides the following information:

[<Answer>](#)

Commodity	Year			
	2006		2008	
	Price (Rs./Kg.)	Quantity (Kg.)	Price (Rs./Kg.)	Quantity (Kg.)
Wheat	7.50	5000	10.25	4800
Rice	10.00	6000	14.00	5500
Pulses	25.00	3000	28.00	3500
Sugar	10.60	3000	14.50	2400
Salt	2.60	500	4.50	600

What is Paasche's price index for the year 2008 using 2006 as the base year?

- (a) 130.68
- (b) 129.57
- (c) 128.46
- (d) 127.35
- (e) 126.24.

(2marks)

63. The following index values pertain to a year:

[<Answer>](#)

Fisher's ideal price index = 125.50

Laspeyres price index = 122.00

Paasche's price index for the year is approximately

- (a) 102.90
- (b) 115.50
- (c) 120.50
- (d) 127.20
- (e) 129.10.

(1 mark)

64. Consider following daily price changes of a share.

[<Answer>](#)

Day	0	1	2	3	4	5	6	7	8
Price	101.1	101.05	101.5	105	105.6	106.5	105.4	110	109

Identify number of runs.

- (a) 3
- (b) 4
- (c) 5
- (d) 6
- (e) 7.

(1 mark)

65. Construct index number of prices for the year 2008 from the following data by applying Marshall-Edgeworth method. The year 2006 is base year.

[<Answer>](#)

Commodity	2006		2008	
	Prices (Rs.)	Quantities (Units)	Price (Rs.)	Quantities (Units)
A	2	8	4	6
B	5	10	6	5
C	4	14	5	10
D	2	19	2	13

- (a) 121.5
- (b) 122.5
- (c) 123.5
- (d) 124.5
- (e) 125.5.

(2marks)

66. What is the moving average of order three associated with 2 of the following data?

[<Answer>](#)

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

- (a) 5.667
- (b) 6.333
- (c) 5.333
- (d) 5.000
- (e) 4.000.

(1 mark)

67. The following details are available with regard to a basket of goods:

[<Answer>](#)

$$\sum P_1 Q_0 = 20,000$$

$$\sum P_0 Q_1 = 10,300$$

Value index calculated on the basis of the same basket of goods = 81.25

What is Fisher's ideal price index?

- (a) 51.505
- (b) 154.605
- (c) 123.105
- (d) 194.175
- (e) 125.605.

(1 mark)

68. Which of the following statements is/are **true** regarding Control Charts?

[<Answer>](#)

- I. $\bar{X}$ and R charts are deal with quantitative variables.
 - II. P charts deal with qualitative factors.
 - III. If the plotted points are within the lower and the upper control limits and there is no increasing trend or decreasing trend or cyclic fluctuations, then we can conclude that the process is out of control.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) All (I), (II) and (III) above.

(1 mark)

69. The advertisement expenditure and the sales of Magna Products Ltd., for the last six years, are given below:

[<Answer>](#)

Advertisement expenditure (Rs. in lakhs)	37	63	60	88	80	73
Sales (Rs. in lakhs)	480	540	590	870	630	790

An estimating equation to predict sales from advertisement expenditure has to be formulated using the simple regression technique.

If the advertisement expenditure is Rs.78 lakhs, then the estimated sales will be

- (a) Rs.601.3547 lakhs
- (b) Rs.650.2467 lakhs
- (c) Rs.727.3627 lakhs
- (d) Rs.752.6247 lakhs
- (e) Rs.787.2657 lakhs.

(2marks)

70. Which of the following statements is/are **true** regarding Dual problem?

[<Answer>](#)

- I. The solution to a dual problem provides all essential information about the solution to the primal problem.
 - II. It may be easier to solve the Dual problem rather than the primal problem as when the primal involves few variables but many constraints.
 - III. For every linear programming formulation there exist too many Dual formulations.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) All (I), (II) and (III) above.

(1 mark)

71. The vertices of the feasible region for a profit maximizing linear programming problem is bounded by the vertices (0, 0), (0, 12), (15, 0) and (12, 6). The profit function is $Z = 8X + 6Y$. The maximum value of Z is

[<Answer>](#)

- (a) 70
- (b) 72
- (c) 90
- (d) 120
- (e) 132.

(1 mark)

72. Which of the following is/are **false**?

[<Answer>](#)

- I. By observing the values in $(Z_j - C_j)$ row, one can know whether the optimum solution has reached or not.
 - II. The profit contributions of slack variables are greater than zero.
 - III. The row containing the pivot element should be compulsorily divided by it.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) Both (II) and (III) above.

(1 mark)

[<Answer>](#)

73. A company manufactures three types of car, A, B and C in two factories; an engine plant E and a body factory F. The net profit on a car of type A is Rs.55,000, on type B it is Rs.60,000 and on type C it is Rs.72,500. There are 10,120 labour units (a labour unit is approximately “one man-hour”) available in E and 11,000 labour units in factory F each month and the number of labour units, needed to build the various products is given in the following table:

Car Type	Engine	Body
A	8	8
B	8	9
C	9	11

This is a problem of maximizing the profit subject to these constraints as a linear programming problem.

At optimal solution how many type B car would be produced by the manufacturer?

- (a) Zero
- (b) 120
- (c) 240
- (d) 440
- (e) 770.

(2marks)

[<Answer>](#)

74. If the objective is to maximize $f(x, y) = 143x + 60y$

Subject to the following constraints:

$$x + y \leq 100$$

$$120x + 210y \leq 15000$$

$$110x + 30y \leq 4000$$

$$x, y \geq 0$$

The value of x at the optimum solution would be

- (a) 20
- (b) 50
- (c) 60
- (d) 100
- (e) 110.

