STATISTICS

1. Suppose a population A has 100 observations 101,102,....,200 and another population B has 100 observations 151,152,....,250 if V_A and V_B represent the variances of the two populations respectively, then $\frac{V_A}{V_B}$ is
   a) $\frac{9}{4}$ b) $\frac{4}{9}$ c) $\frac{2}{3}$ d) 1
2. The SD of 15 items is 6 and if each item is decreases by 1, then standard derivation will be
   a) 5 b) 7 c) $\frac{91}{15}$ d) 6
3. If the S. D. of a variate X is σ, then the S.D. of $a\,X + b$ is
   a) $|a|\ \sigma$ b) σ c) $a\,\sigma$ d) $a\,\sigma + b$
4. The mean weight of 9 items is 15. If one more item is added to the series, the mean becomes 16. The value of 10th item is
   a) 35 b) 30 c) 25 d) 20
5. The mean deviation from the mean of the set of observations, -1, 0, 4 is
   a) 3 b) 1 c) -2 d) 2
6. The regression coefficient of y on x is 2/3 and that of x on y is 4/3 .The acute angle between the two regression lines is $\tan^{-1} k$,where k is equal to
   a) 1/9 b) 2/9 c) 1/18 d) 1/3
7. The mean of the numbers a, b, 8,5,10 is 6 and the variance is 6.80. Then, which one of the following gives possible values of a and$b$?
   a) $a = 3, b = 4$ b) $a = 0, b = 7$ c) $a = 5, b = 2$ d) $a = 1, b = 6$
8. The mean-deviation and coefficient of mean deviation from the data. Weight (in kg) 54, 50, 40, 42, 51, 45, 47, 55, 57 is
   a) 0.0900 b) 0.0956 c) 0.0056 d) 0.0946
9. The weighted AM of first n natural numbers whose weights are equal to the corresponding numbers is equal to
   a) $2\,n + 1$ b) $\frac{1}{2}(2\,n + 1)$ c) $\frac{1}{3}(2\,n + 1)$ d) $\frac{2\,n + 1}{6}$
10. The median of 10,14,11,9,8,12,6 is
    a) 14 b) 11 c) 10 d) 12
11. If $\bar{x}$ is the arithmetic mean of n independent variates $x_1, x_2, x_3, \dots, x_n$ each of the standard derivation σ, then variance $(\bar{x})$ is
    a) $\frac{\sigma^2}{n}$ b) $\frac{n\sigma^2}{2}$ c) $\frac{(n+1)\sigma^2}{3}$ d) None of these
12. If 25% of the observations in a frequency distribution are less than 2 and 25% are more than 40, then the quartile deviation is
    a) 20 b) 30 c) 40 d) 10
13. Standard deviation for first 10 even natural numbers is
    a) 11 b) 7.74 c) 5.74 d) 11.48

14. The AM of the series $1, 2, 4, 8, 16, \ldots, 2^n$ is

a) $\frac{2^n - 1}{n}$ b) $\frac{2^{n+1} - 1}{n+1}$ c) $\frac{2^n + 1}{n}$ d) $\frac{2^n - 1}{n+1}$

15. The correlation coefficient of two variable x and y is 0.8. The regression coefficient of y on x is 0.2, than the regression coefficient of x on y is

a) 3.2 b) -3.2 c) 4 d) 0.16

16. The values of mean, median and mode coincide, then the distribution is

a) Positive skewness b) Symmetric distribution
c) Negative skewness d) All of the above

17. If $\bar{x} = \bar{y} = 0, \sum x_i y_i = 12, \sigma_X = 2, \sigma_Y = 3$ and $n = 10$, then the coefficient of correlation is

a) 0.1 b) 0.3 c) 0.2 d) 0.-1

18. The mode of the series 3,4,2,6,1,7,6,7,6,8,9,5 is

a) 5 b) 6 c) 7 d) 8

19. A data has highest value 120 and lowest value 71. A frequency distribution in descending order with seven classes is to be constructed. The limits of the second classes-interval shall be

a) 71 and 78 b) 78 and 85 c) 113 and 120 d) 106 and 113

20. A group of 10 items has arithmetic mean 6. If the arithmetic mean of 4 of these items is 7.5, then the mean of the remaining items is

a) 6.5 b) 5.5 c) 4.5 d) 5.0

21. The weighted mean of first n natural numbers whose weights are equal is given by

a) $\frac{n+1}{2}$ b) $\frac{2n+1}{2}$ c) $\frac{2n+1}{3}$ d) $\frac{(2n+1)(n+1)}{6}$

22. The variance of the first n natural numbers is

a) $\left(\frac{n^2-1}{12}\right)$ b) $\frac{n(n^2-1)}{12}$ c) $\left(\frac{n^2+1}{12}\right)$ d) $\frac{n(n^2+1)}{12}$

23. Following are the marks obtained by 9 students in Mathematics test: 50,69,20,33,53,39,40,65,59
The mean deviation from the median is

a) 9 b) 10.5 c) 12.67 d) 14.76

24. If the median of $\frac{x}{2}, \frac{x}{3}, \frac{x}{4}, \frac{x}{5}, \frac{x}{6}$ (where $x > 0$) is 6, then $x =$

a) 6 b) 18 c) 12 d) 24

25. Coefficient of skewness for the values
Median $= 18.8, Q_1 = 14.6, Q_3 = 25.2$ is

a) 0.2 b) 0.5 c) 0.7 d) None of these

26. The arithmetic mean of the squares of first n natural numbers is

a) $\frac{n+1}{6}$ b) $\frac{(n+1)(2n+1)}{6}$ c) $\frac{n^2-1}{6}$ d) None of these

27. If G_1, G_2 are the geometric means of two series of observations and G is the GM of the ratios of the corresponding observations then G is equal to

a) $\frac{G_1}{G_2}$ b) $\log G_1 - \log G_2$ c) $\frac{\log G_1}{\log G_2}$ d) $\log(G_1 \cdot G_2)$

28. The coefficient of correlation (r) and the two regression coefficients b_{yx}, b_{xy} are related as

a) $r = \frac{b_{xy}}{b_{yx}}$ b) $r = b_{xy} \times b_{yx}$
c) $r = b_{xy} + b_{yx}$ d) $r = (\text{sign } b_{yx})\sqrt{b_{xy}\, b_{yx}}$

29. Let a, b, c, d, e be the observations with mean m and standard deviation σ. The standard deviation of the observations $a + k, b + k, c + k, d + k, e + k$, is

a) σ b) $k\,\sigma$ c) $k + \sigma$ d) σ/k

30. If the S.D. of a variable X is σ, then the S.D. of $\frac{aX+b}{c}$ $(a, b, c$ are constant), is

a) $\frac{a}{c}\sigma$ b) $\left|\frac{a}{c}\right|\sigma$ c) $\left|\frac{c}{a}\right|\sigma$ d) $\frac{c}{a}\sigma$

31. The mean of the series $x_1, x_2, \dots, x_n$ is $\overline{X}$. If x_2 is replaced by λ, then the new mean is

a) $\overline{X} - x_2 + \lambda$ b) $\frac{\overline{X} - x_2 - \lambda}{n}$ c) $\frac{(n-1)\overline{X} + \lambda}{n}$ d) $\frac{n\overline{X} - x_2 + \lambda}{n}$

32. If σ is the standard deviation of a random variable x, then the standard deviation of the random variable $ax + b$, where $a, b \in R$ is

a) $a\sigma + b$ b) $|a|\sigma$ c) $|a|\sigma + b$ d) $a^2\sigma$

33. If the mean of a set of observations $x_1, x_2, \dots x_{10}$ is 20, then the mean of $x_1 + 4, x_2 + 8, \dots x_{10} + 40$ is

a) 34 b) 38 c) 40 d) 42

34. Which one of the following is correct?

a) Quartile derivation is one half of the sum of the upper and lower quartiles
b) For finding median, the items of the series are arranged in ascending or descending order of magnitude
c) Mean, mode, median have not same unit
d) SD can be computed from any average

35. The mean deviation from mean of the observation $a, a + d, a + 2d, \dots a + 2nd$ is

a) $\frac{n(n+1)d^2}{3}$ b) $\frac{n(n+1)}{2}d^2$ c) $a + \frac{n(n+1)d^2}{2}$ d) None of these

36. If the variance of 1, 2, 3, 4, 5, ..., 10 is $\frac{99}{12}$, then the standard derivation of 3, 6, 9, 12, ..., 30 is

a) $\frac{297}{4}$ b) $\frac{3}{2}\sqrt{33}$ c) $\frac{3}{2}\sqrt{99}$ d) $\sqrt{\frac{99}{12}}$

37. Consider first 10 positive integers having standard deviation 2.87. If we multiply each number by -1 and then add 1 to each number, the standard deviation of the numbers so obtained is

a) 8.25 b) 2.87 c) -2.87 d) -8.25

38. If SD of X is s, then SD of the variable $\mu = \frac{aX+b}{c}$, where a, b, c are constants, is

a) $\left|\frac{c}{a}\right|\sigma$ b) $\left|\frac{a}{c}\right|\sigma$ c) $\left|\frac{b}{c}\right|\sigma$ d) $\left|\frac{c^2}{a^2}\right|\sigma$

39. The S.D. of the series a, $a + d, a + 2d, \dots, a + 2nd$, is

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

40. In a moderately skewed distribution the values of mean and median are 5 and 6 respectively. The value of mode in such a situation is approximately equal to

a) 8 b) 11 c) 16 d) None of these

41. The quartile deviation for the following data is

x	2	3	4	5	6
f	3	4	8	4	1

a) 0 b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) 1

42. The median of the items 6, 10, 4, 3, 9, 11, 22, 18 is

a) 9 b) 10 c) 9.5 d) 11

43. If for a moderately skewed distribution, mode = 60 and mean = 66, then median =

a) 60 b) 64 c) 68 d) None of these

44. If a variable takes values 0, 1, 2, . . , n with frequencies q^n, ${}^nC_1q^{n-1}p$, ${}^nC_2q^{n-2}p^2, \dots {}^nC_np^n$, where $p + q = 1$, then the mean is

a) np b) nq c) $n(p + q)$ d) None of these

45. Consider the following statements :

1. The AM of first n natural number is $\frac{1}{6}n(2n+1)$

2. In a moderately symmetric distribution,

QD $\leq$ MD $\leq$ SD

Which of these is/are not correct?

a) Only (1) b) Only (2) c) Both (1) and (2) d) None of these

46. The AM of n observations is M. If the sum of $n-4$ observations is a, then the mean of remaining 4 observations is

a) $\frac{nM-a}{4}$ b) $\frac{nM+a}{2}$ c) $\frac{nM-a}{2}$ d) $nM+a$

47. The standard derivation of the observations 22, 26, 28, 20, 24, 30 is

a) 2 b) 2.4 c) 3 d) 3.42

48. The age distribution of workers in a factory is as fallows :

Age in Years	No. of Workers
20-28	45
36-44	100
44-52	42
52-60	18

If 15% of the total strength starting from lowest age group is retrenched and 20% of the total strength from the highest age groups is given premature retirement, then the age limit of workers retained in the factory is

a) 20-36 b) 28-44 c) 28-52 d) 36-52

49. In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class is 72, then what is the average of the girls?

a) 73 b) 65 c) 68 d) 74

50. In a college of 300 students every student reads 5 newspapers and every newspaper is read by 60 students. The number of newspapers are

a) At least 30 b) At most 20 c) Exactly 25 d) None of these

51. If the sum of the mode and men of a certain frequency distribution is 129 and the median of the observations is 63, mode and median are respectively

a) 69 and 60 b) 65 and 64 c) 68 and 61 d) None of these

52. For a series the value of mean deviation is 15, the most likely value of its quartile derivation is

a) 12.5 b) 11.6 c) 13 d) 9.7

53. If the mean of n items is $\bar{x}$ and the sum of any $(n-1)$ number is R, then the value of left item is

a) $n+\bar{x}$ b) $n\bar{x}-R$ c) $\bar{x}+Rn$ d) $n\bar{x}-nR$

54. If the mean deviation of number $1, 1+d, 1+2d, \ldots\ldots, 1+100d$ from their mean is 255, then the d is equal to

a) 10.0 b) 20.0 c) 10.1 d) 20.2

55. The weight (in kilogram) of 15 students are as follows 31, 35, 27, 29, 32, 43, 37, 41, 34, 28, 36, 44, 45, 42, 30. If the weight 44 kg is replaced by 46 kg and 27 kg is by 25 kg, then new median is

a) 32 b) 33 c) 34 d) 35

56. Consider the frequency distribution given below

Class-Interval	Frequency
0-10	4
10-20	6
20-30	10
30-40	16
40-50	14

The mean of the above distribution is

a) 25 b) 35 c) 30 d) 31

57. If the variance of 1,2,3,4,5,...,10 is $\frac{99}{12}$, then the standard derivation of 3,6,9,12,...., 30 is

a) $\frac{297}{4}$ b) $\frac{3}{2}\sqrt{33}$ c) $\frac{3}{2}\sqrt{99}$ d) $\sqrt{\frac{99}{12}}$

58. If each observation of a raw data whose variance is σ^2 is multiplied by h, then the variance of the new set is

a) σ^2 b) $h^2\sigma^2$ c) $h\,\sigma^2$ d) $h+\sigma^2$

59. The mean income of a group of workers is $\overline{X}$ and that of another group is $\overline{Y}$. If the number of workers in the second group is 10 times the number of workers in the first group, then the mean income of the combined group is

a) $\frac{\overline{X}+10\,\overline{Y}}{3}$ b) $\frac{\overline{X}+10\,\overline{Y}}{11}$ c) $\frac{10\,\overline{X}+\overline{Y}}{Y}$ d) $\frac{X+10\,\overline{Y}}{9}$

60. If $\overline{X}$ is the mean of $x_1, x_2, x_3 \dots x_n$. Then, the algebraic sum of the deviations about mean $\overline{X}$ is

a) 0 b) $\overline{X}$ c) $n\,\overline{X}$ d) None of these

61. The median of a set of 9 distinct observations is 20.5. if each of the largest 4 observations of the set is increased by 2, then the median of the new set

a) Is increased by 2
b) Is decreased by 2
c) Is two times the original median
d) Remains the same as that of the original set

62. Mean and standard deviation from the following observations of marks of 5 students of a tutorial group (marks out of 25)8, 12, 13, 15, 22 are respectively

a) 14, 4.604 b) 15, 4.604 c) 14, 5.604 d) None of these

63. The mean age of a combined group of men and women is 25 yr. If the mean age of the group of men is 26 yr and that of the group of women is 21 yr, then the percentage of men and women in the group are respectively

a) 60, 40 b) 80, 20 c) 20, 80 d) 40, 60

64. If G is the GM of the product of r sets of observations with geometric means $G_1, G_2, \dots, G_r$ respectively, then G is equal to

a) $\log G_1 + \log G_2 + \cdots + \log G_r$ b) $G_1 \cdot G_2 \cdot \dots \cdot G_r$ c) $\log G_1 \cdot \log G_2 \dots \log G_r$ d) None of these

65. The frequency distribution of marks obtained by 28 students in a test carrying 40 marks is given below:

Marks :	0-10	10-20	20-30	30-40
Number of students :	6	x	y	6

If the mean of the above data is 20, then the difference between x and y is

a) 3 b) 2 c) 1 d) 0

66. Coefficient of deviation is calculated by the formula

a) $\frac{\overline{X}}{\sigma} \times 100$ b) $\frac{\overline{X}}{\sigma}$ c) $\frac{\sigma}{\overline{X}} \times 100$ d) $\frac{\sigma}{\overline{X}}$

67. The standard deviation of the data 6, 5, 9, 13, 12, 8, 10 is

a) $\sqrt{\frac{52}{7}}$ b) $\frac{52}{7}$ c) $\sqrt{6}$ d) 6

68. In a moderately skewed distribution the values of mean and median are 5 and 6 respectively. The value of mode in such a situation is approximately equal to

a) 8 b) 11 c) 16 d) None of these

69. If $\bar{X}_1$ and $\bar{X}_2$ are the means of two distributions, such that $\bar{X}_1 < \bar{X}_2$ and $\bar{X}$ is the mean of the combined distribution, then

a) $\bar{X} < \bar{X}_1$ b) $\bar{X} > \bar{X}_2$ c) $\bar{X} = \frac{\bar{X}_1 + \bar{X}_2}{2}$ d) $\bar{X}_1 < \bar{X} < \bar{X}_2$

