(b) Typist A can type a letter in 5 minutes, typist B in 10 minutes and typist C in 15 minutes. What is the

number of letters typed per hour per typist ?

Ans. Required average $= (12 + 6 + 4)/3 = 7.33$.

8. *(a)* A taxi ride in a city costs one rupee for the first kilometre and sixty paise for each additional kilo, cost for each kilometre is incurred at the beginning of the kilometre, so that the rider pays for a whole kilome

is the average cost for $2\frac{3}{4}$ kilometres ?

Ans. Average cost for $2\frac{3}{4}$ kms $= (100 + 60 + 60) \times \frac{4}{11}$ Paise $= 80$ Paise.

(b) The mean weight of a student in a group of 6 students is 119 lbs. The individual weights of five of

115, 109, 129, 117 and 114 lbs. What is the weight of the sixth student ?

Ans. 130 lbs.

9. *(a)* Average marks in Statistics of 10 students of a class was 68. A new student took admission with

whereas two existing students left the college. If the marks of these students were 40 and 39, find the average

the remaining students.   [*Delhi Univ., B.Com. (Pass*

Hint. $\bar{x} = \frac{(68 \times 10) + 72 - 40 - 39}{10 + 1 - 2} = 74.78$ marks (approx.).

(b) Shri Narendra Kumar has invested his capital in three securities, namely RELIANCE Ltd., TISCO

SATYAM : Rs. 40,000; Rs. 50,000 and Rs. 80,000 respectively. If he collects dividends of Rs. 10,000 from

company, compute his average return from three securities.   [*Delhi Univ. B.Com. (Pass)*

Hint. Average rate of return $= \frac{\text{Total return}}{\text{Total investment}} = \frac{3 \times 10,000}{40,000 + 50,000 + 80,000}$

Ans. 17·65%.

10. *(a)* Twelve persons gambled on a certain night. Seven of them lost at an average rate of Rs. 10·50 while

remaining five gained at an average of Rs. 13·00. Is the information given above correct ? If not, why ?

Ans. Information is incorrect.

(b) Goals scored by a hockey team in successive matches are 5, 7, 4, 2, 4, 0, 5, 5 and 3. What is the number

goals, the team must score in 10th match in order that the average comes to 4 goals per match.

Ans. 5.

(c) The sum of deviations of a certain number of observations measured from 4 is 72 and the sum of the devi

of the same value from 7 is –3. Find the number of observations and their mean.   [*Delhi Univ. B.Com. (Hons.)*

Hint. Let n be the number of observations.

If $d = X - A$, then $\bar{X} = A + \frac{\Sigma d}{n}$; $\therefore$ $\bar{X} = 4 + \frac{72}{n} = 7 + \frac{(-3)}{n}$. Solving, we get $n = 25$, $\bar{X} = 6.88$.

(d) The daily average sales of a store were Rs. 2,750 for the month of Feb. 1996. During the month, the high

and the lowest sales were Rs. 8,950 and Rs. 580 respectively. Find the average daily sales if the highest and the

sales are not taken into account.   [*Delhi Univ. B.Com. (Hons.)*

Hint and Ans. n = No. of days in month of February of 1996 (Leap Year) = 29

Revised mean = Rs. $\frac{1}{27} [\Sigma X - 8,950 - 580]$ = Rs. $\frac{1}{27} [29 \times 2,750 - 8,950 - 580]$ = Rs. 2,600.74

Ans. Rs. 2,600.74

(e) Two variables x and y are related by : $y = (x - 5)/10$ and each of them has 5 observations. If the mean of x

find the mean of y.

Ans. $\bar{y} = [\bar{x} - 5)/10] = 4$.   [*I.C.W.A. (Foundation), Dec.*

11. *(a)* The following are the daily salaries in rupees of 30 employees of a firm :

91, 139, 126, 119, 100, 87, 65, 77, 99, 95, 108, 127, 86, 148.

76, 69, 88, 112, 118, 89, 116, 97, 105, 95, 80, 86, 106, 93.

The firm gave bonus of Rs. 10, 15, 20, 25, 30, 35, 40, 45 and 50 to employees in the respective salary

exceeding 60 but not exceeding 70, exceeding 70 but not exceeding 80 and so on up to exceeding 140

exceeding 150. Construct a frequency distribution and find out the total daily bonus paid per employee.