(2marks)

[<Answer>](#)

75. In which of the following conditions, the graphical solution to a linear programming problem will **not** have multiple optimal solutions?

- (a) One of the edges of the feasible region coincides with the horizontal axis
- (b) One of the edges of the feasible region is parallel to the horizontal axis
- (c) One of the edges of the feasible region coincides with the vertical axis
- (d) One of the edges of the feasible region is parallel to the vertical axis
- (e) None of the edges of the feasible region is parallel to the objective function.

(1 mark)

76. What is the dual of the LPP equation?

[<Answer>](#)

$$\text{Minimize } P = 12W_1 + 20W_2$$

$$\text{Subject to: } W_1 + W_2 \geq 2$$

$$3W_1 + W_2 \geq 6$$

$$2W_1 + W_2 \geq 4$$

$$W_1, W_2 \geq 0$$

(a) Maximize $Z = 2X_1 + 6X_2 + 4X_3$

$$\text{Subject to: } X_1 + 3X_2 + 2X_3 \leq 12$$

$$X_1 + X_2 + X_3 \leq 20$$

$$X_1, X_2, X_3 \geq 0$$

(b) Maximize $Z = X_1 + 3X_2 + 2X_3$

$$\text{Subject to: } 3X_1 + 2X_2 + 1X_3 \geq 12$$

$$X_1 + X_2 + X_3 \leq 20$$

$$X_1, X_2, X_3 \geq 0$$

(c) Maximize $Z = 2X_1 + 6X_2 + 4X_3$

$$\text{Subject to: } 3X_1 + 1X_2 + 2X_3 \leq 12$$

$$X_1 + X_2 + X_3 \geq 20$$

$$X_1, X_2, X_3 \geq 0$$

(d) Maximize $Z = 2X_1 + 6X_2 + 4X_3$

$$\text{Subject to: } X_1 + 3X_2 + 2X_3 \geq 20$$

$$X_1 + X_2 + X_3 \leq 12$$

$$X_1, X_2, X_3 \geq 0$$

(e) Maximize $Z = X_1 + 6X_2 + 4X_3$

$$\text{Subject to: } X_1 + 3X_2 + 2X_3 \leq 12$$

$$X_1 + X_2 + X_3 \geq 20$$

$$X_1, X_2, X_3 \geq 0$$

(2marks)

77. Which of the following statements is **false**?

[<Answer>](#)

- (a) JAVA can run on any operating system
- (b) JAVA can be downloaded straight from internet
- (c) WWW is a network of networks
- (d) Modem is a piece of equipment that connects a computer to a data network
- (e) Internet is a global network of computers.

(1 mark)

78. Which of the following is/are basic characteristics favoring the usage of computers?

[<Answer>](#)

- I. Volume.
- II. Speed.
- III. Accuracy.
- IV. Complexity.

- (a) Only (II) above
- (b) Only (III) above
- (c) Both (II) and (III) above
- (d) (II), (III) and (IV) above
- (e) All (I), (II), (III) and (IV) above.

(1 mark)

79. Which of the following statements is **false** regarding rules while constructing a flow chart?

[<Answer>](#)

- (a) The direction of flow should usually be from the top to the bottom of the page and from the left to the right
- (b) Lines should never cross
- (c) Arrow-heads should be used to show the direction of the flow, especially, if it is other than top to bottom or left to right
- (d) The symbols should be of a fixed size
- (e) Every flow chart should begin with a 'Start' symbol and end with a 'Stop' symbol.

(1 mark)

END OF QUESTION PAPER

Suggested Answers Quantitative Methods (CFA530): January 2009

ANSWER	REASON
1. E Given that $\frac{x}{4} - \frac{x}{8} = x - 7$ $\Rightarrow \frac{x}{4} - \frac{x}{8} = x - 7$ $\frac{8x - 4x}{32} = x - 7$ $\frac{4x}{32} = x - 7$ $x = 8x - 56$ $7x = 56$ $\Rightarrow x = 8.$	< <u>TOP</u> >
2. B option(a) $a < b$ if and only if $(b - a) > 0$ To prove above statement, consider $a < b$, now we have to prove $(b - a) > 0$ If $a < b$, $\Rightarrow 0 < b - a$ $\Rightarrow (b - a) > 0$ Now consider $(b - a) > 0$, now we have to prove $a < b$. If $(b - a) > 0$ $\Rightarrow 0 < b - a$ $\Rightarrow a < b$ Hence $a < b$ if and only if $(b - a) > 0$. Similarly option(c), option(d) and option(e) are correct. option(b) If $a < b$ and $b > c$ then $a < c$ Given that $a < b$ and $b > c$ $\Rightarrow a < b \text{ and } c < b$ From the above relationships we cannot say that $a < c$. Hence option (b) is false.	< <u>TOP</u> >
3. A PVIFA(9, 20) = 4.0310 Thus, The amount Ms. Maya is willing to pay $= 6000 \times 4.0310$ $= 24,186.$	< <u>TOP</u> >

4. E $P = 1100 - 8Q$

$$R = P \times Q$$

$$= (1100 - 8Q) \times Q$$

$$R = 1100Q - 8Q^2$$

$$MR = \frac{\partial R}{\partial Q} = 1100 - 16Q$$

When $Q = 45$, $MR = 380$.

$$C = 1200 + 70Q$$

$$MC = \frac{\partial C}{\partial Q} = 70$$

When $Q = 45$, $MC = 70$.

Therefore $MR = 380$ and $MC = 70$.

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5. C $5x^2 - 10x - 15 = 0$

In the given quadratic equation $a = 5$, $b = -10$ and $c = -15$.