70. The sum of deviations of n observations about 25 is 25 and sum of deviations of the same n observations about 35 is -25. The mean of observations is

a) 25 b) 30 c) 35 d) 40

71. If two lines of regression are $3\bar{x} - 2\bar{y} + 1 = 0$ and $2\bar{x} - \bar{y} - 2 = 0$, then $(\bar{x}, \bar{y})$is

a) (8,5) b) (5,8) c) (5,5) d) (8,8)

72. Consider the following statements

(1) Mode can be computed from histogram

(2) Median is not independent of change of scale

(3) Variance is independent of change of origin and scale

Which of these is/are correct?

a) Only (1) b) Only (2)

c) Only (1) and (2) d) Only (1), (2) and (3)

73. Let G_1, G_2 be the .....geometric means of two ...... series $x_1, x_2, \dots . . x_n; y_1, y_2, \dots, y_n$. If G is the geometic mean of $\frac{x_i}{y_i}, i = 1, 2, \dots, n$. Then G is equal to

a) $G_1 - G_2$ b) $\frac{\log G_1}{\log G_2}$ c) $\frac{G_1}{G_2}$ d) $\log\left(\frac{G_1}{G_2}\right)$

74. The mean deviation of the data 3,10,10,4,7,10,5 from the mean is

a) 2 b) 2.57 c) 3 d) 3.75

75. Sum of absolute deviations about median is

a) Least b) Greatest c) Zero d) None of these

76. Mean deviation for n observations $x_1, x_2, \dots, x_n$ from their mean $\overline{X}$ is given by

a) $\sum_{i=1}^{n}(x_i - \overline{X})$ b) $\frac{1}{n}\sum_{i=1}^{n}|x_i - \overline{X}|$ c) $\sum_{i=1}^{n}(x_i - \overline{X})^2$ d) $\frac{1}{2}\sum_{i=1}^{n}(x_i - \overline{X})^2$

77. For the given data, the calculation corresponding to all values of variates (x, y) is following $\sum(x - \bar{x})^2 = 36, \sum(y - \bar{y})^2 = 25, \sum(x - \bar{x})(y - \bar{y}) = 20$. The Karl Pearson's correlation coefficient is

a) 0.2 b) 0.5 c) 0.66 d) 0.33

78. The correlation coefficient between x and y from the following data $\sum x = 40$, $\sum y = 50, \sum xy = 220, \sum x^2 = 200, \sum y^2 = 262, n = 10$ is

a) 0.89 b) 0.76 c) 0.91 d) 0.98

79. If the two lines of regression are $x + 4y = 3$ and $3x + y = 15$, then value of x for $y = 3$ is

a) 4 b) -9 c) -4 d) None of these

80. The mean of discrete observations $y_1, y_2, \dots, y_n$ is given by

a) $\frac{\sum_{i=1}^{n} y_i f_i}{\sum_{i=1}^{n} f_i}$ b) $\frac{\sum_{i=1}^{n} y_i f_i}{n}$ c) $\frac{\sum_{i=1}^{n} y_i}{n}$ d) $\frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} i}$

81. The following information relates to a sample of size 60: $\sum x_i^2 = 18000, \sum x_i = 960$. The variance is

a) 6.63 b) 16 c) 22 d) 44

82. If in a moderately skewed distribution the values of mode and mean are 6 λ and 9 λ respectively, then the value of the median is

a) 8 λ b) 7 λ c) 6 λ d) 5 λ

83. If the average of the numbers 148, 146, 144, 142, ... in AP, be 125, then the total numbers in the series will be

a) 18 b) 24 c) 30 d) 48

84. The two regression lines are $2x - 7y + 6 = 0$ and $7x - 2y + 1 = 0$. The correlation coefficient between x and y is

a) $-\frac{2}{3}$ b) $\frac{2}{7}$ c) $\frac{4}{9}$ d) None of these

85. An ogive is used to determine

a) Mean b) Median c) Mode d) HM

86. The mean of 30 given numbers, when it is given that the mean of 10 of them is 12 and the mean of the remaining 20 is 9, is equal to

a) 11 b) 10 c) 9 d) 5

87. If the median of 33,28,20,25,34, x is 29, then the maximum possible value of x is

a) 30 b) 31 c) 29 d) 32

88. Let $x_1, x_2, x_3, \dots, x_n$ be n observations and $\overline{X}$ be their arithmetic mean. The formula for the standard deviation is given by

a) $\sum_{i=1}^{n}(x_i-\overline{X})^2$ b) $\frac{1}{n}\sum_{i=1}^{n}(x_i-\overline{X})^2$ c) $\sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i-\overline{X})^2}$ d) $\sqrt{\frac{1}{n}\sum_{i=1}^{n}x_i^2+\overline{X}^2}$

89. If in a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately

a) 24.0 b) 25.5 c) 20.5 d) 22.0

90. The arithmetic mean of a set of observations is $\overline{X}$. If each observation is divided by α and then is increased by 10, then the mean of the new series is

a) $\frac{\overline{X}}{\alpha}$ b) $\frac{\overline{X}+10}{\alpha}$ c) $\frac{\overline{X}+10\,\alpha}{\alpha}$ d) $\alpha\,\overline{X}+10$

91. The mean age of a combined group of men and women is 25 yrs. If the mean age of the group of men is 26 and that of the group of women is 21, then the percentage of men and women in the group is

a) 60, 40 b) 80, 20 c) 20, 80 d) 40, 60

92. If the standard deviation of $x_1, x_2, \dots x_n$ is 3.5, then the standard deviation of $-2x_1-3, -2x_2-3, \dots, -2x_n-3$ is

a) -7 b) -4 c) 7 d) 1.75

93. If $\sum_{i=1}^{18}(x_i-8)=9$ *and* $\sum_{i=1}^{18}(x_i-8)^2=45$, then the standard derivation of $x_1, x_2, \dots, x_{18}$ is

a) $\frac{4}{9}$ b) $\frac{9}{4}$ c) $\frac{3}{2}$ d) None of these

94. The marks of some students were listed out of 75. The SD of marks was found to be 9. Subsequently the marks were raised to a maximum of 100 and variance of new marks was calculated. The new variance is

a) 81 b) 122 c) 144 d) None of these

95. If a variable X takes values $0,1,2,\dots,n$ with frequencies proportional to the binomial coefficients ${}^nC_0, {}^nC_1, {}^nC_2, \dots, {}^nC_n$, then the Var (X) is

a) $\frac{n^2-1}{12}$ b) $\frac{n}{2}$ c) $\frac{n}{4}$ d) None of these

96. If the standard deviation of the observation $-5,-4,-3-2,-1,0,1,2,3,4,5$ is $\sqrt{10}$. The standard deviation of observations 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 will be

a) $\sqrt{10}+20$ b) $\sqrt{10}+10$ c) $\sqrt{10}$ d)

97. The, coefficient of SD and coefficient of variance from the given data is

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	2	10	8	4	6

a) 50, 48.1 b) 51.9, 48.1

c) 0.481, 48.1 d) 0.481, 51.8

98. The mean of the distribution, in which the values of X are $1,2,\dots,n$, the frequency of each being unity is:

a) $\frac{n(n+1)}{2}$ b) $\frac{n}{2}$ c) $\frac{n+1}{2}$ d) None of these

99. The mean deviation from the median is

a) Equal to that measured from another value

b) Maximum if all observations are positive

c) Greater than that measured from any other value
d) Less than that measured from any other value

100. If r is Karl Pearson's coefficient of correlation between two sets of variates, then
a) $r < 1$ b) $r > 1$ c) $r < -1$ d) $|r| \leq 1$

101. 10 is the mean of a set of 7 observations and 5 is the mean of a set of 3 observations. The mean of the combined set is given by
a) 15 b) 10 c) 8.5 d) 7.5

102. The AM. of a set of 50 numbers is 38. If two numbers of the set, namely 55 and 45 are discarded, the AM of the remaining set of numbers is
a) 36 b) 36.5 c) 37.5 d) 38.5

103. The mode of the distribution is

Marks	Number of Students
4	6
5	7
6	10
7	8
8	3

a) 5 b) 6 c) 8 d) 10

104. The AM of n observations is$M$. If the sum of $(n-4)$ observations is a, then the mean of remains four observations is
a) $\frac{nM-a}{4}$ b) $\frac{nM+a}{2}$ c) $\frac{nM-a}{2}$ d) $nM+a$

105. The mean deviation from the mean of the series a, $a+d, a+2\,d, \dots, a+2nd$, is
a) $n(n+1)d$ b) $\frac{n(n+1)d}{2\,n+1}$ c) $\frac{n(n+1)d}{2\,n}$ d) $\frac{n(n-1)d}{2\,n+1}$

106. If the first item is increased by 1, second by 2 and so on, then the new mean is
a) $\overline{X}+n$ b) $\overline{X}+\frac{n}{2}$ c) $\overline{X}+\frac{n+1}{2}$ d) None of these

107. If the mean of the set of numbers $x_1, x_2, \dots x_n$ is $\bar{x}$, then the mean of the numbers $x_i+2i, 1 \leq i \leq n$ is
a) $\bar{x}+2n$ b) $\bar{x}+2$ c) $\bar{x}+n+1$ d) $\bar{x}+n$

108. Standard deviation for first 10 natural number is
a) 5.5 b) 3.87 c) 2.97 d) 2.87

109. The value of mean, median and mode coincides, then the distribution is
a) Positive skewness
b) Symmetrical distribution
c) Negative skewness
d) All of the above

110. The geometric mean of numbers $7, 7^2, 7^3, \dots 7^n$, is
a) $7^{7/4}$ b) $7^{4/7}$ c) $7^{\frac{n-1}{2}}$ d) $7^{\frac{n+1}{2}}$

111. In any discrete series (when all values are not same) the relationship between M.D. about mean and S.D. is
a) $\text{M.D.} = \text{S.D.}$ b) $\text{M.D.} \geq \text{S.D.}$ c) $\text{M.D} < \text{S.D.}$ d) $\text{M.D.} \leq \text{S.D.}$

112. The quartile deviation of daily wages of 7 persons which are Rs. 12, 7, 15, 10, 17, 17, 25 is
a) 14.5 b) 7 c) 9 d) 3.5

113. When the origin is changed, then the coefficient of correlation
a) Becomes zero b) Varies c) Remains fixed d) None of these

114. The standard deviation of the numbers 31, 32, 33,...., 46, 47 is
a) $\sqrt{\frac{17}{12}}$ b) $\sqrt{\frac{47^2-1}{12}}$ c) $2\sqrt{6}$ d) $4\sqrt{3}$

115. The one which is the measure of the central tendency is
a) Mode
b) Mean deviation

c) Standard deviation

d) Coefficient of correlation

116. The mean weight of 9 items is 15. If one more item is added to the series the mean becomes 16. The value of 10th items is

a) 35 b) 30 c) 25 d) 20

117. The median from the table is

Value	7	8	10	9	11	12	13
Frequency	2	1	4	5	6	1	3

a) 100 b) 10 c) 110 d) 1110

118. The AM of ${}^{2n+1}C_0, {}^{2n+1}C_1, {}^{2n+1}C_2, \dots, {}^{2n+1}C_n$ is

a) $\frac{2^n}{n}$ b) $\frac{2^n}{n+1}$ c) $\frac{2^{2n}}{n}$ d) $\frac{2^{2n}}{(n+1)}$

119. If both the regression lines intersect perpendicularly, then

a) $r < -1$ b) $r = -1$ c) $r = 0$ d) $r = \frac{1}{2}$

120. For the arithmetic progression $a, (a+d), (a+2d), (a+3d), \dots \dots, (a+2nd)$, the mean deviation from mean is

a) $\frac{n(n+1)d}{2n-1}$ b) $\frac{n(n+1)d}{2n+1}$ c) $\frac{n(n-1)d}{2n+1}$ d) $\frac{(n+1)d}{2}$

121. The standard deviation of the data:

x: 1 a a^2 $\cdots$ a^n

f: ${}^nC_0$ ${}^nC_1$ ${}^nC_2$ $\cdots$ ${}^nC_n$

is

a) $\left(\frac{1+a^2}{2}\right)^n - \left(\frac{1+a}{2}\right)^n$

b) $\left(\frac{1+a^2}{2}\right)^{2n} - \left(\frac{1+a}{2}\right)^n$

c) $\left(\frac{1+a}{2}\right)^{2n} - \left(\frac{1+a^2}{2}\right)^n$

d) None of these

122. If var(x) =8.25, var(y) =33.96 and cov$(x, y) = 10.2$ then the correlation coefficient is

a) 0.89 b) -0.98 c) 0.61 d) -0.16

123. If the difference between the mode and median is 2, then the difference between the median and mean is (in the given order)

a) 2 b) 4 c) 1 d) 0

124. If the lines of regression are $3x + 12y = 19$ and $3y + 9x = 46$, then r_{xy} will be

a) 0.289 b) -0.289 c) 0.209 d) None of these

125. If $\sum x = 15, \sum y = 36, \sum xy = 110, n = 5$, then cov$(x, y)$ equals

a) 1/5 b) -1/5 c) 2/5 d) -2/5

126. A statistical measure which cannot be determined graphically is

a) Median b) Mode c) Harmonic mean d) Mean

127. The mean of n observations is $\bar{x}$. If one observation x_{n+1} is added, then the mean remains same. The value of x_{n+1} is

a) 0 b) 1 c) n d) $\bar{x}$

128. Let $x_1, x_2, x_3, \dots, x_n$ be n observations with mean m and standard deviation s. Then the standard deviation of the observations $ax_1, ax_2, ax_3, \dots, ax_n$, is

a) $a + x$ b) s/a c) $|a|$ s d) as

129. The positional average of central tendency is

a) GM b) HM c) AM d) Median

130. The mean of a set of observations is $\bar{x}$. If each observation is divided by, $\alpha \neq 0$ and then is increased by 10, then the mean of the new set is

a) $\frac{\bar{x}}{\alpha}$ b) $\frac{\bar{x}+10}{\alpha}$ c) $\frac{\bar{x}+10\alpha}{\alpha}$ d) $\alpha\bar{x}+10$

131. The median of 19 observations of a group is 30. If two observations with values 8 and 32 are further included, then the median of the new group of 21 observations will be

a) 28 b) 30 c) 32 d) 34

132. The variance of first n natural numbers is

a) $\frac{n^2+1}{12}$ b) $\frac{n^2-1}{12}$ c) $\frac{(n+1)(2n+1)}{6}$ d) None of these

133. What is the standard deviation of the following series.

Measurements	0-10	10-20	20-30	30-40
Frequency	1	3	4	2

a) 81 b) 7.6

c) 9 d) 2.26

134. If a variable takes discrete values $x+4, x-\frac{7}{2}, x-\frac{5}{2}, x-3, x-2, x+\frac{1}{2}, x-\frac{1}{2}, x+5, (x>0)$, then the median is

a) $x-\frac{5}{4}$ b) $x-\frac{1}{2}$ c) $x-2$ d) $x+\frac{5}{4}$

135. The weighted AM of first n natural numbers whose weights are equal to the corresponding numbers is equal to

a) $2n+1$ b) $\frac{1}{2}(2n+1)$ c) $\frac{1}{3}(2n+1)$ d) $\frac{2n+1}{6}$

136. If each of n numbers $x_i = i$ is replaced by $(i+1)x_i$, then the new mean is

a) $\frac{(n+1)(n+2)}{n}$ b) $n+1$ c) $\frac{(n+1)(n+2)}{3}$ d) None of these

137. The most stable measure of central tendency is

a) The mean b) The median c) The mode d) None of these

138. If the median of the scores $1, 2, x, 4, 5$ (where $1<2<x<4<5$) is 3, then the mean of the scores is

a) 2 b) 3 c) 4 d) 5

139. Mode of a certain series is x. If each score is decreased by 3, then mode of the new series is

a) x b) $x-3$ c) $x+3$ d) $3x$

140. The coefficient of quartile deviation is calculated by the formula

a) $\frac{Q_1+Q_2}{4}$ b) $\frac{Q_3+Q_1}{4}$ c) $\frac{Q_3-Q_1}{Q_3+Q_1}$ d) $\frac{Q_2+Q_1}{Q_2-Q_1}$