Ans. Average daily bonus = Rs. 27·50.

(b) The management of a college decides to give scholarship to the students who have scored marks 70 and

70 in Business Statistics. The following are the marks scored by II B.Com. students :

| 71 | 73 | 74 | 85 | 86 | 88 | 91 | 94 | 96 | 99 |
| 74 | 74 | 76 | 93 | 91 | 94 | 96 | 98 | 88 | 94 |

The scholarship payable is given below :

Marks	70—75	75—80	80—85	85—90	90—95	95—100
Scholarship amount (Rs.)	100	200	300	400	500	600

Estimate the total scholarship payable and the average scholarship payable. *(Bangalore Univ. B.Com., 1999)*

12. A certain number of salesmen were appointed in different territories and the following data were compiled from their sales reports :

Sales ('000 Rs.)	4—8	8—12	12—16	16—20	20—24	24—28	28—32	32—36	36—40
No. of salesmen	11	13	16	14	—	9	17	6	4

If the average sales is believed to be Rs. 19,920, find the missing information.

Ans. Missing Frequency = 10.

13. The mean of the following frequency distribution is 50. But the frequencies f_1 and f_2 in classes 20—40 and 60—80 are missing. Find the missing frequencies.

Class	0—20	20—40	40—60	60—80	80—100	
Frequency	17	f_1	32	f_2	19	Total 120

[Delhi Univ. B.Com. (Pass), 1997]

Ans. $f_1 = 28, f_2 = 24$.

14. (a) The average salary of 49 out of 50 employees in a firm is Rs. 100. The salary of the 50th employee is Rs. 97·50 more than the average salary of all the 50 workers. Find the mean salary of all the employees in the firm.

(b) The mean of 99 items is 55. The value of 100th item is 99 more than the mean of 100 items. What is the value of 100th item. *[Delhi Univ. B.Com (Hons.), 2001]*

Ans. (a) Rs. 101·99, (b) 155.

15. (a) The mean of 200 items was 50. Later on it was discovered that two items were wrongly read as 92 and 8 instead of 192 and 88. Find out the correct mean.

Ans. 50·9.

(b) The average daily income for a group of 50 persons working in a factory was calculated to be Rs. 169. It was later discovered that one figure was mis-read as 134 instead of the correct value 143. Calculate the correct average income.

Ans. Rs. 169·18.

(c) The average marks of 80 students were found to be 40. Later, it was discovered that a score of 54 was misread as 84. Find the correct mean of 80 students. *[C.S. (Foundation), June 2001]*

Ans. 39·625.

16. 100 students appeared for an examination. The results of those who failed are given below :

Marks	5	10	15	20	25	30	Total
No. of Students	4	6	8	7	3	2	30

If the average marks of all students were 68.6, find out average marks of those who passed.

[Delhi Univ. B.Com. (Hons.), 2008]

Ans. $n_1 + n_2 = 100, n_1 = 30 \Rightarrow n_2 = 70$; $\overline{X}_1 =$ Mean marks of failed students $= \dfrac{\Sigma fX}{\Sigma f} = \dfrac{475}{30}$.

$$\overline{X}_{12} = \dfrac{n_1 \overline{X}_1 + n_2 \overline{X}_2}{n_1 + n_2} = \dfrac{475 + 70\,\overline{X}_2}{100} = 68.6 \Rightarrow \overline{X}_2 = 91.21$$

17. Fifty students appeared in an examination. The results of the passed students in given in the adjoining table.

The average marks of all the students is 52. Find the average marks of the students who failed in the examination.

[I.C.W.A. (Foundation), Dec. 2006]

Ans. 21.

Marks	No. of students
40	6
50	14
60	7
70	5
80	4
90	4

18. Out of 50 examinees, those passing the examination are shown below. If average marks of all the examinees 5·16, what would be the average marks of examinees having failed in it ?

5.32

8. Calculate arithmetic mean and median from the following series :

	0—5	5—10	10—15	15—20	20—25	25—
	5	7	10	8	6	4

[C.S. (Foundation), ...

Ans. Arithmetic mean = 14.375 ; Median = 14.