We now substitute these values in the formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{10 \pm \sqrt{100 - 4 \times 5 \times (-15)}}{10}$$

$$x = \frac{10 \pm 20}{10}$$

$$x = \frac{30}{10} \text{ and } x = \frac{-10}{10}$$

$$x = 3 \text{ and } x = -1.$$

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6. B $Y = a + bX$, where a is the Y-intercept and b is the slope of the line.

At point $(4, 3)$, $3 = a + b(4)$

At point $(7, 2)$, $2 = a + b(7)$

Therefore, $3b = -1$ or $b = -1/3$.

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7. D $y = 3x^3 - 2x + 1$

$$\frac{dy}{dx} = 9x^2 - 2$$

If $x = 2$, then $\frac{dy}{dx} = 9(2)^2 - 2 = 36 - 2 = 34$.

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8. A The given series is of the form,

$$a + ar + ar^2 + ar^3 + \dots \alpha$$

The sum of a series of this form,

$$S = \frac{a}{1-r}$$

$$a = 4(1/2)$$

$$r = 1/2$$

$$\therefore S = \frac{4(1/2)}{1-1/2} \Rightarrow \frac{2}{1/2}$$

$$\Rightarrow 2 \times 2$$

$$\Rightarrow 4.$$

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9. A

$$\begin{aligned} \lim_{t \rightarrow 0} \frac{2 - \sqrt{4 - t^2}}{t^2} &= \lim_{t \rightarrow 0} \frac{(2 + \sqrt{4 - t^2})(2 - \sqrt{4 - t^2})}{t^2(2 + \sqrt{4 - t^2})} \\ &= \lim_{t \rightarrow 0} \frac{4 - (4 - t^2)}{t^2(2 + \sqrt{4 - t^2})} \\ &= \lim_{t \rightarrow 0} \frac{t^2}{t^2(2 + \sqrt{4 - t^2})} \\ &= \lim_{t \rightarrow 0} \frac{1}{2 + \sqrt{4 - t^2}} \\ &= \frac{1}{2 + 2} = \frac{1}{4}. \end{aligned}$$

[<](#)
[TOP](#)
[>](#)

10. A

Given that $f(x) = \frac{1-x}{2+x}$.

If $f(x) = \frac{g(x)}{h(x)}$, then $f'(x) = \frac{g'(x)h(x) - g(x)h'(x)}{(h'(x))^2}$

$$\begin{aligned} f'(x) &= \frac{(-1)(2+x) - (1-x) \times 1}{(2+x)^2} \\ &= \frac{-2-x-1+x}{(2+x)^2} \\ &= \frac{-3}{(2+x)^2}. \end{aligned}$$

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11. D

(The outer layer is “the square root” and the inner layer is $(13x^2 - 5x + 8)$).

Differentiate “the square root” first, leaving $(13x^2 - 5x + 8)$ unchanged. Then differentiate $(13x^2 - 5x + 8)$. Thus,

$$\begin{aligned} D \left\{ \sqrt{13x^2 - 5x + 8} \right\} &= D (13x^2 - 5x + 8)^{\frac{1}{2}} \\ &= \left(\frac{1}{2} \right) (13x^2 - 5x + 8)^{\frac{1}{2}-1} D(13x^2 - 5x + 8) \\ &= \left(\frac{1}{2} \right) (13x^2 - 5x + 8)^{-\frac{1}{2}} (26x - 5) \\ &= \frac{26x - 5}{2(13x^2 - 5x + 8)^{\frac{1}{2}}} \\ &= \frac{26x - 5}{2\sqrt{13x^2 - 5x + 8}}. \end{aligned}$$

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12. E The sales figure for 2003

$$= 26 + \frac{46 - 26}{2004 - 2002} (2004 - 2003)$$

$$= 26 + 10$$

$$= 36 \text{ (thousand units).}$$

13. B The value of variance remains the same if in a series each of the observation is increased or decreased by a constant quantity.

Here each of the observation is increased by 2.

Original series : 8, 12, 14, 16, 18

New series: $8 + 2 = 10$, $12 + 2 = 14$, $14 + 2 = 16$, $16 + 2 = 18$ and $18 + 2 = 20$.

Therefore variance remains same. That is 14.8.

14. B
- $$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

Security	A	B	C	D	E
Mean returns	12	24	18	36	42
Standard deviation	2	3	4	5	6
Coefficient of Variation	16.6667	12.5	22.2222	13.8889	14.2857

Here minimum coefficient of variation is associated to security B.

Hence security B is consistent.

15. D Standard deviation is regarded as best measure of dispersion.

16. D Here largest frequency is 47 and it lies in the class interval 10 – 20. Therefore modal class is 10 – 20

$$\text{Mode} = L_{m_0} + \frac{(f - f_1)}{2f - f_1 - f_2} \times W$$

$$= 10 + \frac{47 - 26}{(2(47) - 26 - 33)} \times 10$$

$$= 10 + 6 = 16.$$

17. A

Sample	Pollution rating (PPM)
3	64.3
9	56.7
4	52.8
5	47.6
8	45.0
10	41.1
2	38.7
7	33.9
1	27.2
6	23.4

Class of pollution rating	Number of samples
20.0 – 29.9	2
30.0 – 39.9	2
40.0 – 49.9	3
50.0 – 59.9	2
60.0 – 69.9	1
Total	10

18. A We first arrange the data in an ascending order, row wise.

14.77	14.89	14.91	15.02	15.05	15.22	15.24	15.27
15.75	15.99	16.01	16.02	16.05	16.11	16.11	16.11

The median is the average of the eighth and ninth data points.

$$\text{Median} = \frac{15.27 + 15.75}{2} = 15.51.$$

19. B Raw data is information before it is processed or analyzed. In data array, the data points are arranged in an ascending or descending order. We observe that while the histogram indicates the fluctuations in frequencies from class to class, it does not clearly reveal the rate of change in frequency from one class to the next.