141. The means of a set of numbers is $\overline{X}$. If each number is divided by 3, then the new mean is

a) $\overline{X}$ b) $\overline{X}+3$ c) $3\overline{X}$ d) $\frac{\overline{X}}{3}$

142. The variance of the data 2, 4, 6, 8, 10 is

a) 6 b) 7 c) 8 d) None of these

143. If the sum of 11 consecutive natural numbers is 2761, then the middle number is

a) 249 b) 250 c) 251 d) 252

144. If the two lines of regression are $4x+3y+7=0$ and $3x+4y+8=0$,then the means of x and y are

a) $\frac{-4}{7}, \frac{-11}{7}$ b) $\frac{-4}{7}, \frac{11}{7}$ c) $\frac{4}{7}, \frac{-11}{7}$ d) 4,7

145. The AM of n numbers of a series is $\overline{X}$. If the sum of first $(n-1)$ terms is k, then the n^{th} number is

a) $\overline{X}-k$ b) $n\overline{X}-k$ c) $\overline{X}-nk$ d) $n\overline{X}-nk$

146. The 7th percentile is equal to

a) 7th decile b) Q_3 c) 6th decile d) None of these

147. Which of the following is not a measure of central tendency

a) Mean b) Median c) Mode d) Range

148. The median can graphically be found from

a) Ogive b) Histogram c) Frequency curve d) None of these

149. Mean of 100 observation is 45. If it was later found that two observations 19 and 31 were incorrectly recorded as 91 and 13. The correct mean is

a) 44 b) 45 c) 44.46 d) 45.54

150. If the regression coefficients are 0.8 and 0.2, then the value of coefficient of correlation is

a) 0.16 b) 0.4 c) 0.04 d) 0.164

151. The arithmetic mean of ${}^nC_0$, ${}^nC_1$, ${}^nC_2, \dots, {}^nC_n$, is

a) $\frac{2^n}{n}$ b) $\frac{2^n-1}{n}$ c) $\frac{2^n}{n+1}$ d) $\frac{2^{n-1}}{n+1}$

152. If there exists a linear statistical relationship between two variable x and y, then the regression coefficient of yon x is

a) $\frac{cov(x,y)}{\sigma_x\sigma_y}$ b) $\frac{cov(x,y)}{\sigma^2{}_y}$ c) $\frac{cov(x,y)}{\sigma_x^2}$ d) None of these

153. Mean marks scored by the students of a class is 53. The mean marks of the girls is 55 and the mean marks of the boys is 50. What is the percentage of girls in the class?

a) 60% b) 40% c) 50% d) 45%

154. The mean age of a combined group of men and women is 25 yr. if the mean age of the group of men is 26 and that of the group of women is 21, then the percentage of men and women in the group is

a) 46, 60 b) 80, 20 c) 20, 80 d) 60, 40

155. The best statistical measure used for comparing two series is

a) Mean derivation b) Range

c) Coefficient of variation d) None of these

156. If the mean of n observations $1^2, 2^2, 3^2, \dots, n^2$ is $\frac{46n}{11}$, then n is equal to

a) 11 b) 12 c) 23 d) 22

157. A batsman scores runs in 10 innings as 38, 70, 48, 34, 42, 55, 63, 46, 54 and 44. The mean deviation about mean is

a) 8.6 b) 6.4 c) 10.6 d) 7.6

158. The intersecting point of two regression lines is

a) $(\bar{x},0)$ b) $(0,\bar{y})$ c) (b_{xy}, b_{yx}) d) $(\bar{x},\bar{y})$

159. If the values of regression coefficients are -0.33 and -1.33, then the value of coefficients of correlation between the two variables, is

a) 0.2 b) -0.66 c) 0.4 d) -0.4

160. In a bivariate data $\Sigma x = 30, \Sigma y = 400, \Sigma x^2 = 196, \Sigma xy = 850\ and\ n = 10$. the regression coefficient of y on x is

a) -3.1 b) -3.2 c) -3.3 d) -3.4

161. The mode of the data 6,4,3,6,4,3,4,6,3, x can be

a) Only 5 b) Both 4 and 6 c) Both 3 and 6 d) 3, 4 or 6

162. The arithmetic mean of first n odd natural numbers is

a) n b) $\frac{n+1}{2}$ c) $n-1$ d) None of these

163. If a variable takes discrete values $x+4, x-\frac{7}{2}, x-\frac{5}{2}, x-3, x-2, x+\frac{1}{2}, x-\frac{1}{2}, x+5, (x>0)$ then the median is

a) $x-\dfrac{5}{4}$ b) $x-\dfrac{1}{2}$ c) $x-2$ d) $x+\dfrac{5}{4}$

164. If $x_1, x_2, x_3, \dots, x_n$ are n values of a variable X and $y_1, y_2, \dots, y_n$ are n values of a variable Y such that $y_i = \frac{x_i-a}{h}; i=1,2,\dots,n$, then

a) $\text{Var}(Y) = \text{Var}(X)$
b) $\text{Var}(X) = h^2 \text{Var}(Y)$
c) $\text{Var}(Y) = h^2 \text{Var}(X)$
d) $\text{Var}(X) = h^2 \text{Var}(Y) + a$

165. If a variate X is expressed as a linear function of two variates $\mathcal{U}$ and V the form $X = a\,\mathcal{U} + b\,V$, then mean $\overline{X}$ of X is

a) $a\overline{\mathcal{U}} + b\overline{V}$ b) $\overline{\mathcal{U}} + \overline{V}$ c) $b\,\overline{\mathcal{U}} + a\overline{\mathcal{U}}$ d) None of these

166. The means and variance of n observations $x_1, x_2, x_3, \dots, x_n$ are 5 and 0 respectively. If $\sum_{i=1}^{n} x_i^2 = 400$, then the value of n is equal to

a) 80 b) 25 c) 20 d) 16

167. Given the following frequency distribution with some missing frequencies

Class	Frequency
10-20	180
20-30	-
30-40	34
40-50	180
50-60	136
60-70	-
70-80	50

If the total frequency is 685 and median is 42.6, then missing frequencies are respectively

a) 81, 24 b) 80, 25 c) 82, 23 d) 83, 22

168. Let r be the range and $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i-\overline{x})^2$ be the S.D. of a set observations $x_1, x_2, \dots, x_n$, then

a) $S \le r\sqrt{\dfrac{n}{n-1}}$ b) $S = r\sqrt{\dfrac{n}{n-1}}$ c) $S \ge r\sqrt{\dfrac{n}{n-1}}$ d) None of these

169. The variance of first n numbers is

a) $\frac{n^2+1}{12}$ b) $\frac{n^2-1}{12}$ c) $\frac{(n+1)(2n+1)}{6}$ d) $\left[\frac{n(n+1)}{2}\right]^2$

170. Quartile deviation is

a) $\dfrac{4}{5}\sigma$ b) $\dfrac{3}{2}\sigma$ c) $\dfrac{2}{3}\sigma$ d) $\dfrac{5}{4}\sigma$

171. If the mean of the following distribution is 13, then $p =$

x_i :	5	10	12	17	16	20
f_i :	9	3	p	8	7	5

a) 6 b) 7 c) 10 d) 4

172. If a variable x takes values x_i such that $a \le x_i \le b$, for $i = 1, 2, \dots n$, then

a) $a^2 \le \text{var}(x) \le b^2$ b) $a \le \text{var}(x) \le b$ c) $\dfrac{a^2}{4} \le \text{var}(x)$ d) $(b-a)^2 \ge \text{var}(x)$

173. If $y = f(x)$ be a monotonically increasing or decreasing function of x and M is the median of variable x, then the median of y is

a) $f(M)$ b) $M/2$ c) $f^{-1}(M)$ d) None of these

174. For a certain, frequency table which has been partly reproduced here, the Arithmetic mean was found to be Rs 28.07

Income (in Rs)	No. of workers
15	8

20	12
25	?
30	16
35	?
40	10

If the total number of workers is 75, then missing frequencies are respectively

a) 14, 15 b) 15, 14 c) 13, 16 d) 12, 17

175. In an experiment with 15 observations on$x$, the following results were available$\sum x^2 = 2830, \sum x = 170$. One observation that was 20, was found to be wrong and was replaced by the correct value 30. Then, the corrected variance is

a) 78.0 b) 188.66 c) 177.33 d) 8.33

176. The following age group are included in the proportion indicated

Age Group	Relative Proportion in Population
12-17	0.17
18-23	0.31
24-29	0.27
30-35	0.21
36+	0.04

How many of each age group should be included in a sample of 3000 people to make the sample representative?

a) 850, 155, 135, 905, 955 b) 510, 930, 810, 630, 120
c) 600, 600, 600, 600, 600 d) 510, 630, 950, 100, 810

177. The mean of the value of $1, 2, 3, \dots n$ with respectively frequencies $x, 2x, 3x, \dots nx$ is

a) $\frac{n}{2}$ b) $\frac{1}{3}(2n+1)$ c) $\frac{1}{6}(2n+1)$ d) $\frac{n}{2}$

178. If $Z = aX + bY$ and r be the correlation coefficient between X and Y, then σ_Z^2 is equal to

a) $a^2\sigma_X^2 + b^2\sigma_Y^2 + 2abr\sigma_X\sigma_Y$ b) $a^2\sigma_X^2 + b^2\sigma_Y^2 - 2abr\sigma_X\sigma_Y$
c) $2abr\sigma_X\sigma_Y$ d) None of the above

179. The mean deviation of the series $a, a+d, a+2d, \dots, a+2nd$ from its mean, is

a) $\frac{(n+1)d}{2n+1}$ b) $\frac{nd}{2n+1}$ c) $\frac{n(n+1)d}{2n+1}$ d) $\frac{(2n+1)d}{n(n+1)}$

180. The AM of the series $1, 2, 4, 8, 16, \dots, 2^n$, is

a) $\frac{2^n - 1}{n}$ b) $\frac{2^{n+1} - 1}{n+1}$ c) $\frac{2^n + 1}{n}$ d) $\frac{2^n - 1}{n+1}$

181. A group of 10 items has arithmetic mean 6. If the arithmetic mean of 4 of these items is 7.5, then the mean of the remaining items is

a) 6.5 b) 5.5 c) 4.5 d) 5.0

182. If the coefficient of variation is 45% and the mean is 12 then its standard derivation is

a) 5.2 b) 5.3 c) 5.4 d) None of these

183. Consider any set of 201 observations$x_1, x_2, \dots x_{200}, x_{201}$. It is given that $x_1 < x_2 < \dots < x_{200} < x_{201}$. Then, the mean deviation of this set of observations about a point k is minimum when k equals

a) $(x_1 + x_2 + \dots + x_{200} + x_{201})/201$ b) x_1 c) x_{101} d) x_{201}

184. Consider the following statements :

1. The values of median and mode can be determined graphically
2. Mean, Median and Mode have the same unit
3. Range is the best measure of dispersion.

Which of these is/are correct?

a) (1) alone b) (2) alone c) Both (2) and (3) d) None of these

185. Variance is independent of change of

a) Origin only b) Scale only c) Origin and scale both d) None of these

186. The algebraic sum of the deviation of 20 observations measured from 30 is 2. Then, mean of observations is

a) 28.5 b) 30.1 c) 30.5 d) 29.6

187. The average marks of boys in a class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is

a) 40% b) 20% c) 80% d) 60%

188. If the mean of five observations $x, x+2, x+4, x+6$ and $x+8$ is 11, then the mean of last three observations is

a) 13 b) 15 c) 17 d) None of these

189. In a series of $2n$ observations, half of them equal a and remaining half equal $-a$. If the standard deviation of the observations is 2, then $|a|$ equals

a) $\frac{1}{n}$ b) $\sqrt{2}$ c) 2 d) $\frac{\sqrt{2}}{n}$

190. The weighted means of first n natural numbers whose weights are equal to the squares of corresponding numbers is

a) $\frac{n+1}{2}$ b) $\frac{3\,n(n+1)}{2(2\,n+1)}$ c) $\frac{(n+1)(2\,n+1)}{6}$ d) $\frac{n(n+1)}{2}$

191. Which one of the following statements is incorrect?

a) If $\overline{X}$ is the mean of n values of a variable X, then $\sum_{i=1}^{n}(x_i - \overline{X})$ is equal to 0

b) If $\overline{X}$ is the mean of n values of a variable X and a has any value other than $\overline{X}$, then $\sum_{i=1}^{n}(x_1 - \overline{X})^2$ is the least value of $\sum_{i=1}^{n}(x_i - a)^2$

c) The mean deviation of the data is least when deviations are taken about mean

d) The mean deviation of the data is least when deviations are taken about median

192. The mean of n items is $\bar{X}$. If the first term is increased by 1, second by 2 and so on, then the new mean is

a) $\bar{X}+n$ b) $\bar{X}+\frac{n}{2}$ c) $\bar{X}+\frac{n+1}{2}$ d) None of these

193. The standard deviation for the scores 1, 2, 3, 4, 5, 6 and 7 is 2. Then, the standard deviation of 12, 23, 34, 45, 56 , 67 and 78 is

a) 2 b) 4 c) 22 d) 11

194. The first of two samples has 100 items with mean 15 and SD=3. If the whole group has 250 items with mean 15.6 and $SD = \sqrt{13.44}$, the SD of the second group is

a) 4 b) 5 c) 6 d) 3.52

195. The GM of the series 1,2,4,8,16, ... , 2^n is

a) $2^{n+1/2}$ b) 2^{n+1} c) $2^{n/2}$ d) 2^n

196. The standard deviation of a variable x is 10. Then, the standard deviation of $50+5x$ is

a) 50 b) 550 c) 10 d) 500

197. The two lines of regression are given by $3x+2y=26$ *and* $6x+y=31$.The coefficient of correlation between x and y is

a) $-1/3$ b) $1/3$ c) $-1/2$ d) $1/2$

198. If θ is the angle between two regression lines with correlation coefficient γ, then

a) $sin\theta \geq 1-\gamma^2$ b) $sin\theta \leq 1-\gamma^2$ c) $sin\theta \leq \gamma^2+1$ d) $sin\theta \leq \gamma^2-1$

199. The standard deviation of n observations $x_1, x_2, \ldots\ldots, x_n$ is 2. If $\sum_{i=1}^{n} x_i = 20$ and $\sum_{i=1}^{n} x_i^2 = 100$, then n is

a) 10 or 20 b) 5 or 10 c) 5 or 20 d) 5 or 15

200. Median of ${}^{2n}C_0, {}^{2n}C_1, {}^{2n}C_2, {}^{2n}C_3, \ldots, {}^{2n}C_n$ (where n is even) is

a) ${}^{2n}C_{\frac{n}{2}}$ b) ${}^{2n}C_{\frac{n+1}{2}}$ c) ${}^{2n}C_{\frac{n-1}{2}}$ d) None of these

201. If a variable X takes values $0,1,2,\dots,n$ with frequencies proportional to the binomial coefficients ${}^nC_0, {}^nC_1, {}^nC_2, \dots, {}^nC_n$, the mean square deviation about $x = 0$, is

a) $\frac{n(n-1)}{4}$ b) $\frac{n(n+1)}{4}$ c) $\frac{n(n-1)}{2}$ d) $\frac{n(n+1)}{2}$

202. If the mean of a set of observations $x_1, x_2, \dots, x_n$ is $\overline{X}$, then the mean of the observations $x_i + 2\,i; i = 1, 2, \dots, n$ is

a) $\overline{X} + 2$ b) $\overline{X} + 2\,n$ c) $\overline{X} + (n+1)$ d) $\overline{X} + n$

203. Consider the following statements :

1. In a bar graph not only height but also width of each rectangle matters
2. In a bar graph height of each rectangle matters and not its width
3. In a histogram the height as well as the width of each rectangle matters
4. A bar graph is two-dimensional of these statements

Which of these is/are correct?

a) (1) alone is correct b) (3) alone is correct
c) (2) and (3) are correct d) (1) and (4) are correct