9. For the data given below, find the missing freqeuncy if the Arithmetic Mean is Rs. 33. Also find the ...
the series

Less per shop (Rs.)	0—10	10—20	20—30	30—40	40—50	50—
No. of shops	10	15	30	—	25	2...

[C.A. (Foundation), ...

Ans. Missing frequency = 25 ; Median = 33.

10. Given below is the distribution of marks obtained by 140 students in an examination.

Marks	10—19	20—29	30—39	40—49	50—59	60—69	70—79	80—89	...
No. of students	7	15	18	25	30	20	16	7	...

Find the median of the distribution.

[C.A. PEE-I, Ma...

Ans. 51.167.

11. Compute median from the following data :

Mid-value	115	125	135	145	155	165	175	185	...
Frequency	6	25	48	72	116	60	38	22	...

Hint. The class intervals are : 110—120, 120—130,......, 190—200

Ans. Median = 153.79.

12. You are given below a certain statistical distribution :

Value	Less than 100	100—200	200—300	300—400	400 and above	Total
Frequency	40	89	148	64	39	380

Calculate the most suitable average giving reasons for your choice.

Ans. Md = 241.22.

13. The following table gives the distribution of marks secured by some students in a certain examination :

Marks	0—20	21—30	31—40	41—50	51—60	61—70	71—
No. of Students	42	38	120	84	48	36	31

Find : (i) Median marks.

(ii) The percentage of failure if minimum for a pass is 35 marks.

Ans. (i) Md = 40.46 (ii) 31.58%.

14. Calculate the median from the following data :

Weight (in gms.)	410—419	420—429	430—439	440—449	450—459	460—469	470—
No. of Apples	14	20	42	54	45	18	7

Ans. Median = 443.94 gms

[Andhra Pradesh Univ. B.Com. ...

15. Given below is the distribution of 140 candidates obtaining marks X or higher in a certain examination :
marks are given in whole numbers)

Marks (More than)	10	20	30	40	50	60	70	80	90	100
Freqeuncy	140	133	118	100	75	45	25	9	2	0

Calculate the mean and median marks obtained by the candidates.

Ans. Mean = 50.714, Median = 51.167.

16. The following table gives the weekly wages in rupees in a certain commercial organisation.

Weekly wages ('00 Rs.)	30—	32—	34—	36—	38—	40—	42—	44—	46—	48—
Frequency	3	8	24	31	50	61	38	21	12	2

Find : (i) the median and the first quartile, (ii) the number of wage earners receiving between Rs. 3700 Rs. 4700 per week.

Ans. (i) Md = Rs. 4029.51; Q_1 = Rs. 3777.42; (ii) 191.

17. Define a percentile. Find the 45th and 57th percentiles for the following data on marks obtained by 100 students:

Marks	20—25	25—30	30—35	35—40	40—45	45—50
No. of Students	10	20	20	15	15	20

[C.A. (Foundation), May 1996]

Ans. $P_{45} = 33.75$; $P_{57} = 37.33$.

18. Find :

(a) the 2nd decile,   (b) the 4th decile,   (c) the 90th percentile, and   (d) the 68th percentile

for the data given below, interpreting clearly the significance of each.

Age of Head of Family (years)	Number (in millions)	Age of Head of Family (years)	Number (in millions)
Under 25	2·22	55—64	6·63
25—29	4·05	65—74	4·16
30—34	5·08	75 and over	1·66
35—44	10·45		Total 43·72
45—54	9·47		

Ans. $D_2 = 31.94$ years, $D_4 = 40.38$ years, $P_{90} = 67.98$ years, $P_{68} = 52.87$ years.

19. Find the   (i) Lower quartile,   (ii) Upper quartile,   (iii) 7th decile, and   (iv) 60th percentile,

for the following frequency distribution :

Wages (Rs.)	30—40	40—50	50—60	60—70	70—80	80—90	90—100
No. of Persons	1	3	11	21	43	32	9

Ans. (i) Rs. 67·14,   (ii) Rs. 83·44,   (iii) Rs. 81·56,   (iv) Rs. 78·37.

20. Draw an ogive for the data given below and show how can the value of median be read off from this graph. Verify your result.