Hence the answer is (b).

20. B Let E be the event that the screw is defective.
Let A be the event that the screw is produced on machine A.
Let B be the event that the screw is produced on machine B.
Let C be the event that the screw is produced on machine C.

$$\text{Required probability} = P(E/A) = \frac{0.15}{0.15 + 0.1 + 0.2} = \frac{1}{3}.$$

21. C Here three curves are on same scale and Curve A mean is less than Curve B mean and Curve B mean is less than Curve C mean.
Therefore Curve C has larger mean than Curve A and Curve B.

22. B $[8(0.15) + 6(0.45) + 3.5(0.40)] \times 1000 = \text{Rs. } 5,300$

23. D $P(F/STO) = P(F \text{ and } STO)/P(STO)$.
 $P(F \text{ and } STO) = P(F) \cdot P(STO/F) = 15/45 \cdot 4/15$
 $P(STO) = 8/45$
Thus, $P(F/STO) = 15/45 \times 4/15 \times 45/8 = 1/2$.

24. A $P^* = ML/(ML + MP) = 2000/(10000 + 2000) = 2000/12000 = 1/6 = 0.1667$.

25. D The expected pay-off under perfect information = $12(0.2) + 15(0.8) = 14.4$. (The sum products of probability and the maximum profit in each column).

26. B Estimated Return on Security A

$$= 0.5(7) + 0.5(11) = 9$$

Estimated Return on Security B

$$= 0.5(13) + 0.5(5) = 9$$

$$\sigma_A^2 = 0.5(7 - 9)^2 + 0.5(11 - 9)^2 = 4;$$

$$\text{then } \sigma_A = \sqrt{4} = 2$$

$$\sigma_B^2 = 0.5(13 - 9)^2 + 0.5(5 - 9)^2 = 16;$$

$$\text{Then } \sigma_B = \sqrt{16} = 4.$$

$$\begin{aligned} \text{Portfolio Risk} &= \sqrt{X_A^2 \sigma_A^2 + X_B^2 \sigma_B^2 + 2X_A X_B \text{Cov}_{(A,B)}} \\ &= \sqrt{(0.75)^2 (4) + (0.25)^2 (16) + 2(0.75)(0.25)(-8)} \\ &= \sqrt{0.25} = 0.5. \end{aligned}$$

$$\text{Where, } \text{Cov}_{(A,B)} = 0.5(7 - 9)(13 - 9) + 0.5(11 - 9)(5 - 9) = -8.$$

27. B

X	Probability	Cumulative Probability	Random numbers allotted
5	0.2	0.20	00 – 19
10	0.5	0.70	20 – 69
18	0.1	0.80	70 – 79
20	0.2	1.00	80 – 99

Since the random number generated was 37 (which falls in between 20 – 69), the value of X in this run is 10.

28. C Let the event of having a degree be denoted by D and let the event of having relevant work experience be denoted by WE.

$$\text{We have, } P(D) = 0.7, P(WE) = 0.6$$

$$P(D \text{ and } WE) = 0.5$$

The required probability is

$$\begin{aligned} P(D \text{ or } WE) &= P(D) + P(WE) - P(D \text{ and } WE) \\ &= 0.7 + 0.6 - 0.5 = 0.8. \end{aligned}$$

29. B Let P(A), P(B) and P(C) be the probabilities of portfolio managers A, B and C to beat the market.

$$P(A) = 4/5$$

$$P(B) = 3/4$$

$$P(C) = 2/3$$

$$P(ABC) = \frac{4}{5} \times \frac{3}{4} \times \frac{2}{3} = \frac{2}{5}.$$

30. B Let A be the event that a ball picked is red and A_i be the event that i^{th} box is selected ($i = 1, 2$)

$$P(A/A_1) = \frac{999}{1,000} \text{ and } P(A/A_2) = \frac{1}{1,000} \text{ and}$$

$$P(A_i) = \frac{1}{2}.$$

Hence, by Baye's theorem

$$P(A_1/A) = \frac{P(A_1) \cdot P(A/A_1)}{\sum_{i=1}^2 P(A/A_i) P(A_i)}$$

$$= \frac{\frac{1}{2} \times \frac{999}{1,000}}{\left(\frac{999}{1,000} + \frac{1}{1,000}\right) \frac{1}{2}} = \frac{999}{1,000}.$$

Hence, the required probability is $\frac{999}{1,000}$.

31. C $F\text{-ratio} = \frac{\text{Estimate based on the variance among sample means}}{\text{Estimate based on the variances within the samples}}$

$$\frac{6.724}{2.248} = 2.9911.$$

32. D ${}^{10}C_5 = 10!/[(10-5)! 5!] = [10 \times 9 \times 8 \times 7 \times 6]/[5 \times 4 \times 3 \times 2 \times 1] = 252.$

33. C $z = (x - \mu)/\sigma$
 $z = (95 - 80)/9 = 1.67$; the corresponding value for z-score 1.67 is equal to 0.4525 (see z table).
 Since this is a right tailed test, in addition to the above area we have to consider the total area of left hand side, which is equal to 0.5.
 Thus, $P(0 < z < 95) = 0.4525 + 0.5 = 0.9525.$

34. C In systematic sampling each element among first k elements ($k < n$) has an equal chance of being selected, but each sample does not have the same chance of being selected. Here, the first element of the population is randomly selected.
 But thereafter the elements are selected according to a systematic plan.