204. A batsman scores sums in 10 innings 38, 70, 48, 34, 42, 55, 46, 63, 54 and 44, then the deviation from median is

a) 8.6 b) 6.4 c) 9.6 d) 10.6

205. If a variable takes values $0, 1, 2, \dots, n$ with frequencies $1, {}^nC_1, {}^nC_2, \dots, {}^nC_n$, then the AM is

a) n b) $\frac{2^n}{n}$ c) $n+1$ d) $\frac{n}{2}$

206. The mean deviation of the data 2,9,9,3,6,9,4 from the mean is

a) 2.23 b) 2.57 c) 3.23 d) 3.57

207. If the variable takes the values 0, 1, 2, ..., n with frequencies proportional to the binomial coefficients $C(n,0), C(n,1), C(n,2), \dots\dots, C(n,n)$ respectively, then the variance of the distribution is

a) n b) $\frac{\sqrt{n}}{2}$ c) $\frac{n}{2}$ d) $\frac{n}{4}$

208. Angle between two lines of regression is given by

a) $\tan^{-1}\left(\frac{b_{xy} - \frac{1}{b_{yx}}}{1 - \frac{b_{xy}}{b_{yx}}}\right)$ b) $\tan^{-1}\left(\frac{b_{yx}.b_{xy} - 1}{b_{yx}+b_{xy}}\right)$ c) $\tan^{-1}\left(\frac{b_{xy} - \frac{1}{b_{yx}}}{1 + \frac{b_{xy}}{b_{yx}}}\right)$ d) $\tan^{-1}\left(\frac{b_{yx} - b_{xy}}{1 + b_{yx}.b_{xy}}\right)$

209. The mean of the n observations $x_1, x_2, x_3, \dots, x_n$ be $\bar{x}$. Then , the mean of n observations $2x_1 + 3, 2x_2 + 3, 2x_3 + 3, \dots, 2x_n + 3$ is

a) $3\bar{x} + 2$ b) $2\bar{x} + 3$ c) $\bar{x} + 3$ d) $2\bar{x}$

210. The mean of the values $0, 1, 2, 3, \dots n$ with the corresponding weights ${}^nC_0, {}^nC_1, \dots, {}^nC_n$ respectively is

a) $\frac{2^n}{(n+1)}$ b) $\frac{2^{n+1}}{n(n+1)}$ c) $\frac{n+1}{2}$ d) $\frac{n}{2}$

211. One of the methods of determining mode is

a) Mode = 2 median −3 mean
b) Mode = 2 median +3 mean
c) Mode = 3 median −2 mean
d) Mode = 3 median +2 mean

212. If $x_1, x_2, \dots\dots, x_{18}$ are observation such that $\sum_{j=1}^{18}(x_j - 8) = 9$ and $\sum_{j=1}^{18}(x_j - 8)^2 = 45$, then these standard derivation of these observations is

a) $\sqrt{\frac{81}{34}}$ b) 5 c) $\sqrt{5}$ d) $\frac{3}{2}$

213. For dealing with qualitative data the best average is

a) AM b) GM c) Mode d) Median

214. The average of the squares of the numbers 0, 1, 2, 3,4, …, n is

a) $\frac{1}{2}n(n+1)$ b) $\frac{1}{6}n(2n+1)$ c) $\frac{1}{6}(n+1)(2n+1)$ d) $\frac{1}{6}n(n+1)$

215. If the standard deviation of a variable x is σ, then the standard deviation of another variable $\frac{ax+b}{c}$ is

a) $\frac{\sigma a+b}{c}$ b) $\frac{\sigma a}{c}$ c) σ d) None of these

216. In a class of 100 students, the average amount of pocket money is Rs 35 per student. If the average is Rs 25 for girls and Rs 50 for boys, then the number of girls in the class is

a) 20 b) 40 c) 60 d) 80

217. The mean value of the median and mean of the odd divisors of 360 is

a) 13 b) 7 c) 6 d) 10

218. In a class of 50 students, 10 have failed and their average marks are 28. The total marks obtained by the entire class are 2800. The average marks of those who have passed, are

a) 43 b) 53 c) 63 d) 70

219. Mean square deviation of a distribution is least when deviations are taken about

a) Mean b) Median c) Mode d) None of these

220. Standard deviation of the first $2n+1$ natural numbers is equal to

a) $\sqrt{\frac{n(n+1)}{2}}$ b) $\sqrt{\frac{n(n+1)(2n+1)}{3}}$ c) $\sqrt{\frac{n(n+1)}{3}}$ d) $\sqrt{\frac{n(n-1)}{2}}$

221. For two data sets, each of size 5, the variance are given to be 4 and 5 and the corresponding means are given to be 2 and 4, respectively. The variance of the combined data set is

a) $\frac{5}{2}$ b) $\frac{11}{2}$ c) 6 d) $\frac{13}{2}$

222. The sum of the squares of derivations of a set of values is minimum when taken about

a) AM b) GM c) HM d) Median

223. If the variance of $x=9$ and regression equations are $4x-5y+33=0$ and $20x-9y-10=0$,than the coefficient of correlation between x and y and the variance of y respectively are

a) 0.6;16 b) 0.16;16 c) 0.3;4 d) 0.6;4

224. The mean of the values 0,1,2,3,….,n with the corresponding weights ${}^nC_0, {}^nC_1, \dots, {}^nC_n$ respectively, is

a) $\frac{n+1}{2}$ b) $\frac{n-1}{2}$ c) $\frac{2^n-1}{2}$ d) $\frac{n}{2}$

225. The measure which takes into account all the data items is

a) Mean b) Median c) Mode d) None of these

226. The average of the four-digit numbers that can be formed using each of the digits 3, 5, 7 and 9 exactly once in each number, is

a) 4444 b) 5555 c) 6666 d) 7777

227. If $\overline{X}_1$ and $\overline{X}_2$ are the means of two distributions such that $\overline{X}_1 < \overline{X}_2$ and $\overline{X}$ is the mean of the combined distribution, then

a) $\overline{X} < \overline{X}_1$ b) $\overline{X} > \overline{X}_2$ c) $\overline{X} = \frac{\overline{X}_1+\overline{X}_2}{2}$ d) $\overline{X}_1 < \overline{X} < \overline{X}_2$

228. Geometric mean of 3, 9, and 27, is

a) 18 b) 6 c) 9 d) None of these

229. Two numbers within the brackets denote the ranks of 10 students of a class in two subjects (1, 10), (2,9), (3,8), (4,7), (5,6), (6,5), (7,4), (8,3), (9,2), (10,1), then rank correlation coefficient is

a) 0 b) -1 c) 1 d) 0.5

230. If the mean of n observation $1^2, 2^2, 3^2, \dots., n^2$ is $\frac{46n}{11}$, then n is equal to

a) 11 b) 12 c) 23 d) 22

231. The mean of a certain number of observations is m. If each observation is divided by $x(\neq 0)$ and increased by y, then mean of the new observations is

a) $mx + y$ b) $\dfrac{mx+y}{x}$ c) $\dfrac{m+xy}{x}$ d) $m + xy$

232. Let $x_1, x_2, \dots.., x_x$ be n observations such that $\sum x_i^2 = 400$ and $\sum x_i = 80$. Then a possible value of n among the following is

a) 12 b) 9 c) 18 d) 15

STATISTICS

: ANSWER KEY :

1)	d	2)	d	3)	a	4)	c
5)	d	6)	c	7)	a	8)	b
9)	c	10)	c	11)	a	12)	d
13)	c	14)	b	15)	a	16)	b
17)	c	18)	b	19)	b	20)	d
21)	a	22)	a	23)	c	24)	d
25)	a	26)	b	27)	a	28)	d
29)	a	30)	b	31)	d	32)	b
33)	d	34)	b	35)	d	36)	b
37)	b	38)	b	39)	b	40)	a
41)	d	42)	c	43)	b	44)	a
45)	a	46)	a	47)	d	48)	b
49)	b	50)	c	51)	a	52)	a
53)	b	54)	c	55)	d	56)	d
57)	b	58)	b	59)	b	60)	a
61)	d	62)	a	63)	b	64)	b
65)	d	66)	c	67)	a	68)	a
69)	d	70)	b	71)	b	72)	c
73)	c	74)	b	75)	a	76)	b
77)	c	78)	c	79)	a	80)	c
81)	d	82)	a	83)	b	84)	b
85)	b	86)	b	87)	a	88)	c
89)	a	90)	c	91)	b	92)	c
93)	c	94)	c	95)	c	96)	d
97)	c	98)	c	99)	d	100)	d
101)	c	102)	c	103)	b	104)	a
105)	b	106)	c	107)	c	108)	d
109)	b	110)	d	111)	d	112)	d
113)	c	114)	c	115)	a	116)	c
117)	b	118)	d	119)	c	120)	b

121)	a	122)	c	123)	c	124)	b
125)	c	126)	c	127)	d	128)	c
129)	d	130)	c	131)	b	132)	b
133)	c	134)	a	135)	c	136)	d
137)	a	138)	b	139)	b	140)	c
141)	d	142)	c	143)	c	144)	a
145)	b	146)	d	147)	d	148)	a
149)	c	150)	b	151)	c	152)	c
153)	a	154)	b	155)	c	156)	a
157)	a	158)	d	159)	b	160)	c
161)	d	162)	a	163)	a	164)	c
165)	a	166)	d	167)	c	168)	a
169)	b	170)	c	171)	b	172)	d
173)	a	174)	b	175)	a	176)	b
177)	b	178)	a	179)	c	180)	b
181)	d	182)	c	183)	c	184)	a
185)	a	186)	b	187)	c	188)	a
189)	c	190)	b	191)	d	192)	c
193)	c	194)	a	195)	a	196)	a
197)	c	198)	b	199)	c	200)	a
201)	b	202)	c	203)	c	204)	a
205)	d	206)	b	207)	d	208)	b
209)	b	210)	d	211)	c	212)	d
213)	d	214)	b	215)	b	216)	c
217)	d	218)	c	219)	a	220)	c
221)	b	222)	a	223)	a	224)	d
225)	a	226)	c	227)	d	228)	c
229)	b	230)	a	231)	c	232)	c

STATISTICS

: HINTS AND SOLUTIONS :

1 **(d)**

Since variance is independent of change of origin. Hence, variance of observations 101, 102, ..., 200 is same as variance of observations 151, 152, ...,250.

$\therefore V_A = V_B$

$\Rightarrow \frac{V_A}{V_B} = 1$

3 **(a)**

Let $x_1, x_2, \dots, x_n$ be n values of X. Then,

$$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{X})^2 \quad \dots \text{(i)}$$

The variable $a\,X + b$ takes values $a\,x_1 + b, a\,x_2 + b, \dots, a\,x_n + b$ with mean $a\,\overline{X} + b$

$$\therefore \text{Var}(aX+b) = \frac{1}{n}\sum_{i=1}^{n}\{(ax_i + b) - (a\overline{X} + b)\}^2$$

$$= a^2\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{X})^2$$

$$\Rightarrow (\text{S.D. of } a\,X + b) = \sqrt{a^2\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{X})^2} = |a|\sigma$$

4 **(c)**

Total weight of 9 items $= 15 \times 9 = 135$

And total weight of 10 items $= 16 \times 10 = 160$

$\therefore$ weight of 10th item $= 160 - 135 = 25$

5 **(d)**

$$\bar{x} = \frac{-1+0+4}{3} = 1$$

$$\therefore MD = \frac{\Sigma|x_i - \bar{x}}{n}$$

$$= \frac{|-1-1| + |0-1| + |4-1|}{3}$$

$= 2$

6 **(c)**

$$\theta = \tan^{-1}\left\{\frac{\frac{2}{3}\times\frac{4}{3} - 1}{\frac{2}{3}+\frac{4}{3}}\right\}$$

$$\Rightarrow \theta = \tan^{-1}\left\{-\frac{\frac{1}{9}}{2}\right\} = \tan^{-1}\left\{-\frac{1}{18}\right\}$$

$\therefore$ Angle is acute angle.

$\therefore \text{k}=\frac{1}{18}$

7 **(a)**

According to the given condition

$$6.80 = \frac{\left[\begin{array}{c}(6-a)^2 + (6-b)^2 + (6-8)^2 \\ +(6-5)^2 + (6-10)^2\end{array}\right]}{5}$$

$\Rightarrow 34 = (6-a)^2 + (6-b)^2 + 4 + 1 + 16$

$\Rightarrow (6-a)^2 + (6-b)^2 = 13 = 9 + 4$

$= 3^2 + 2^2$

$\Rightarrow \quad a = 3, b = 4$

8 **(b)**

On arranging the terms in increasing order of magnitude

40,42,45,47,50,51,54,55,57

Number of terms ,N=9

$\therefore$ Median $= \left(\frac{9+1}{2}\right)$th term $=$ 5th term

$= 50$kg

Weight (kg)	Deviation from median (d)	|d|
40	-10	10
42	-8	8
45	-5	5
47	-3	3
50	0	0
51	1	1
54	4	4
55	5	5
57	7	7

		$|d|=43$

MD from median $=\frac{43}{9}=4.78$kg

$\therefore$Coefficient of MD from median

$=\frac{\text{MD}}{\text{median}}$

$=\frac{4.78}{50}=0.0956$

9 **(c)**

The required weighted mean is given by

$$\overline{X}=\frac{1\cdot 1+2\cdot 2+3\cdot 3+\cdots+n\cdot n}{1+2+3+\cdots+n}$$

$$\Rightarrow \overline{X}=\frac{\frac{n(n+1)(2n+1)}{6}}{\frac{n(n+1)}{2}}=\frac{2n+1}{3}$$

11 **(a)**

We have, $\bar{x}=\frac{1}{n}\sum_{i=1}^{n}x_i$

$$\therefore \quad \text{var}(\bar{x})=\frac{1}{n^2}\left[\sum_{i=1}^{n}\text{var}(x_i)+2\sum_{i\neq j}^{n}\text{cov}(x_i,x_j)\right]$$

$$=\frac{1}{n^2}[n\sigma^2]=\frac{\sigma^2}{n}$$

[$\because x_i$ and x_j are independent variable, therefore $\text{cov}(x_i,x_j)=0$]

14 **(b)**

The required AM is

$$\bar{X}=\frac{1+2+2^2+2^3+\ldots+2^n}{n+1}$$

$$=\frac{1(2^{n+1}-1)}{(2-1)}\cdot\frac{1}{(n+1)}=\frac{2^{n+1}-1}{n+1}$$

15 **(a)**

Given, $r=0.8$ *and* $b_{yx}=0.2$

$\therefore r^2=b_{xy}b_{yx}$

$\Rightarrow (0.8)^2=b_{xy}.(0.2)$

$\Rightarrow b_{xy}=\frac{0.64}{0.2}=3.2$

16 **(b)**

If the values of mean, median and mode coincide, then the distribution is symmetric distribution.

17 **(c)**

$$r=\frac{\frac{1}{n}\Sigma xy-\bar{x}\bar{y}}{\sigma_x\times\sigma_y}=\frac{\frac{1}{10}\times 12-0}{2\times 3}=0.2$$

18 **(b)**

In the given distribution 6 occurs most of the times hence mode of the series=6.

22 **(a)**

$$\bar{x}=\frac{1+2+3+\ldots+n}{n}=\frac{(n+1)}{2}$$

Variance, $\sigma^2=\frac{\Sigma(x_i)^2}{n}-(\bar{x})^2$

$$=\frac{\sum n^2}{n}-\left(\frac{n+1}{2}\right)^2$$

$$=\frac{n(n+1)(2n+1)}{6n}-\left(\frac{n+1}{2}\right)^2$$

$$=\frac{n^2-1}{12}$$

25 **(a)**

Coefficient of skewness $=\frac{Q_3-Q_1-2(median)}{Q_3-Q_1}$

$$=\frac{25.2+14.6-2(18.8)}{25.2-14.6}$$

$$=\frac{2.2}{10.6}=0.20$$

27 **(a)**

Let $x_1,x_2,\ldots,x_n$ and $y_1,y_2,\ldots y_n$ be two series of observations with geometric means G_1 and G_2 respectively

Then,

$G_1=(x_1\cdot x_2\cdot\ldots\cdot x_n)^{1/n}$ and $G_2=(y_1\cdot y_2\cdot\ldots\cdot y_n)^{1/n}$

Since G is the geometric mean of the ratios of the corresponding observations

$$\therefore G=\left(\frac{x_1}{y_1}\cdot\frac{x_2}{y_2}\cdot\ldots\cdot\frac{x_n}{y_n}\right)^{1/n}=\frac{(x_1x_2\ldots x_n)^{1/n}}{(y_1\cdot y_2\ldots y_n)^{1/n}}=\frac{G_1}{G_2}$$

28 **(d)**

We know that,

$$r=\pm\sqrt{b_{yx}.b_{xy}}$$

Also we know that sign of r, b_{xy}, b_{yx} *are all same.*

$$\therefore r=(\text{sign } of\ b_{yx})\sqrt{b_{yx}.b_{xy}}$$

30 **(b)**

Let $Y=\frac{aX+b}{c}$. Then, $\overline{Y}=\frac{1}{c}(a\overline{X}+b)$

$$\therefore Y-\overline{Y}=\frac{a}{c}(X-\overline{X})$$

$$\Rightarrow \frac{1}{N}\sum(Y-\overline{Y})^2=\frac{a^2}{c^2}\frac{1}{N}\sum(X-\overline{X})^2$$

$$\therefore \sigma_Y=\sqrt{\frac{a^2}{c^2}\times\frac{1}{N}\sum(X-\overline{X})^2}=\sqrt{\frac{a^2}{c^2}\sigma^2}=\left|\frac{a}{c}\right|\sigma$$

31 **(d)**

We have,

$$\overline{X}=\frac{x_1+x_2+\cdots+x_{n-1}+x_n}{n}$$

$$\Rightarrow n\overline{X}=x_1+x_2+\cdots+x_{n-1}+x_n$$

Let $\overline{Y}$ be the new mean when x_2 is replaced by λ.

Then,

$$\overline{Y}=\frac{x_1+\lambda+x_3+\cdots+x_{n-1}+x_n}{n}$$

$$\Rightarrow \overline{Y}=\frac{(x_1+x_2+\cdots+x_n)-x_2+\lambda}{n}$$

$$\Rightarrow \overline{Y}=\frac{n\overline{X}-x_2+\lambda}{n}$$

32 **(b)**

Let $x_1, x_2, \ldots x_n$ be n values of x.

Then, $\sigma=\frac{1}{n}\sum_{i=1}^{n}(x_i-\bar{x})^2 \ldots$ (i)

The variable $ax+b$ takes values $ax_1+b, ax_2+b, \ldots, ax_n+b$ with mean $\bar{x}+b$.

$\therefore SD\ of\ (ax+b)$

$$=\sqrt{\frac{1}{n}\sum_{i=1}^{n}\{(ax_i-b)-(a\bar{x}+b)\}^2}$$

$$=\sqrt{a^2.\frac{1}{n}\sum_{i=1}^{n}(x_i-\bar{x})^2}$$

$=|a|\sigma$

Alternate $SD(ax+b)=SD(ax)+SD(b)$

$=|a|SD(x)+0$

$=|a|\sigma$

33 **(d)**

$$\text{Mean}=\frac{1}{10}[(x_1+x_2+\ldots+x_{10})+(4+8+\ldots+40)]$$

$$=\frac{1}{10}(x_1+x_2+\cdots+x_{10})+\frac{4}{10}(1+2+\cdots+10)$$

$$=20+\frac{4\times10\times11}{10\times2}=42$$

35 **(d)**

$$\bar{x}=\frac{1}{2n+1}[a+(a+d)+\cdots+(a+2nd)]$$

$$=\frac{1}{2n+1}[(2n+1)a+d(1+2+\cdots+2n)]$$

$$=a+d\frac{2n}{2}.\frac{(2n+1)}{2n+1}=a+nd$$

$$\therefore \text{MD from mean}=\frac{1}{2n+1}\sum|x_1-\bar{x}|$$

$$=\frac{1}{2n+1}2|d|(1+2+\ldots+n)$$

$$=\frac{n(n+1)|d|}{(2n+1)}$$

36 **(b)**

Given, $\sigma_{10}^2=\frac{99}{12}=\frac{33}{4}$

$$\Rightarrow \sigma_{10}=\frac{\sqrt{33}}{2}$$

SD of required series $=3\sigma_{10}=\frac{3\sqrt{33}}{2}$

38 **(b)**

We know that,

$\text{var}(aX+b)=a^2\text{var}(X)$

$$\therefore \text{var}\left(\frac{aX+b}{c}\right)=\left(\frac{a}{c}\right)^2\text{var}(X)=\frac{a^2}{c^2}\sigma^2$$

$$\therefore \text{SD}=\sqrt{\text{var}\left(\frac{aX+b}{c}\right)}=\left|\frac{a}{c}\right|\sigma$$

39 **(b)**

We have,

$$\sigma^2=\frac{1}{2n+1}\sum_{r=0}^{2n}\{(a+rd)-(a+nd)\}^2$$

$$\Rightarrow \sigma^2=\frac{2d^2}{2n+1}\{1^2+2^2+\cdots+n^2\}$$

$$\Rightarrow \sigma^2=\frac{n(n+1)}{3}d^2 \Rightarrow \sigma=\sqrt{\frac{n(n+1)}{3}}d$$

40 **(a)**

Given that, mean=5, median=6

For a moderately skewed distribution, we have

Mode =3 median −2 mean

$\Rightarrow$ Mode $=3(6)-2(5)=8$

41 **(d)**

Here, $N=\Sigma f=20$

$Q_1=\frac{N+1}{4}th=\left(\frac{21}{4}\right)th=3rd$ observation

Similarly, $Q_3=3\left(\frac{N+1}{4}\right)th$

$=\left(\frac{63}{4}\right)th=5\ th$ observation

$\therefore$ QD$=\frac{1}{2}(Q_3-Q_1)=\frac{1}{2}(5-3)=1$

44 **(a)**

The required mean X is given by

$$\overline{X}=\frac{0\times{}^nC_0q^np^0+1\times{}^nC_1q^{n-1}p+\cdots+n\times{}^nC_nq^0p^n}{{}^nC_0q^np^0+{}^nC_1q^{n-1}p^1+\cdots+{}^nC_nq^{n-n}p^n}$$

$$\Rightarrow \overline{X}=\frac{\sum_{r=0}^{n}r\times{}^nC_rq^{n-r}p^r}{\sum_{r=0}^{n}{}^nC_rq^{n-r}p^r}$$

$$\Rightarrow \overline{X}=\frac{\sum_{r=1}^{n}r\times\frac{n}{r}{}^{n-1}C_{r-1}q^{n-r}\times p\times p^{r-1}}{\sum_{r=0}^{n}{}^nC_rq^{n-r}p^r}$$

$$\Rightarrow \overline{X} = \frac{np\{\sum_{r=1}^{n} {}^{n-1}C_{r-1} p^{r-1} q^{(n-1)-(r-1)}\}}{\sum_{r=0}^{n} {}^{n}C_r q^{n-r} p^r}$$

$$\Rightarrow \overline{X} = \frac{np(q+p)^{n-1}}{(q+p)^n}$$

$$\Rightarrow \overline{X} = np \qquad [\because q+p=1]$$

46 **(a)**

Let the mean of the remaining 4 observations be $\overline{X}_1$. Then,

$$M = \frac{a + 4\overline{X}_1}{(n-4)+4} \Rightarrow \overline{X}_1 = \frac{nM - a}{4}$$

48 **(b)**

Total number of workers =300

Retrenched =15% of 300=45

These are all from age group $(20-28)$

Prematured retried =20% of 300=60

=18 from age group $52-60$

And 42 from age group $(44-52)$

∴ Age limit of workers retained is $28-44$

49 **(b)**

Total number of students=100

Average marks of the class=72

Total marks of the class $= 72 \times 100 = 7200$

And total marks of the boys $= 70 \times 75 = 5250$

So, total marks of the girls$=7200 - 5250 = 1950$

Hence, average of girls $= \frac{1950}{30} = 65$

50 **(c)**

Let n be the number of newspapers which are read

Then, $60n = (300) \times 5$

$\Rightarrow n = 25$

52 **(a)**

Since, $\text{MD} = \frac{4}{5}\sigma$, $\text{QD} = \frac{2}{3}\sigma$

$$\therefore \frac{\text{MD}}{\text{QD}} = \frac{6}{5}$$

$$\Rightarrow \text{QD} = \frac{5}{6}(\text{MD}) = \frac{5}{6}(15) = 12.5$$

54 **(c)**

$$\bar{x} = \frac{\text{Sum of quantities}}{n} = \frac{\frac{n}{2}(a+1)}{n}$$

$$= \frac{1}{2}[1 + 1 + 100d] = 1 + 50d$$

$$\therefore MD = \frac{1}{n}\Sigma|'x_i - \bar{x}|$$

$$\Rightarrow 255 = \frac{1}{101}[50d + 49d + \cdots + d + 0 + d + \cdots + 50d]$$

$$= \frac{2d}{101}\left[\frac{50 \times 51}{2}\right]$$

$$\Rightarrow d = \frac{255 \times 101}{50 \times 51} = 10.1$$

55 **(d)**

Since, 44 kg is replaced by 46 kg and 27 kg is replaced by 25 kg, then the given series becomes 31, 35, 25, 29, 32, 43, 37, 41, 34, 28, 36, 46, 45, 42, and 30.

On arranging this series in ascending order, we get

25, 28, 29, 30, 31, 32, 34, 35, 36, 37, 41, 42, 43, 45, 46.

Total numbers of students are 15, therefore middle term is 8th whose corresponding value is 35.

56 **(d)**

CI	x	f	xf
0-10	5	4	20
10-20	15	6	90
20-30	25	10	250
30-40	35	16	560
40-50	45	14	630
		$\sum f = 50$	$\sum fx = 1550$

$$\therefore \text{Mean } \frac{\sum fx}{\sum f} = \frac{1550}{50} = 31$$

57 **(b)**

Given, $\sigma_{10}^2 = \frac{99}{12} = \frac{33}{4}$

$\Rightarrow \sigma_{10} = \frac{\sqrt{33}}{2}$

SD of required series$=3\sigma_{10} = \frac{3\sqrt{33}}{2}$

58 **(b)**

Let $x_1, x_2, \dots, x_n$ be a raw data. Then,

$$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{X})^2$$

If each value is multiplied by h, then the values are $h\,x_1, h\,x_2, \dots, h\,x_n$. The AM of the new values is

$$\frac{h\,x_1 + h\,x_2 + \dots + h\,x_n}{n} = h\,\overline{X}$$

The variance σ_1^2 of the new set of values is given by

$$\sigma_1^2 = \frac{1}{n}\sum_{i=1}^{n}(h\,x_i - h\,\overline{X})^2 = h^2\left\{\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{X})^2\right\}$$

$$= h^2\sigma^2$$

61 **(d)**

Median of new set remains the same as that of the original set.

62 **(a)**

$$\bar{x} = \frac{8+12+13+15+22}{5} = \frac{70}{5} = 14$$

$$\sigma = \sqrt{\frac{(8-14)^2 + (12-14)^2 + (13-14)^2 + (15-14)^2 + (22-14)^2}{5}}$$

$$= \sqrt{\frac{36+4+1+1+64}{5}}$$

$= \sqrt{212} = 4.604$

63 **(b)**

The formula for combined mean is

$$\bar{X} = \frac{n_1\bar{X}_1 + n_2\bar{X}_2}{n_1 + n_2}$$

We are given $\bar{X} = 25, \bar{X}_1 = 26, \bar{X}_2 = 21$. Let $n_1 + n_2 = 100$

and n_1 denotes men and n_2 denotes women

$n_2 = 100 - n_1$

$\therefore 25 = \frac{26n_1 + 21(100-n_1)}{100} \Rightarrow n_1 = 80$

So, $n_2 = 20$

Hence, the percentage of men and women is 80 and 20 respectively

64 **(b)**

Taking X as the product of variates $X_1, X_2, \dots, X_r$ corresponding to r sets of observations i.e. $X = X_1X_2 \dots X_r$, we have

$\log X = \log X_1 + \log X_2 + \cdots \log X_r$

$$\Rightarrow \sum \log X = \sum \log X_1 + \sum \log X_2 + \cdots + \sum \log X_r$$

$$\Rightarrow \frac{1}{n}\sum \log X = \frac{1}{n}\sum \log X_1 + \frac{1}{n}\sum \log X_2 + \cdots + \frac{1}{n}\sum \log X_r$$

$\Rightarrow \log G = \log G_1 + \log G_2 + \cdots + \log G_r$

$\Rightarrow G = G_1G_2 \dots G_r$

68 **(a)**

For a moderately skewed distribution, we have

Mode = 3 Median −2 Mean

$\Rightarrow$ Mode $= 3(6) - 2(5) = 8$

69 **(d)**

Let n_1 and n_2 be the number of observations in two groups having means $\bar{X}_1$ *and* $\bar{X}_2$ respectively

Then, $\bar{X} = \frac{n_1\bar{X}_1 + n_2\bar{X}_2}{n_1+n_2}$

Now, $\bar{X} - \bar{X}_1 = \frac{n_1\bar{X}_1 + n_2\bar{X}_2}{n_1+n_2} - \overline{X}_1$

$= n_2\frac{(\bar{X}_2 - \bar{X}_1)}{n_1+n_2} > 0 \quad (\because \bar{X}_2 > \bar{X}_1)$

$\Rightarrow \bar{X} > \bar{X}_1$ ...(i)

And $\bar{X} - \bar{X}_2 = \frac{n_1(\bar{X}_1 - \bar{X}_2)}{n_1+n_2} < 0 \quad \because \bar{X}_2 > \bar{X}_2$

$\Rightarrow \bar{X} < \bar{X}_2$ ...(ii)

From relations (i) and (ii), we get

$\bar{X}_1 < \bar{X} < \bar{X}_2$

71 **(b)**

Given lines are $3\bar{x} - 2\bar{y} + 1 = 0$ ... (i)

And $2\bar{x} - \bar{y} - 2 = 0$ ... (ii)

On solving Eqs. (i)and (ii), we get $\bar{x} = 5, \bar{y} = 8$

72 **(c)**

It is true that mode can be computed from histogram and median is not independent of change of scale.

But variance is independent of change of origin and not of scale.

77 **(c)**

$$r_{xy} = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}}$$

$$= \frac{20}{\sqrt{36\times25}} = \frac{2}{3} = 0.66$$

78 **(c)**

Correlation coefficient,

$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{\{n\sum x^2 - (\sum x)^2\}}\sqrt{\{n\sum y^2 - (\sum y)^2\}}}$

$= \frac{10(220) - 40 \times 50}{\sqrt{10(200) - (40)^2}\sqrt{10(262) - (50)^2}}$

$= \frac{200}{20 \times 10.954} = \frac{200}{219.08} = 0.91$

79 **(a)**

Let us assume that line of regression y on x $+4y = 3$ and x on y is $3x + y = 15$.