35. C $P(X_2 - X_1 \geq 30)$

$$= P\left(Z \geq \frac{30 - \text{mean}(X_2 - X_1)}{\text{sd}(X_2 - X_1)}\right)$$

$$= P\left(Z \geq \frac{30 - 25}{\sqrt{4^2 + 3^2}}\right) = P(Z \geq 1).$$

36. E Given that standard deviation of the population, $\sigma = 0.005$ inches. The sample size, $n = 100$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.005}{\sqrt{100}} = 0.0005.$$

The standard error of mean

37. C Here, $\bar{X} = 150$

$$s = 25$$

$$n = 9$$

$$\text{Degrees of freedom} = n - 1 = 9 - 1 = 8$$

If we refer to the t table we see that for 8 degrees of freedom, the area in both tails combined is 0.5 or 5%,

when $t = 2.306$.

$$\bar{X} - t \left(\frac{s}{\sqrt{n}} \right) \text{ and } \bar{X} + t \left(\frac{s}{\sqrt{n}} \right) \text{ is 95\% when } t = 2.306.$$

Hence, area under the curve between

$$150 - \left[2.306 \times \frac{25}{\sqrt{9}} \right] \text{ to } 150 + \left[2.306 \times \frac{25}{\sqrt{9}} \right].$$

So, the 95% confidence interval is

Hence, we are 90% confident that the population mean lies in the interval 130.78 to 169.22.

38. A If a hypothesis is tested at a 10% significance level then, it means that there is a 10% probability that the null hypothesis will be rejected though it is true.

b, c, d & e are incorrect interpretations of the significance level.

39. B This is a chi-square test of goodness of fit.

Let us take the null hypothesis that there is no difference in the MBA results and general examinations results.

On the basis of ratio 2: 3: 3: 2, the expected number of students failing, getting third division, second division, and first division,

should be 40, 60, 60 and 40 respectively.

The following table is generated for observed and expected frequencies:

Category	Observed frequency (f_o)	Expected frequency (f_e)	$(f_o - f_e)^2 / f_e$
Failed	46	40	0.900
Third Division	68	60	1.067
Second Division	62	60	0.067
First Division	24	40	6.400

$$\sum \frac{(f_o - f_e)^2}{f_e} = 8.434$$

The value of Chi square statistic, $\chi^2 =$

The table value of chi-square for $4 - 1 = 3$ degrees of freedom at 5% level of significance is 7.815. The calculated value of

chi-square is greater than the table value. The null hypothesis is rejected. Hence it can be included that the MBA

results are not commensurate with the general examination results (i.e., the MBA results are different from general examination results).

40. B In statistics, the collection of all the elements under study is called population.

41. B The sample size is large and population standard deviation is known, hence we use normal distribution to test this hypothesis.

$$\frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{30.3 - 28}{16 / \sqrt{64}} = \frac{2.3}{2} = 1.15.$$

The test statistic $z =$

42. C Only given statement III is true.

Statements (I) and (II) are false. Since correct statements are

If an estimate of a population parameter is given by a single value, then the estimate is called a **Point** estimate.

If an estimate of a population parameter is given by two distinct numbers between which the parameter may be considered to lie, then the estimate is called an **interval** estimate.

So option (c) is correct.

43. A For a paired sample {X,Y}

$$\text{Cov}_{XY} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{n - 1}$$

Here n=5, $\sum X=25$, $\sum Y=61$

$$\bar{X} = 5, \bar{Y} = 12.2 \text{ and } \sum (X - \bar{X})(Y - \bar{Y}) = -11$$

$$\therefore \text{Cov}_{XY} = \frac{-11}{5-1} = \frac{-11}{4} = -2.75$$

44. A

$$R_{1.23} = \sqrt{(r_{12}^2 + r_{13}^2 - 2r_{12}r_{23}r_{13})/[1 - r_{23}^2]}$$

$$= \sqrt{[(0.8196)^2 + (0.7698)^2 - 2(0.8196)(0.7698)(0.7984)]/[1 - (0.7984)^2]}$$

$$= \sqrt{\frac{0.2567}{1 - (0.7984)^2}} = \sqrt{\frac{0.2567}{0.3626}} = 0.8414.$$

$$R_{1.23}^2 = (0.8414)^2 = 0.7080.$$

Therefore 70.80 percentage of the variation in X_1 can be explained by the multiple regression equation in terms of X_2 and X_3 .

45. C (a) This is a wrong answer. The standard error of the estimate is not calculated using the number of degrees of freedom as $n - 2$.
 (b) This is a wrong answer. The standard error of the estimate is not calculated using the number of degrees of freedom as $n - k$.
 (c) This is the right answer. In a multiple regression with n number of observations and k independent variables, the standard error of the estimate is calculated using the number of degrees of freedom as $n - k - 1$.
 (d) This is a wrong answer. The standard error of the estimate is not calculated using the number of degrees of freedom as $n - k + 1$.
 (e) This is a wrong answer. The standard error of the estimate is not calculated using the number of degrees of freedom as $n + k - 1$.

46. D Explained variation is given by $r^2 = (0.60)^2 = 0.36$ and hence the unexplained variation is given by $= 1 - 0.36 = 0.64 = 64\%$.