$\therefore$ put $y = 3$ in $3x + y = 15$

$\Rightarrow 3x = 15 - 3$

$x = 4$

82 **(a)**

For a moderately skewed distribution

Mode = 3 Median −2 Mean

$\Rightarrow 6\lambda = 3$ Median -18λ

$\Rightarrow$ Median $= 8\lambda$

83 **(b)**

Given series is 148, 146, 144, 142,... whose first term and common difference is

$a = 148, d = (146 - 148) = -2$

$S_n = \frac{n}{2}[2a + (n+1)d] = 125$ (given)

$\Rightarrow 125n = \frac{n}{2}[2 \times 148 + (n-1) \times (-2)]$

$\Rightarrow n^2 - 24n = 0 \Rightarrow n(n - 24) = 0$

$\Rightarrow n = 24 \quad (n \neq 0)$

84 **(b)**

Let us assume that line of regression y on x is $2x - 7y + 6 = 0$ and x on y is $7x - 2y + 1 = 0$

$\therefore b_{yx} = \frac{2}{7}$ and $b_{xy} = \frac{2}{7}$

$\therefore \quad r = \sqrt{\left(\frac{2}{7}\right)\left(\frac{2}{7}\right)} = \frac{2}{7}$

86 **(b)**

Given that, $n_1 = 10, \bar{x}_1 = 12, n_2 = 20, \bar{x}_2 = 9$

$\therefore \quad \bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} = \frac{10 \times 12 + 20 \times 9}{10 + 20}$

$= \frac{120 + 180}{30} = \frac{300}{30} = 10$

89 **(a)**

$\because$ Mode=3 Median-2 Mean

$\because$ Mode=3(22)-2(21)

$\Rightarrow$ Mode=66-42=24

90 **(c)**

Let $x_1, x_2, \dots, x_n$ be n observations. Then,

$\overline{X} = \frac{1}{n}\sum x_i$

Let $y_i = \frac{x_i}{\alpha} + 10$. Then,

$\frac{1}{n}\sum_{i=1}^{n} y_i = \frac{1}{\alpha}\left(\frac{1}{n}\sum x_i\right) + \frac{1}{n}(10\, n)$

$\Rightarrow \overline{Y} = \frac{1}{\alpha}\overline{X} + 10 = \frac{\overline{X} + 10\,\alpha}{\alpha}$

91 **(b)**

The formula for combined mean is

$\overline{X} = \frac{n_1\overline{X}_1 + n_2\overline{X}_2}{n_1 + n_2}$ ... (i)

We are given $\overline{X} = 25, \overline{X}_1 = 26, \overline{X}_2 = 21$

Let $n_1 + n_2 = 100$, where n_1 denotes the number of men and n_2 the number of women

$\therefore n_2 = 100 - n_1$

Substituting those values in (i), we have

$25 = \frac{26\,n_1 + 21(100 - n_1)}{100} \Rightarrow n_1 = 80$

$\therefore n_1 + n_2 = 100 \Rightarrow n_2 = 20$

Hence, the percentages of men and women are 80 and 20 respectively

92 **(c)**

If $d_i = \frac{x_i - A}{h}$, then $\sigma_x = |h|\sigma_d$

Now, $-2x_i - 3 = \frac{x_i + \frac{3}{2}}{-\frac{1}{2}}$

Here, $h = -\frac{1}{2}$

$\therefore \quad \sigma_d = \frac{1}{|h|}\sigma_x$

$= 2 \times 3.5 = 7$

93 **(c)**

Let $d_i = x_i - 8$

$\therefore \sigma_x^2 = \sigma_d^2 = \frac{1}{18}\sum d_i^2 - \left(\frac{1}{8}\sum d_i\right)^2$

$= \frac{1}{18} \times 45 - \left(\frac{9}{18}\right)^2 = \frac{5}{2} - \frac{1}{4} = \frac{9}{4}$

$\Rightarrow \sigma_x^2 = \frac{3}{2}$

94 **(c)**

Given, $\sigma = 9$

Let a student obtains x marks out of 75. Then, his marks out of 100 are $\frac{4x}{3}$. Each observation is multiply by $\frac{4}{3}$

$\therefore$ New SD, $\sigma = \frac{4}{3} \times 9 = 12$

Hence, variance is $\sigma^2 = 144$

95 **(c)**

We have,

$$\overline{X} = \frac{0 \times {}^nC_0 \times +1 \times {}^nC_1 + 2 \times {}^nC_2 + \cdots + n \times {}^nC_n}{{}^nC_0 + {}^nC_1 + {}^nC_2 + \cdots + {}^nC_n}$$

$$\Rightarrow \overline{X} = \frac{\sum_{r=0}^{n} r \times {}^nC_r}{\sum_{r=0}^{n} {}^nC_r}$$

$$\Rightarrow \overline{X} = \frac{1}{2^n}\sum_{r=1}^{n} r \times \frac{n}{r}\ {}^{n-1}C_{r-1} \left[\because \sum_{r=0}^{n} {}^nC_r = 2^n ;\ {}^nC_r = \frac{n}{r}\ {}^{n-1}C_{r-1}\right]$$

$$\Rightarrow \overline{X} = \frac{n}{2^n}\sum_{r=1}^{n} {}^{n-1}C_{r-1}$$

$$\Rightarrow \overline{X} = \frac{n}{2^n}(2^{n-1}) = \frac{n}{2}\ \left[\because \sum_{r=1}^{n} {}^{n-1}C_{r-1} = 2^{n-1}\right]$$

and,

$$\frac{1}{N}\sum f_i x_i^2 = \frac{1}{2^n}\sum_{r=0}^{n} r^2\ {}^nC_r$$

$$\Rightarrow \frac{1}{N}\sum f_i x_i^2 = \frac{1}{2^n}\sum_{r=0}^{n}\{r(r-1)+r\}\ {}^nC_r$$

$$\Rightarrow \frac{1}{N}\sum f_i x_i^2 = \frac{1}{2^n}\left\{\sum_{r=0}^{n} r(r-1)\ {}^nC_r + \sum_{r=0}^{n} r\ {}^nC_r\right\}$$

$$\Rightarrow \frac{1}{N}\sum f_i x_i^2 = \frac{1}{2^n}\left\{\sum_{r=2}^{n} r(r-1)\frac{n}{r} \times \frac{n-1}{r-1}\ {}^{n-2}C_{r-2}\right.$$

$$\left. + \sum_{r=1}^{n} r\frac{n}{r}\ {}^{n-1}C_{r-1}\right\}$$

$$\Rightarrow \frac{1}{N}\sum f_i x_i^2 = \frac{1}{2^n}\left\{n(n-1)\sum_{r=2}^{n} {}^{n-2}C_{r-2} + n\sum_{r=1}^{n} {}^{n-1}C_{r-1}\right\}$$

$$\Rightarrow \frac{1}{N}\sum f_i x_i^2 = \frac{1}{2^n}\{n(n-1)2^{n-2} + n \cdot 2^{n-1}\} = \frac{n(n-1)}{4} + \frac{n}{2}$$

$$\therefore \text{Var}(X) = \frac{1}{N}\sum f_i x_i^2 - \overline{X}^2 = \frac{n(n-1)}{4} + \frac{n}{2} - \frac{n^2}{4} = \frac{n}{4}$$

96 **(d)**

The new observations are obtained by adding 20 to each. Hence, σ does not change.

97 **(c)**

Class	Mid value x	f	fx	$d = x - m$	fd	fd^2
0-10	5	2	10	-20.7	-41.4	856.98
10-20	15	10	150	-10.7	-107	1148.9
20-30	25	8	200	-0.7	-5.6	3.92
30-40	35	4	140	9.3	37.2	345.96
40-50	45	6	270	19.3	115.8	2234.94
		$\Sigma f = 3$	$\Sigma fx = 77$		$\Sigma fd = -1$	$\Sigma fd^2 = 458$

$M = \frac{770}{30} = 25.7$

SD $(\sigma) = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2}$

$= \sqrt{\frac{4586.7}{30} - \left(\frac{-1}{30}\right)^2}$

$\sqrt{15289 - 0.005 = 12365}$

$\therefore$Coefficient of SD$= \frac{\sigma}{x} = \frac{12.365}{25.7} = 0.481$

and Coefficient of variance

$= \text{coeff. of SD} \times 100$

$= 0.481 \times 100 = 48.1$

98 **(c)**

We have,

$\overline{X} = \frac{1+2+3+\cdots+n}{n} = \frac{n(n+1)}{2\,n} = \frac{n+1}{2}$

100 **(d)**

Karl pearson's coefficient of correlation r lies in the interval [-1, 1].

101 **(c)**

We have,

$n_1 = 7, \overline{X}_1 = 10, n_2 = 3, \overline{X}_2 = 5$

$\therefore$ Combined mean $= \frac{n_1\overline{X}_1 + n_2\overline{X}_2}{n_1+n_2} = \frac{85}{10} = 8.5$

103 **(b)**

From the given table, it is clear that required mode=6

104 **(a)**

Let $x_1, x_2, \dots, x_n$ be n observations

$\therefore\ M = \frac{x_1+x_2+x_3+\ldots+x_n}{n}$

$= \frac{x_1+x_2+\ldots+x_{n-4}+x_{n-3}+x_{n-2}+x_{n-1}+x_n}{n}$

$\Rightarrow\ nM = a + x_{n-3}+x_{n-2}+x_{n-1}+x_n$

$\Rightarrow\ \frac{nM-a}{4} = \frac{x_{n-3}+x_{n-2}+x_{n-1}+x_n}{4}$

105 **(b)**

The mean of the series $a, a+d, a+2\,d, \dots, a+2\,nd$ is

$\overline{X} = \frac{1}{2\,n+1}[a+a+d+a+2\,d+\cdots+a+2\,nd]$

$\Rightarrow \overline{X} = \frac{1}{2\,n+1}\left\{\frac{2\,n+1}{2}(a+a+2\,nd)\right\} = a+nd$

$\therefore$ Mean deviation from mean

$\text{M. D.} = \frac{1}{2\,n+1}\sum_{r=0}^{2\,n}|(a+rd)-(a+nd)|$

$\Rightarrow \text{M. D.} = \frac{1}{2\,n+1}\sum_{r=0}^{2\,n}|r-n|d$

$\Rightarrow \text{M. D.} = \frac{1}{2\,n+1}\{2\,d(1+2+\cdots+n)\}$

$= \frac{n(n+1)}{2\,n+1}d$

106 **(c)**

Let $x_1, x_2, \dots, x_n$ be n values of variable X. Then,

$\overline{X} = \frac{1}{n}\sum x_i$

Let $y_1 = x_1+1, y_2 = x_2+2, y_3 = x_3+3, \dots, y_n = x_n+n$. Then, the mean of the new series is given by

$\overline{X'} = \frac{1}{n}\sum y_i$

$\Rightarrow \overline{X'} = \frac{1}{n}\sum_i (x_i+i)$

$\Rightarrow \overline{X'} = \frac{1}{n}\sum_i x_i + \frac{1}{n}(1+2+3+\cdots+n)$

$\Rightarrow \overline{X'} = \overline{X} + \frac{1}{n}\cdot\frac{n(n+1)}{2} = \overline{X} + \frac{n+1}{2}$

107 **(c)**

Mean $= \frac{\sum_{i=1}^{n}(x_i+2i)}{n} = \frac{\sum_{i=1}^{n}x_i + 2(1+2+\ldots+n)}{n}$

$\bar{x} + \frac{2n(n+1)}{2n} = \bar{x} + (n+1)$

109 **(b)**

If mean, median and mode coincides, then their is a symmetrical distribution

111 **(d)**

Let $x_i/f_i; i = 1,2, \dots, n$ be a frequency distribution. Then,

$\text{S. D.} = \sqrt{\frac{1}{N}\sum_{i=1}^{n} f_i(x_i-\overline{X})^2}$ and M. D.

$= \frac{1}{N}\sum_{i=1}^{n} f_i|x_i-\overline{X}|$

Let $|x_i-\overline{X}| = z_i; i = 1,2, \dots, n$. Then,

$(\text{S. D.})^2 - (\text{M. D.})^2 = \frac{1}{N}\sum_{i=1}^{n} f_i z_i^2 - \left(\frac{1}{N}\sum_{i=1}^{n} f_i z_i\right)^2$

$= \sigma_z^2 \geq 0$

$\Rightarrow \text{S. D.} \geq \text{M. D.}$

112 **(d)**

We have,

$Q_3 = 17$ and $Q_1 = 10 \Rightarrow \text{Q. D.} = \frac{1}{2}(Q_3-Q_1) = 3.5$

113 **(c)**

When the origin is changed, then the coefficient of correlation is unsalted.

114 **(c)**

$\bar{x} = \frac{31+32+33+\cdots+47}{47} = \frac{663}{17} = 39$

$\therefore \sum_{i=1}^{17}(x_i-\bar{x})^2 = (31-39)^2 + (32-39)^2$

$+(33-39)^2 + (34-39)^2 + (35-39)^2$

$+(36-39)^2 + (37-39)^2 + (38-39)^2$

$+(39-39)^2 + (40-39)^2 + (41-39)^2$

$+(42-39)^2 + (43-39)^2 + (44-39)^2$

$+(45-39)^2 + (46-39)^2 + (47-39)^2$

$= 64 + 49 + 36 + 25 + 16 + 9 + 4 + 1 + 0 + 1$

$+4+9+16+25+36+49+64$

$=408$

Hence, standard deviation $= \sqrt{\frac{408}{17}} = \sqrt{24} = 2\sqrt{6}$

117 **(b)**

Arranging the terms in increasing order

Value x	Frequency f	Commulative frequency
7	2	2
8	1	3
9	5	8
10	4	12
11	6	18
12	1	19
13	3	22

$\because \quad N = 22$

$\because$ Median number $= \frac{N+1}{2} = 11.5$

Which comes under the cumulative frequency the corresponding value of $x$will be the median ie,

Median=10

118 **(d)**

$^{2n+1}C_0 + {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_{2n} + {}^{2n+1}C_{2n+1} = 2^{2n+1}$

Now, $^{2n+1}C_0 = {}^{2n+1}C_{2n+1}$,

$^{2n+1}C_1 = {}^{2n+1}C_{2n} \ldots {}^{2n+1}C_r = {}^{2n+1}C_{2n-r+1}$

So, sum of first $(n+1)$ terms= sum of last $(n+1)$ terms

$\Rightarrow {}^{2n+1}C_0 + {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_n = 2^{2n}$

$\Rightarrow \frac{{}^{2n+1}C_0 + {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_n}{n+1} = \frac{2^{2n}}{(n+1)}$

119 **(c)**

If both two regression lines are perpendicular, then correlation coefficient will be zero.

120 **(b)**

The mean of the series $a, a+d, \ldots\ldots, a+2nd$ is

$\bar{x} = \frac{1}{2n+1}[a + a + d + a + 2d + \cdots + a + 2nd]$

$= \frac{1}{2n+1}\left[\frac{2n+1}{2}(a + a + 2nd)\right] = a + nd$

$\therefore$ Mean deviation from mean

$= \frac{1}{2n+1}\sum_{r=0}^{2n}|(a + rd) - (a + nd)|$

$= \frac{1}{2n+1}\sum_{r=0}^{2n}(r - n)d$

$= \frac{1}{2n+1}2d(1 + 2 + \cdots + n)$

$= \frac{n(n+1)}{2n+1}d$

122 **(c)**

$r_{xy} = \frac{\text{cov}(x,y)}{\sqrt{\text{var}(x)\text{var}(y)}}$

$= \frac{10.2}{\sqrt{(8.25)(33.96)}} = 0.61$

124 **(b)**

Let us assume that line of regression y on x is $3x + 12y = 19$ *and x on y is* $3y + 9x = 46$.

$\therefore b_{yx} = -\frac{3}{12}$ *and* $b_{xy} = -\frac{3}{9} = -\frac{1}{3}$

$\therefore r_{xy} = -\sqrt{b_{yx} \times b_{xy}} = -\sqrt{\left(\frac{3}{12}\right) \times \left(\frac{1}{3}\right)}$

$= -\sqrt{\frac{1}{12}} = -\sqrt{0.083}$

$= -0.289$

125 **(c)**

$\text{Cov}(x,y) = \frac{1}{n}\Sigma xy - \bar{x}\bar{y}$

$= \frac{1}{2}(110) - \left(\frac{15}{5}\right)\left(\frac{36}{5}\right) = \frac{2}{5}$

127 **(d)**

Let $x_1, x_2, x_3, \ldots, x_n$ be n observation

$\therefore \quad \bar{x} = \frac{\sum x_i}{n}$ ...(i)

New mean$= \frac{\sum x_i + x_{n+1}}{n+1}$

According to the question $\bar{x} = \frac{\sum x_i + x_{n+1}}{n+1}$

$\Rightarrow \quad (n+1)\bar{x} = n\bar{x} + x_{n+1}$

$\Rightarrow \quad x_{n+1} = \bar{x}$

130 **(c)**

Let $x_1, x_2, x_3, \ldots, x_n$ be n observations. Then,

$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

$\therefore$ New mean, $\bar{X} = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\alpha} + 10\right)$

$= \frac{1}{\alpha}\left(\frac{1}{n}\sum_{i=1}^{n} x_i\right) + \frac{1}{n}.(10n)$

$= \frac{1}{\alpha}\bar{x} + 10 = \frac{\bar{x} + 10\alpha}{\alpha}$

131 **(b)**

Since, there are 19 observations. So, the middle term is 10th

After including 8 and 32, *ie*, 8 will come before 30 and 32 will come after 30

Here, new median will remain 30

132 **(b)**

We have,

$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n} x_i^2 - \left(\frac{1}{n}\sum_{i=1}^{n} x_i\right)^2$

$\Rightarrow \sigma^2 = \frac{1}{n}(1^2 + 2^2 + \cdots + n^2)$

$- \left(\frac{1}{n}(1 + 2 + \cdots + n)\right)^2$

$\Rightarrow \sigma^2 = \frac{1}{n} \times \frac{n(n+1)(2n+1)}{6} - \left(\frac{n+1}{2}\right)^2$

$= \frac{n^2 - 1}{12}$

133 **(c)**

Class	f_i	y_i	$D_i = y_i - A$, $A = 25$	$f_i d_i$	$f_i d_i^2$
0-10	1	5	-20	-20	400
10-20	3	15	-10	-30	300
20-30	4	25	0	0	0
30-40	2	35	10	20	200
Total	**10**			**-30**	**900**

$\therefore \sigma^2 = \frac{\Sigma f_i d_i^2}{\Sigma f_i} - \left(\frac{\Sigma f_i d_i}{\Sigma f_i}\right)^2$

$= \frac{900}{10} - \left(\frac{-30}{10}\right)^2 = 90 - 9$

$\Rightarrow \sigma^2 = 81$

$\Rightarrow \sigma = 9$

134 **(a)**

Arranging the given values in ascending order of magnitude

$x - \frac{7}{2}, x - 3, x - \frac{5}{2}, x - 2, x + \frac{1}{2}, x + 4, x + 5$

There are 8 observations in the series, therefore

$\text{median} = \frac{\text{Value of 4th term} + \text{Value of 5th term}}{2}$

$= \frac{x - 2 + x - \frac{1}{2}}{2} = x - \frac{5}{4}$

136 **(d)**

The required AM is given by

$\text{AM} = \frac{1}{n}\sum_{i=1}^{n}(i+1)x_i$

$\Rightarrow \text{AM} = \frac{1}{n}\sum_{i=1}^{n}(i+1)i$

$\Rightarrow \text{AM} = \frac{1}{n}\left\{\sum_{i=1}^{n}(i^2 + i)\right\}$

$\Rightarrow \text{AM} = \frac{1}{n}\left\{\sum_{i=1}^{n} i^2 + \sum_{i=1}^{n} i\right\}$

$\Rightarrow \text{AM} = \frac{1}{n}\left\{\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}\right\}$

$\Rightarrow \text{AM} = \frac{(n+1)(2n+1)}{6} + \frac{n+1}{2}$

$\Rightarrow \text{AM} = \frac{(n+1)(5n+4)}{6}$

141 **(d)**

Let $x_1, x_2, \dots, x_n$ be n numbers. Then,

$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} x_i$

If each number is divided by 3, then the new mean $\overline{Y}$ is given by

$\overline{Y} = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{3}\right) = \frac{1}{3}\left(\frac{1}{n}\sum_{i=1}^{n} x_i\right) = \frac{\overline{X}}{3}$

142 **(c)**

Let $x_1, x_2, x_3, \dots, x_n$ be the variates corresponding to n sets of data, each having the same number of observations say k and x be their product. Then,

$x = x_1, x_2, \dots, x_n$

$\log x = \log x_1 + \log x_2 + \cdots + \log x_n$

$\Rightarrow \frac{\sum \log x}{k} = \frac{\sum \log x_1}{k} + \frac{\sum \log x_2}{k} + \cdots + \frac{\sum \log x_n}{k}$

$\Rightarrow \log G = \log G_1 + \log G_2 + \cdots + \log G_n$

$\Rightarrow G = G_1 G_2, \dots, G_n$

143 **(c)**

Let the first natural number be x

According to the question,

$x + x + 1 + x + 2 + x + 3 + x + 4 + x + 5 + x$
$+ 6 + x + 7 + x + 8 + x + 9 + x + 10 = 2761$

$\Rightarrow 11x + 55 = 2761$

$\Rightarrow x = \frac{2761 - 55}{11} = 246$

$\therefore$ Middle number $= x + 5 = 246 + 5 = 251$

144 **(a)**

We have, $4\bar{x}+3\bar{y}+7=0$ ... (i)

And $3\bar{x}+4\bar{y}+8=0$ ....(ii)

On solving Eqs.(i) and (ii), we get

$$\bar{x}=-\frac{4}{7} \text{ and } \bar{y}=-\frac{11}{7}$$

145 **(b)**

Let the n-numbers be $x_1, x_2, \dots, x_n$. Then,

$$\overline{X}=\frac{1}{n}\sum_{i=1}^{n} x_i$$

$$\Rightarrow \overline{X}=\frac{x_1+x_2+\cdots+x_{n-1}+x_n}{n}$$

$$\Rightarrow \overline{X}=\frac{k+x_n}{n} \quad [\because x_1+x_2+\cdots x_{n-1}=k]$$

$$\Rightarrow x_n=n\,\overline{X}-k$$

146 **(d)**

7th decile $D_7=\frac{7n}{10}$ ...(i)

And 7th percentile, $P_{70}=\frac{7n}{100}$ ...(ii)

From Eqs. (i) and (ii), we get

$D_7 \neq P_{70}$

149 **(c)**

Total of corrected observations

$=4500-(91+13)+(19+31)$

$=4446$

$\therefore$ Mean $=\frac{4446}{100}=44.46$

150 **(b)**

Given $b_{yx}=0.8, b_{xy}=0.2$

Then, $r=\sqrt{b_{xy}b_{yx}}=\sqrt{(0.8)(0.2)}=\sqrt{0.16}$

$\Rightarrow \quad r=0.4$

152 **(c)**

Regression coefficient of y on x is given by $\frac{cov(x,y)}{\sigma_x^2}$

153 **(a)**

Let numbers of boys are x and numbers of girls are y.

$\therefore \quad 53(x+y)=55y+50x$

$\Rightarrow \quad 3x=2y$

$\Rightarrow \quad x=\frac{2y}{3}$

$\therefore$ total number of students $=x+y=\frac{2y}{3}+y=\frac{5}{3}y$

Hence, required percentage

$=\frac{y}{5y/3}\times 100\%=\frac{3}{5}\times 100\%=60\%$

154 **(b)**

Let n_1 and n_2 be the number of men and women in a group. According to the given condition,

$$\frac{n_1\times 26+n_2\times 21}{n_1+n_2}=25$$

$$\Rightarrow 26n_1+21n_2=25n_1+25n_2$$

$$\Rightarrow n_1=4n_2 \Rightarrow \frac{n_1}{n_2}=\frac{4}{1}$$

$$\Rightarrow \frac{n_1}{n_2}=\frac{80}{20}$$

158 **(d)**

The intersecting point of two regression lines is on mean ie, $(\bar{x},\bar{y})$.

159 **(b)**

Let the regression coefficients be b_{yx}=-0.33

And $b_{xy}=-1.33$

$\therefore \quad r=-\sqrt{b_{yx}\times b_{xy}}$

$=-\sqrt{0.33\times 1.33}$

$=-\sqrt{0.4389}$

$=-0.66$

160 **(c)**

Cov $(x,y)=\frac{\Sigma xy}{n}-\frac{\Sigma x}{n}.\frac{\Sigma y}{n}=\frac{1}{10}(850)-\left(\frac{30}{10}\right)\left(\frac{400}{10}\right)$

$=85-120=-35$

And var $(x)=\sigma_x^2=\frac{1}{n}\Sigma x^2-\left(\frac{\Sigma x}{n}\right)^2$

$$=\frac{196}{10}-\left(\frac{30}{10}\right)^2=10.6$$

$$\therefore \quad b_{yx}=\frac{cov(x,y)}{var(x)}=\frac{-35}{10.6}=-3.3$$

163 **(a)**

Arranging the given values in ascending order of magnitude, we get

$$x-\frac{7}{2}, x-3, x-\frac{5}{2}, x-2, x-\frac{1}{2}, x+\frac{1}{2}, x+4, x+5$$

There are 8 observations in this series

$\therefore$ Median = AM of 4th and 5th observation

$\Rightarrow$ Median = AM of $(x-2)$ and $(x-1/2)$

$\Rightarrow$ Median $=\frac{x-2+x-\frac{1}{2}}{2}=x-\frac{5}{4}$

165 **(a)**

We have,

$$\sum X=a\sum u+b\sum v$$

$$\overline{X} = \frac{1}{n}\sum X = a\cdot\left\{\frac{1}{n}\sum U\right\} + b\left\{\frac{1}{n}\sum V\right\}$$
$$= a\overline{U} + b\overline{V}$$

166 **(d)**

$\bar{x} = 5$

Variance $= \frac{1}{n}\Sigma x_i^2 - (\bar{x}^2)$

$$0 = \frac{1}{n}.400 - 25$$
$$\Rightarrow n = \frac{400}{25}$$
$$= 16$$

168 **(a)**

We have,

$$r = \max_{i\neq j}|x_i - x_j| \text{ and}, S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{X})^2$$

Now,

$$(x_i - \overline{X})^2 = \left\{x_i - \frac{x_1 + x_2 + \cdots + x_n}{n}\right\}^2$$
$$\Rightarrow (x_i - \overline{X})^2 = \frac{1}{n^2}[(x_i - x_1) + (x_i - x_2) + \cdots + (x_i - x_{i-1}) + (x_i - x_{i+1}) + \cdots + (x_i - x_n)]^2$$
$$\Rightarrow (x_i - \overline{X})^2 \leq \frac{1}{n^2}[(n-1)r]^2 \quad [\because |x_i - x_j| \leq r]$$
$$\Rightarrow (x_i - \overline{X})^2 \leq r^2$$
$$\Rightarrow \sum_{i=1}^{n}(x_i - \overline{X})^2 \leq \frac{n\,r^2}{(n-1)}$$
$$\Rightarrow \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{X})^2 \leq \frac{n\,r^2}{(n-1)}$$
$$\Rightarrow S^2 \leq \frac{n\,r^2}{(n-1)} \Rightarrow S \leq r\sqrt{\frac{n}{n-1}}$$

169 **(b)**

$$\bar{x} = \frac{1 + 2 + 3 + \cdots + n}{n} = \frac{(n+1)}{2}$$
$$\therefore \sigma^2 = \frac{\Sigma(x_i)^2}{n} - (\bar{x})^2$$
$$= \frac{\Sigma n^2}{n} - \left(\frac{n+1}{2}\right)^2$$
$$= \frac{n(n+1)(2n+1)}{6n} - \left(\frac{n+1}{2}\right)^2 = \frac{n^2 - 1}{12}$$

172 **(d)**

Since, SD < Range

$\Rightarrow \sigma \leq (b - a)$

$\Rightarrow \sigma^2 \leq (b - a)^2$

174 **(b)**

$\because\ 8 + 12 + f_1 + 16 + f_2 + 10 = 75$

$\Rightarrow\ f_1 + f_2 = 29$ ...(i)

And $120 + 240 + 25f_1 + 480 + 35f_2 + 400 = 28.07 \times 75$

$\Rightarrow\ 1240 + 25f_1 + 35f_2 = 2105.25$

$\Rightarrow\ 5f_1 + 7f_2 = 173.25$ ...(ii)

On solving eqs. (i) and (ii), we get

$f_1 = 15$ and $f_2 = 14$

175 **(a)**

Given, n=15, $\Sigma x^2 = 2830, \Sigma x = 170$

Since, one observation 20 was replaced by 30, then

$\Sigma x^2 = 2830 - 400 + 900 = 3330$

And $\Sigma x = 170 - 20 + 30 = 180$

Variance, $\sigma^2 = \frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2 = \frac{3330}{15} - \left(\frac{180}{15}\right)^2$

$$= \frac{3330 - 12 \times 180}{15} = \frac{1170}{15} = 78.0$$

178 **(a)**

We have, $Z = aX + bY$

...(i)

$\Rightarrow \quad \bar{Z} = a\bar{X} + b\bar{Y}$

...(ii)

$$Z - \bar{Z} = a(X - \bar{X}) + b(Y - \bar{Y})$$
$$\Rightarrow (Z - \bar{Z})^2 = a^2(X - \bar{X})^2 + b^2(Y - \bar{Y})^2 + 2ab(X - \bar{X})(Y - \bar{Y})$$
$$\Rightarrow \frac{1}{n}\Sigma(Z - \bar{Z})^2 = a^2\frac{1}{n}\Sigma(X - \bar{X})^2 + b^2\frac{1}{n}\Sigma(Y - \bar{Y})^2 + 2ab\frac{1}{n}\Sigma(X - \bar{X})(Y - \bar{Y})$$
$$\Rightarrow \sigma_Z^2 = a^2\sigma_X^2 + b^2\sigma_Y^2 + 2ab\,\text{cov}\,(X, Y)$$
$$\Rightarrow \sigma_Z^2 = a^2\sigma_X^2 + b^2\sigma_Y^2 + 2ab\,r\sigma_X\sigma_Y$$
$$\left[\therefore \frac{\text{cov}(X, Y)}{\sigma_X\sigma_Y} = r\right]$$

180 **(b)**

The required AM is given by

$$\overline{X} = \frac{1 + 2 + 2^2 + 2^3 + \cdots + 2^n}{n+1} = \frac{(2^{n+1} - 1)}{(n+1)(2-1)}$$
$$= \frac{2^{n+1} - 1}{n+1}$$

181 **(d)**

Given that, $n_1 = 4,\ \bar{x} = 7.5,\ n_1 + n_2 = 10,\ \bar{x} = 6$

$$\therefore\ 6 = \frac{4 \times 7.5 + 6 \times \bar{x}_2}{10}$$
$$\Rightarrow\ 60 = 30 + 6\bar{x}_2$$
$$\Rightarrow\ \bar{x}_2 = \frac{30}{6} = 5$$

182 **(c)**

Since, percentage of coefficient of variation

$$= \frac{\text{Standerd deviation}}{\text{Mean}} \times 100$$

$\therefore 45 = \frac{\sigma}{12} \times 100$

$\Rightarrow \sigma = \frac{45 \times 12}{100} = 5.4$

183 **(c)**

Given that, $x_1 < x_2 < x_3 < \cdots < x_{201}$

$\therefore$ Median of the given observation $= \left(\frac{201+1}{2}\right)$th item Now, deviation will be minimum of taken from the median. $\therefore$ Mean deviation will be minimum, if $k = x_{101}$

184 **(a)**

It is true that median and mode can be determined graphically

186 **(b)**

Given that, $\sum_{i=1}^{20}(x_i - 30) = 2$

$\Rightarrow \sum_{i=1}^{20} x_i - \sum_{i=1}^{20}(30) = 2$

$\Rightarrow \quad \bar{x} = \frac{20.30}{20} + \frac{2}{20}$

$= 30 + 0.1 = 30.1$

187 **(c)**

Let the number of boys and girls be x and y

$\therefore 52x + 42y = 50(x + y)$

$\Rightarrow 2x = 8y$

$\Rightarrow x = 4y$

$\therefore$ Total number of students in the class

$= x + y = 5y$

$\therefore$ Required percentage of boys

$= \frac{4y}{5y} \times 100\% = 80\%$

188 **(a)**

Since, $\frac{x+(x+2)+(x+4)+(x+6)+(x+8)}{5} = 11$

$\Rightarrow \quad \frac{5x + 20}{5} = 11 \Rightarrow x = 7$

$\therefore$ Mean of the last three values $= \frac{11+13+15}{3} = 15$

189 **(c)**

Let $a, a, \ldots n$ times and $-a, -a, \ldots\ldots, n$ times, ie, mean=0

And SD$=\sqrt{\frac{n(a-0)^2+n(-a-0)^2}{2n}} = 2 \qquad (given)$

$\Rightarrow 4 = \frac{2na^2}{2n}$

$\Rightarrow a^2 = 4$

$\Rightarrow |a| = 2$

190 **(b)**

The required mean is given by

$\overline{X} = \frac{1 \cdot 1^2 + 2 \cdot 2^2 + 3 \cdot 3^2 + \cdots + n \cdot n^2}{1^2 + 2^2 + \cdots + n^2} = \frac{\sum n^3}{\sum n^2}$

$\Rightarrow \overline{X} = \frac{\left\{\frac{n(n+1)^2}{2}\right\}^2}{\frac{n(n+1)(2n+1)}{6}} = \frac{3\, n(n+1)}{2(2\,n+1)}$

193 **(c)**

Here, $n = 7$, sum=315

$\therefore \quad Mean = \frac{315}{7} = 45$

Now, standard deviation

$= \sqrt{\frac{(12-45)^2 + (23-45)^2 + (34-45)^2 + (45-45)^2 + (56-45)^2 + (67-45)^2 + (78-45)^2}{7}}$

$= \sqrt{\frac{2(1089 + 484 + 121)}{7}} = \sqrt{\frac{3388}{7}}$

$\sqrt{484} = 22$

194 **(a)**

We know, $\sigma^2 = \frac{n_1(\sigma_1^2+d_1^2)+n_2(\sigma_2^2+d_2^2)}{n_1+n_2}$

Where $d_1 = m_1 - a, d_2 = m_2 - a, a$ being the mean of the whole group

$\therefore \quad 15.6 = \frac{100 \times 15 + 150 \times m_2}{250}$

$\Rightarrow \quad m_2 = 16$

Thus, $13.44 = \frac{[(100\times9+150\times\sigma^2)+100\times(0.6)^2+150\times(0.4)^2]}{250}$

$\Rightarrow \quad \sigma = 4$

195 **(a)**

We have,

$\text{GM} = (1 \times 2 \times 4 \times 8 \times \ldots \times 2^n)^{1/n}$

$= (1 \times 2^1 \times 2^2 \times 2^3 \times \ldots \times 2^n)^{1/n}$

$\Rightarrow \text{GM} = \left\{2^{\frac{n(n+1)}{2}}\right\}^{1/n} = 2^{\frac{n+1}{2}}$

196 **(a)**

Given the standard deviation (SD) of the variable x is 10.