47. D

$$\text{Coefficient of determination} = \frac{\text{RSS}}{\text{TSS}} = \frac{\text{RSS}}{\text{ESS} + \text{RSS}}$$

$$\begin{aligned} \frac{\frac{\text{RSS}}{\text{ESS}}}{\frac{\text{ESS}}{\text{ESS}} + \frac{\text{RSS}}{\text{ESS}}} &= \frac{\frac{3}{2}}{1 + \frac{3}{2}} = \frac{1.5}{2.5} = 0.60 \\ &= \frac{\text{RSS}}{\text{ESS} + \text{RSS}} \end{aligned}$$

48. C A simple regression equation is of the form:

$$\hat{Y} = a + bX$$

Given:

$$\text{If } X = 15, \hat{Y} = 75 \quad \therefore 75 = a + 15b \dots\dots\dots (A)$$

$$\text{If } X = 10, \hat{Y} = 55 \quad \therefore 55 = a + 10b \dots\dots\dots (B)$$

Subtracting (A) from (B) we get:

$$(75 - 55) = (15 - 10)b$$

$$\text{or } 20 = 5b$$

$$\text{or } b = \frac{20}{5} = 4$$

Putting the values of b in (B):

$$55 = a + 10 \times 4 = a + 40$$

$$\text{or } a = 55 - 40 = 15$$

$$\therefore \hat{Y} = 15 + 4X$$

$$\bar{Y} - b\bar{X} = \bar{Y} - b\left(\frac{\sum X}{n}\right)$$

Now, a =

$$\bar{Y} = a + b\left(\frac{\sum X}{n}\right) = 15 + 4\left(\frac{60}{6}\right) = 55$$

$$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n\bar{X}^2} \text{ or } 4 = \frac{\sum XY - 6\left(\frac{60}{6}\right)(55)}{645 - 6\left(\frac{60}{6}\right)^2} \text{ or } 4 = \frac{\sum XY - 3300}{45}$$

$$\text{or } \sum XY = (4 \times 45) + 3300 = 3480$$

49. E In multiple regression relationship:

$$\text{Standard error of estimate, } s_e = \sqrt{\frac{\sum (Y - \hat{Y})^2}{n - k - 1}} = \sqrt{\frac{ESS}{n - k - 1}}$$

Given : ESS = 576

$$n = ?$$

$$k = 2$$

$$s_e = 4.8$$

$$\therefore 4.8 = \sqrt{\frac{ESS}{n - 2 - 1}}$$

$$\therefore \frac{ESS}{n - 3} = 23.04$$

$$\text{or } \frac{576}{n - 3} = 23.04$$

$$\text{or } n = \frac{576}{23.04} + 3 = 28.$$

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50. C Here $n = 10$ and $\sum d_i^2 = 76$.

The rank correlation coefficient is given by

Company	Profit (x_i)	Working capital (y_i)	$d_i = x_i - y_i$	d_i^2
1	5	4	1	1
2	2	1	1	1
3	7	10	-3	9
4	1	3	-2	4
5	6	9	-3	9
6	9	7	2	4
7	3	5	-2	4
8	4	6	-2	4
9	10	8	2	4
10	8	2	6	36
Total				76

$$R = 1 - \left[\frac{6 \sum d_i^2}{n(n^2 - 1)} \right]$$

$$= 1 - (6)(76)/10(99) = 1 - 0.46 = 0.54.$$

51. E The ESS = 0 when there is a perfect correlation between the independent variable (X) and dependent variable (Y)

$$\text{i.e. At, } r = \pm 1, r^2 = 1 \Rightarrow \frac{RSS}{TSS} = 1$$

$$\text{or } RSS = TSS \Rightarrow ESS = 0$$

$$\therefore ESS = 0 \text{ when } |r| = 1.$$

52. E Upper control limit (UCL) = $\bar{p} + 3 \sqrt{\frac{\bar{p} \times (1 - \bar{p})}{n}}$
- $$= 0.33 + 3 \sqrt{\frac{0.33 \times 0.67}{60}} = 0.512.$$

53. A The expected frequency for the cell (white collar, neutral) is $[(21 + 30 + 25) \times (26 + 30 + 28)]/244$
 $= (76 \times 84)/244 = 26.163.$

54. D $DOF = (\text{Number of rows} - 1)(\text{Number of columns} - 1) = (4 - 1)(3 - 1) = 6.$

55. C Total number of defectives out of 40,000 items in 20 samples is:

$$405 + 418 + 324 + \dots + 460 + 190 = 6572$$

$$\bar{p} = \frac{6572}{40000} = 0.1643$$

Therefore the central line is set at 0.1643.

56. D $\bar{\bar{x}} = \frac{\sum x_{ji}}{n} = \frac{420+450+380+390}{20} = \frac{1640}{20} = 82$ [< TOP >](#)

The value of the grand mean

Variance between the samples can be computed as below:

n_j	$\bar{x}_j$	$(\bar{x}_j - \bar{\bar{x}})^2$	$n_j (\bar{x}_j - \bar{\bar{x}})^2$
5	84	4	20
5	90	64	320
5	76	36	180
5	78	16	80
Total			600

The variance between the sample means = $s_x^2 = \frac{\sum n_j (\bar{x}_j - \bar{\bar{x}})^2}{k-1} = \frac{600}{4-1} = 200$

57. E It is given that sample variance = 28 [< TOP >](#)
Hypothesized value of the population variance = 56
Sample size = 25

The value of the Chi-square statistic is $\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(25-1)28}{56} = 12$.

58. B This is an analysis of variance. The critical value would be found from the table of F-distribution. [< TOP >](#)
The number of degrees of freedom in numerator = $(k-1) = 3-1 = 2$
The number of degrees of freedom in denominator = $(n_T - k) = 15-3=12$ = 15 - 3 = 12.
The value for F statistic from the table at 5% level of significance is given as:
 $F(2, 12, 0.05) = 3.89$.