$\therefore$ Standard deviation of 50+5$x = 5x = 50 \quad [\because x = 10]$

197 **(c)**

Given, $3x + 2y = 26$

$\Rightarrow y = -\frac{3}{2}x + 13$

And $6x + y = 31$

$\Rightarrow \quad x = -\frac{1}{6}y + \frac{31}{6}$

$\therefore\ r = -\sqrt{\left(\frac{-3}{2}\right)\left(\frac{-1}{6}\right)}$

$\Rightarrow r = -\frac{1}{2}$

198 **(b)**

We Know, $(\sigma_x - \sigma_y)^2 \geq 0$

$\Rightarrow \sigma_x^2 + \sigma_x^2 \geq 2\sigma_x\sigma_y$

$\Rightarrow \frac{\sigma_x\sigma_y}{\sigma_x^2 + \sigma_y^2} \leq \frac{1}{2}$

If

θ *is* angle between two regression lines with c

$\tan\theta = \left(\frac{1-y^2}{y}\right)\left(\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\right)$

$\Rightarrow tan\theta\ \leq \frac{1-y^2}{2y}$

$\Rightarrow \tan^2\theta \leq \left(\frac{1-y^2}{2y}\right)^2$

Since, $\sin^2\theta \leq 1\ and 1 - y^2 < 1 + y^2$

$\therefore sin\theta \leq 1 - y^2$

199 **(c)**

Given, SD= $2 = \sqrt{\frac{100}{n} - \left(\frac{20}{n}\right)^2}$

$\Rightarrow 4 = \frac{100}{n} - \frac{400}{n^2}$

$\Rightarrow\ n^2 - 25n + 100 = 0$

$\Rightarrow\ \ n = 20,5$

200 **(a)**

${}^{2n}C_0,\ {}^{2n}C_1,\ {}^{2n}C_{2,\dots,}\ {}^{2n}C_n$ are binomial coefficients which are in odd numbers (because n is even) and middle binomial coefficient is ${}^{2n}C_{n/2}$which is required median.

201 **(b)**

We have,

$S^2 = \frac{1}{N}\sum f_i x_i^2 = \frac{n(n-1)}{4} + \frac{n}{2}$

$\Rightarrow S^2 = \frac{n(n+1)}{4}$

202 **(c)**

We have,

$\overline{X} = \frac{x_1 + x_2 + \cdots + x_n}{n} \Rightarrow n\,\overline{X} = x_1 + x_2 + \cdots + x_n$

Let $\overline{Y}$ be the mean of observations $x_i + 2\,i; i = 1,2,\dots,n$. Then,

$\overline{Y} = \frac{(x_1 + 2\cdot 1) + (x_2 + 2\cdot 2) + (x_3 + 2\cdot 3) + \cdots + (x_n + 2\cdot n)}{n}$

$\Rightarrow \overline{Y} = \frac{\sum_{i=1}^{n} x_i + 2(1 + 2 + 3 + \cdots + n)}{n}$

$\Rightarrow \overline{Y} = \frac{1}{n}\sum_{i=1}^{n} x_i + \frac{2\,n(n+1)}{2\,n} = \overline{X} + (n+1)$

203 **(c)**

Statement (2) and (3) are correct

204 **(a)**

The ascending order of the given data are 34, 38, 42,44,46,48, 54,55,63, 70

Hence, Median, $M = \frac{46+48}{2} = 47$

$\therefore$ Median deviation

$= \frac{\sum|x_i - M|}{n} = \frac{\sum|x_i - 47|}{n}$

$= \frac{13 + 9 + 5 + 3 + 1 + 1 + 7 + 8 + 16 + 23}{10}$

$= 8.6$

205 **(d)**

The required mean is given by

$\overline{X} = \frac{0\cdot 1 + 1\cdot {}^nC_1 + 2\cdot {}^nC_2 + 3\cdot {}^nC_3 + \cdots + n\cdot {}^nC_n}{1 + {}^nC_1 + {}^nC_2 + \cdots + {}^nC_n}$

$\Rightarrow \overline{X} = \frac{\sum_{r=0}^{n} r\cdot {}^nC_r}{\sum_{r=0}^{n} {}^nC_r} = \frac{\sum_{r=1}^{n} r\cdot\frac{n}{r}\,{}^{n-1}C_{r-1}}{\sum_{r=0}^{n} {}^nC_r} = \frac{n\sum_{r=1}^{n} {}^{n-1}C_{r-1}}{\sum_{r=0}^{n} {}^nC_r}$

$\Rightarrow \overline{X} = \frac{n \times 2^{n-1}}{2^n} = \frac{n}{2}$

207 **(d)**

Now, $\mu_1' = \frac{\sum_{r=0}^{n} r\,{}^nC_r}{\sum_{r=0}^{n} {}^nC_r} = \frac{n.2^{n-1}}{2^2} = \frac{n}{2}$

$\mu_2' = \frac{\sum_{r=0}^{n} r^2\,{}^nC_r}{\sum_{r=0}^{n} {}^nC_r} = \frac{n(n-1)}{2^2}.2^{n-2} + \frac{n}{2}$

$= \frac{n(n-1)}{4}\frac{n}{2}$

∴ Variance,

$\mu_2' = (\mu_2') - (\mu_2')^2 = \frac{n(n-1)}{4} + \frac{n}{2} - \frac{n^2}{4} = \frac{n}{4}$

208 **(b)**

The slopes of the lines of regression of y on x and x on y are $m_1 = b_{yx}$ and $m_2 = \frac{1}{b_{xy}}$ respectively. Therefore, the angle between them is given by

$$tan\theta = \frac{m_1 - m_2}{1 + m_1 m_2} = \frac{b_{yx} - \frac{1}{b_{xy}}}{1 + \frac{b_{yx}}{b_{xy}}}$$

$$\Rightarrow \theta = \tan^{-1}\left(\frac{b_{yx} \times b_{xy} - 1}{b_{yx} + b_{xy}}\right)$$

209 **(b)**

Given that, $\bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n}$

$\Rightarrow \quad n\bar{x} = x_1 + x_2 + \ldots\ldots + x_n$

Now, required mean $= \frac{2x_1 + 3 + \ldots + 2x_n + 3}{n}$

$$= \frac{2(x_1 + x_2 + \ldots + x_n) + 3n}{n}$$

$$= \frac{2n\bar{x} + 3n}{n} = 2\bar{x} + 3$$

210 **(d)**

Required mean $= \frac{0.{}^nC_0 + 1.{}^nC_1 + 2.{}^nC_2 \ldots + n.{}^nC_n}{{}^nC_0 + {}^nC_1 + {}^nC_2 + \ldots + {}^nC_n}$

$$= \frac{n.2^{n-1}}{2^n} = \frac{n}{2}$$

212 **(d)**

Standard deviation

$$= \sqrt{\frac{\sum_{j=1}^{18}(x_j - 8)^2}{n} - \left(\frac{\sum_{j=1}^{18}(x_j - 8)}{n}\right)^2}$$

$$= \sqrt{\frac{45}{18} - \left(\frac{9}{18}\right)^2}$$

$$= \sqrt{\frac{45}{18} - \frac{1}{4}} = \sqrt{\frac{81}{36}}$$

$$= \frac{9}{6} = \frac{3}{2}$$

214 **(b)**

Mean $= \frac{0^2 + 1^2 + 2^2 + 3^2 + \ldots + n^2}{(n+1)}$

$$= \frac{n(n+1)(2n+1)}{6(n+1)} = \frac{1}{6}n(2n+1)$$

215 **(b)**

Standard deviation does not depend on origin but it depends on scale, so,

$$\frac{ax + b}{c} = \frac{ax}{c} + \frac{b}{c}$$

$\Rightarrow$ Standard deviation of $\frac{ax+b}{c}$ is $\frac{a\sigma}{c}$.

216 **(c)**

Let the number of girls in the class $= y$

∴ Number of boys in the class $= 100 - y$

Now, $\bar{x}_1 = 25, n_1 = y, \bar{x}_2 = 50, n_2 = 100 - y$

and $\bar{x} = 35, n_1 + n_2 = 100$

$$\therefore \quad 35 = \frac{25 \times y + 50 \times (100 - y)}{100}$$

$\Rightarrow \quad 3500 = 25y + 5000 - 50y$

$\Rightarrow \quad 25y = 1500 \quad \Rightarrow \quad y = 60$

∴ Number of girls in the class $= 60$

218 **(c)**

∵ Total marks of 10 failed students $= 28 \times 10 = 280$

and Total marks of 50 students $= 2800$

∴ Total marks of 40 passed students $= 2800 - 280 = 2520$

∴ Average marks of 40 passed students $= \frac{2520}{40} = 63$

220 **(c)**

The given series is 1,2,3,...(2n+1)

$$\bar{x} = \frac{1 + 2 + 3 + \cdots + (2n+1)}{2n+1}$$

$$= \frac{(2n+1)(2n+2)}{2(2n+1)}$$

$$= (n+1)$$

$$\therefore \sigma^2 = \frac{1}{2n+1}\sum_{r=0}^{2n}\{(1+r) - (1+n)\}^2$$

$$= \frac{2}{2n+1}(1^2 + 2^2 + \cdots + n^2)$$

$$\Rightarrow \sigma^2 = \frac{n(n+1)}{3}$$

$$\Rightarrow \quad \sigma = \sqrt{\frac{n(n+1)}{3}}$$

221 **(b)**

∵ $\sigma_x^2 = 4 and \sigma_y^2 = 5$

Also $\bar{x} = 2$ and $\bar{y} = 4$

Now, $\frac{\Sigma x_i}{5} = 2 \Rightarrow \Sigma x_i = 10$

$\frac{\Sigma y_i}{5} = 4 \Rightarrow \Sigma y_i = 20$

Since $\sigma_x^2 = \frac{1}{5}(\Sigma x_i^2) - (\bar{x})^2$

$\Rightarrow \Sigma x_i^2 = 40$

Similarly $\Sigma x_i^2 = 105$

$\therefore \sigma_x^2 = \frac{1}{10}(\Sigma x_i^2 + \Sigma y_i^2) - \left(\frac{\bar{x}+\bar{y}}{2}\right)^2$

$= \frac{1}{10}(40+105) - 9$

$= \frac{55}{10} = \frac{11}{2}$

223 **(a)**

Given, $\sigma_x^2 = 9$

And lines of regression are

$4x - 5y + 33 = 0, 20x - 9y - 10 = 0$

Ie, $y = \frac{4}{5}x + \frac{33}{5} and\ x = \frac{9}{20}y + \frac{10}{20}$

$\therefore$Regression coefficient are

$b_{yx} = \frac{4}{5} and\ b_{xy} = \frac{9}{20}$

Now, $b_{yx} = \frac{cov(x,y)}{\sigma_x^2}$

$\Rightarrow cov(x,y) = \frac{4}{5} \times 9 = \frac{36}{5}$

And $b_{xy} = \frac{cov(x,y)}{\sigma_y^2}$

$\Rightarrow \sigma_y^2 = \frac{36}{5} \times \frac{20}{9} = 16$

Now, $p(x,y) = \frac{cov(x,y)}{\sigma_x \sigma_y} = \frac{36}{5 \times 3 \times 4} = 0.6$

224 **(d)**

Mean$= \frac{0 \times {}^nC_0 + 1 \times {}^nC_1 + 2 \times {}^nC_2 + \dots + n \times {}^nC_n}{{}^nC_0 + {}^nC_1 + {}^nC_2 + \dots + {}^nC_n}$

$= \frac{0 + 1 \times^n C_1 + 2 \times^n C_2 + \dots + n \times^n C_n}{2^n}$

$= \frac{n.2^{n-1}}{2^n} = \frac{n}{2}$

226 **(c)**

The sum of all the four digit numbers using the digits 3, 5, 7 and 9

$= (3+5+7+9) \times (4-1)! \left(\frac{10^4 - 1}{10 - 1}\right)$

$= 24 \times 6 \times \left(\frac{10^4 - 1}{10 - 1}\right)$

$= \frac{24 \times 6 \times 9999}{9}$

$\therefore$ Required average $= \frac{24 \times 6 \times 9999}{9 \times 24} = 6666$

227 **(d)**

Let n_1 and n_2 be the number of observations in two groups having means $\overline{X}_1$and $\overline{X}_2$ respectively. Then

$\overline{X} = \frac{n_1\overline{X}_1 + n_2\overline{X}_2}{n_1 + n_2}$

Now,

$\overline{X} - \overline{X}_1 = \frac{n_1\overline{X}_1 + n_2\overline{X}_2}{n_1 + n_2} - \overline{X}_1$

$\Rightarrow \overline{X} - \overline{X}_1 = \frac{n_2(\overline{X}_2 - \overline{X}_1)}{n_1 + n_2} > 0 \quad [\because \overline{X}_2 > \overline{X}_1]$

$\Rightarrow \overline{X} > \overline{X}_1$ ... (i)

And, $\overline{X} - \overline{X}_2 = \frac{n(\overline{X}_1 - \overline{X}_2)}{n_1 + n_2} < 0 \quad [\because \overline{X}_2 > \overline{X}_1]$

$\Rightarrow \overline{X} < \overline{X}_2$ ... (ii)

From (i) and (ii), we have $\overline{X}_1 < \overline{X} < \overline{X}_2$

229 **(b)**

x	y	$d = x - y$	d^2
1	10	-9	81
2	9	-7	49
3	8	-5	25
4	7	-3	9
5	6	-1	1
6	5	1	1
7	4	3	9
8	3	5	25
9	2	7	49
10	1	9	81
			$\sum d^2 = 330$

$\therefore$ Rank correlation $R = 1 - \frac{6d^2}{n(n^2-1)}$

$= 1 - \frac{6 \times 330}{10(10^2-1)}$

$= 1 - \frac{198}{99} = -1$

230 **(a)**

Mean of $1^2, 2^2, 3^2, \dots . n^2\ is$

$\frac{1^2 + 2^2 + 3^3 + \cdots n^2}{n} = \frac{\Sigma n^2}{n}$

$\frac{46n}{11} = \frac{n(n+1)(2n+1)}{6n}$

$\Rightarrow 22n^2 + 33n + 11 - 276n = 0$

$\Rightarrow (n-11)(22n-1) = 0$

$\Rightarrow n = 11\ and\ n \neq \frac{1}{22}$

232 **(c)**

Given, $\sum x_i^2 = 400$ and $\sum x_i = 80, since\ \sigma^2 \geq 0$

$$\Rightarrow \frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2 \geq 0$$

$$\Rightarrow \frac{400}{n} - \frac{6400}{n^2} \geq 0$$

$\Rightarrow\ n \geq 16$

$\therefore n\ = 18$