59. C $(334 - 310)/310 \times 100 = 7.74\%$. [< TOP >](#)

60. D $(10000/4) \times (155/100) = 3,875$ [Hint: 4 quarters = 1 year]. [< TOP >](#)

61. C (a) This is a wrong answer. If we observe that the sample means are hugging the center line then the deviations are minor and uniform in nature. This indicates that the variation has been reduced to great extent. [< TOP >](#)
(b) This is a wrong answer. If the observations are such that it can be described to be 'hugging the control limits', then this refers to the deviations being uniform in nature but having large magnitude. This indicates that the means of two different populations are being observed.
(c) This is the right answer. If the observations can be described as jumps in the level around which the observations vary, then this pattern indicates that the process mean has been shifting.
(d) This is a wrong answer. If some of the points lie outside the upper or lower control limits or if there is an increasing or decreasing trend in the observations, we conclude that the process is out of control.
(e) This is a wrong answer.

62. D [<](#)
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$$\text{We know that Paasche's index} = \frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100$$

$$\sum P_1 Q_1 = (10.25 \times 4800) + (14.00 \times 5500) + (28.00 \times 3500) + (14.50 \times 2400) + (4.50 \times 600) = 261700.$$

$$\sum P_0 Q_1 = (7.5 \times 4800) + (10.00 \times 5500) + (25.00 \times 3500) + (10.60 \times 2400) + (2.60 \times 600) = 205500.$$

$$\begin{aligned} \text{Paasche's index} &= \frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100 \\ &= \frac{261700}{205500} \times 100 = 127.35. \end{aligned}$$

63. E [<](#)
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$$\text{Fisher's ideal price index} = \sqrt{\text{Laspeyres price index} \times \text{Paasches price index}}$$

$$\text{Paasches price index} = \frac{(\text{Fisher's ideal price index})^2}{\text{Laspeyres price index}}$$

$$= \frac{(125.5)^2}{122} = 129.10.$$

64. C [<](#)
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In a typical Runs Test the change in share prices may be classified as '+' meaning an increase and '-' meaning a decrease.

A run is said to last as long as the price changes do not change direction.

Day	0	1	2	3	4	5	6	7	8
Price	101.1	101.05	101.5	105	105.6	106.5	105.4	110	109
Daily Price change		-	+	+	+	+	-	+	-
Runs		1	2				3	4	5

Therefore, here the number of runs is 5.

So, option (c) is correct.

65. E [<](#)
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Marshall-Edgeworth price index =

$$\frac{\sum P_1 (Q_0 + Q_1)}{\sum P_0 (Q_0 + Q_1)} \times 100 = \frac{\sum P_1 Q_0 + \sum P_1 Q_1}{\sum P_0 Q_0 + \sum P_0 Q_1} \times 100 = \frac{200 + 130}{160 + 103} \times 100 = \frac{330}{263} \times 100 = 125.5$$

66. D [<](#)
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Data Points.	Moving total of order 3.	Moving averages
4		
5	17	5.667
8	19	6.333
6	16	5.333
2	15	5.000
7	12	4.000
3	11	3.667
1	13	4.333
9		

Here moving total 17 represents 4 + 5 + 8; moving total 19 represents 5 + 8 + 6 etc.,

Here moving average 5.667 is associated to 5,

Here moving average 6.333 is associated to 8,

Similarly,

Moving average 5.000 is associated to 2.

67. E

$$\begin{aligned}\text{Fisher's ideal price index} &= \sqrt{\frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times \frac{\sum P_1 Q_0}{\sum P_0 Q_0}} \times 100 \\ &= \sqrt{\frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times 100 \times \frac{\sum P_1 Q_0}{\sum P_0 Q_1} \times 100} \\ &= \sqrt{\text{Value index} \times \left(\frac{\sum P_1 Q_0}{\sum P_0 Q_1} \times 100 \right)} \\ &= \sqrt{81.25 \times \left(\frac{20,000}{10,300} \times 100 \right)} \\ &= 125.605.\end{aligned}$$

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68. D The following statements are **true** regarding Control Charts.

- I. $\bar{X}$ and R charts are deal with quantitative variables.
- II. P charts deal with qualitative factors.

Given Statement III is false. Because, If the plotted points are within the lower and the upper control limits and there is no increasing trend or decreasing trend or cyclic fluctuations then we can conclude that the process is **within** control.

Hence option (d) is correct.

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69. C Let the following notations be used:

X = Advertisement expenditure

Y = Sales

$$\hat{Y} = a + bX$$

$$b = \frac{n \sum XY - \sum X \sum Y}{n \sum X^2 - (\sum X)^2}$$

X	Y	X ²	XY
37	480	1369	17760
63	540	3969	34020
60	590	3600	35400
88	870	7744	76560
80	630	6400	50400
73	790	5329	57670
Total	401	3,900	28,411

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$$\sum XY = 2,71,810; \sum X = 401; \sum Y = 3,900$$

$$\sum X^2 = 28,411; n = 6$$

$$b = \frac{6(2,71,810) - (401)(3,900)}{6(28,411) - (401)^2} = \frac{66,960}{9,665} = 6.928$$

$$a = \bar{Y} - b\bar{X}$$

$$= \frac{3900}{6} - 6.928 \times \frac{401}{6}$$

$$= 186.9787.$$

$$\hat{Y} = a + bX$$

$$= 186.9787 + 6.928X$$

If X = 78, then

$$\hat{Y} = 186.9787 + 6.928 \times 78$$

$$= 727.3627.$$

70. D The following statements are true regarding dual of a LPP. [≤](#)
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[≥](#)
- I. The solution to a dual problem provides all essential information about the solution to the primal problem.
 - II. It may be easier to solve the Dual problem rather than the primal problem as when the primal involves few variables but many constraints.
- Given statement (III) is false because, For every Linear Programming formulation there exist one and only one Dual formulation.
- Hence option(d) is correct.
71. E Substitute the different values of X and Y of the vertices of the feasible region and find the maximum value of Z as follows: [≤](#)
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[≥](#)
- $Z = 8X + 6Y$
- For (0, 0), $Z = 8 \times 0 + 6 \times 0 = 0$
- For (0, 12), $Z = 8 \times 0 + 12 \times 6 = 72$
- For (15, 0), $Z = 8 \times 15 + 6 \times 0 = 120$
- For (12, 6), $Z = 8 \times 12 + 6 \times 6 = 132$.
- Hence (e) is the answer.
72. B The $(Z_j - C_j)$ row is also called the index row or the net evaluation row which is used to indicate whether the optimal solution has reached or not. The slack variables represent unused resources and therefore their contribution in the objective function is zero. To compute new values for the key row or pivot row, divide all values in the pivot row by the pivot element. [≤](#)
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73. A Let the number of type of A, B and C cars are A, B and C respectively.

Objective function: $55000A + 60000B + 72500C$

Subject to:

$$8A + 8B + 9C \leq 10120$$

$$8A + 9B + 11C \leq 11000$$

Using slack variables the constraints would look like

$$8A + 8B + 9C + S_1 = 10120 \quad \dots\dots\dots(i)$$

$$8A + 9B + 11C + S_2 = 11000 \quad \dots\dots\dots(ii)$$

So, the first tableau of the simplex method of this problem would look like

Tableau 1

			55000	60000	72500	0	0	
Variable	X_j	C_j	A	B	C	S_1	S_2	Min. Ratio
S_1	10120	0	8	8	9	1	0	$\frac{10120}{9} = 1124.4$
S_2	11000	0	8	9	11	0	1	$\frac{11000}{11} = 1000$
	$(Z_i - C_i)$		-55000	-60000	-72500	0	0	

Variable to enter: C

Variable to leave: S_2

Tableau 2

			55000	60000	72500	0	0	
Variable	Solution	C_j	A	B	C	S_1	S_2	Min. Ratio
S_1	1120	0	$\frac{16}{11}$	$\frac{7}{11}$	0	1	$\frac{9}{-11}$	$\frac{1120 \times 11}{16} = 770$
C	1000	72500	$\frac{8}{11}$	$\frac{9}{11}$	1	0	$\frac{1}{11}$	$\frac{1000 \times 11}{8} = 1375$
	$(Z_i - C_i)$		$-\frac{25000}{11}$	$-\frac{7500}{11}$	0	0	$\frac{72500}{11}$	

Variable to enter: A

Variable to leave: S_1

Tableau 3

			55000	60000	72500	0	0
Variable	Solution	C_j	A	B	C	S_1	S_2
A	770	55000	1	$\frac{7}{16}$	0	$\frac{11}{16}$	$\frac{9}{-16}$
C	440	72500	0	$\frac{1}{2}$	1	$-\frac{1}{2}$	$\frac{1}{2}$
	$(Z_i - C_i)$		0	312.5	0	$\frac{3125}{2}$	$\frac{10625}{2}$

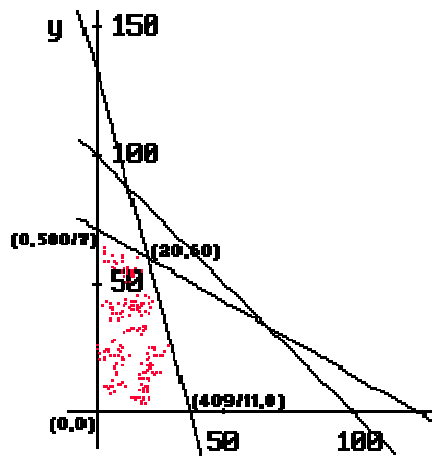
Since, all $(Z_i - C_i)$ value are non-negative, the optimal solution is reached

A = 770, B = 0, C = 440. So the company would not produce any type B cars.

74. A Objective function is maximize $f(x, y) = 143x + 60y$

Consider the corresponding system of linear equations and the feasible region:

$$\begin{cases} x + y = 100 \\ 120x + 210y = 15000 \\ 110x + 30y = 4000 \\ x, y = 0 \end{cases}$$



Feasible region vertices are $(0, 0)$, $(0, 500/7)$, $(400/11, 0)$ and $(20, 60)$.

Here the maximum value is **6460** at **$(20, 60)$** .

The value of x at the optimum solution is 20.

75. E A graphical solution to a linear programming problem will have multiple optimal solutions if the objective function is parallel to an edge of the feasible region which is in the direction of the optimal movement of the objective function. If none of the edges of the feasible region is parallel to the objective function then, the possibility of multiple optimal solutions does not arise.

76. A The dual of this problem would be

$$\begin{aligned} &\text{Maximize} && Z = 2X_1 + 6X_2 + 4X_3 \\ &\text{Subject to:} && X_1 + 3X_2 + 2X_3 \leq 12 \\ &&& X_1 + X_2 + X_3 \leq 20 \\ &&& X_1, X_2, X_3 \geq 0. \end{aligned}$$

77. D Modern-modulator demodulator is a device or program that enables a computer to transmit data over analogue telephone lines. Computer information is stored digitally, when as information transmitted over telephone lines is transmitted in the form of analogue base.

78. E The following are basic characteristics favoring the usage of computers

- I. Volume.
- II. Speed.
- III. Accuracy.
- IV. Complexity.

Hence option (e) is correct.

79. D Statement (d) is false. The correct statement is the symbols may be of any size, only the shape is standard.

Given statements (a), (b), (c) and (e) is true.

Hence option (d) is correct.

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