Class Interval	0—5	5—10	10—15	15—20	20—25	25—30
Frequency	5	10	15	8	7	5

Ans. Median = 13·5 (approx.); By formula, Md = 13·33.

21. Draw a 'less than ogive' from the following data and hence find out the value of lower quartile.

Class Interval	0—5	5—10	10—20	20—30	30—40	40—50
Frequency	5	7	15	20	8	5

Ans. $Q_1 = 12$.

22. The frequency distribution of heights of 100 college students is as follows :

Height (cms.)	141—150	151—160	161—170	171—180	181—190	Total
Frequency	5	16	56	19	4	100

Draw an ogive (less than or more than type) of this distribution and from the ogive find

(i) the first quartile,   (ii) the median,   (iii) the third quartile,   and   (iv) Inter-quartile Range.

Ans. $Q_1 = 161.2$ cms, $Q_3 = 170.1$ cms,   Median = 165·7 cms,   I.Q. Range = 8.9 cm.

23. The monthly salary distribution of 250 families in a certain locality in Agra is given below :

Monthly Salary (Rs.)	No. of Families	Monthly Salary (Rs.)	No. of Families
More than 0	250	More than 2,000	55
More than 500	200	More than 2,500	30
More than 1,000	120	More than 3,000	15
More than 1,500	80	More than 3,500	5

Draw a 'less than' ogive for the data given above and hence find out :
(i) Limits of the income of middle 50% of the families ; and
(ii) If income tax is to be levied on families whose income exceeds Rs. 1,800 p.m., calculate the percentage of families, which will be paying income tax.
[Delhi Univ. B.Com. (Hons.)]

Ans. (i) Q_1 = Rs. 878 (approx.), Q_3 = Rs. 1850

(ii) $\frac{25}{(2000-1500)} \times (2000-1800) + 25 + 15 + 10 + 5 = 65$

$\therefore$ Percentage of families paying income tax = $\frac{65}{250} \times 100 = 26\%$.

24. Draw a 'less than' and 'more than' ogive curve for the following data and find median value :

No. of Children	0	1	2	3	4	5
No. of Families	150	72	50	28	12	8

[Delhi Univ. B.Com. (Pass)]

Hint. Since the number of children is a discrete random variable which can take only positive integers, the given frequency distribution can be expressed as grouped frequency distribution with exclusive type classes as given below.

Variable	0—1	1—2	2—3	3—4	4—5	5—6
Frequency	150	72	50	28	12	8

Ans. Median from ogive = 1·1 (approx.).

25. With the help of given data, find :
(i) Value of middle 50% items; (ii) Value of exactly 50% item; (iii) The value of P_{40} and D_6
(iv) Graphically with the help of ogive curve, the values of Q_1, Q_3, median, P_{40} and D_6 :

Class Interval	10—14	15—19	20—24	25—29	30—34	35—39	Total
Frequencies	5	10	15	20	10	5	65

[Delhi Univ. B.Com. (Hons.)]

Ans. (i) $Q_3 - Q_1$ = 29.19 – 19.92 = 9.27; (ii) $Md = Q_2$ = 25.13 ; (iii) P_{40} = 23.17, $D_6 = 26$

26. One hundred and twenty students appeared for a certain test and the following marks distribution obtained:

Marks	0—20	20—40	40—60	60—80	80—100
Students	10	30	36	30	14

Find : (i) The limits of marks of middle 30% students.
(ii) The percentage of students getting marks more than 75.
(iii) The number of students who fail, if 35 marks are required for passing.

Ans. (i) P_{35} = 41·1 ; P_{65} = 61·3 ; (ii) $\frac{100}{120}\left[\left(\frac{30}{20}\times5\right)+14\right]$ = 17·9 %; (iii) $10 + \frac{15}{20} \times 30 = 32·5 \approx 33$

27. The expenditure of 1,000 families is given as under :

Expenditure (in Rs.)	40—59	60—79	80—99	100—119	120—139
No. of families	50	?	500	?	50

The median for the distribution is Rs. 87. Calculate the missing frequencies.
Ans. 262·5, 137·5 ≈ 263, 137.

28. An incomplete frequency distribution is given as follows :

Variable	10—20	20—30	30—40	40—50	50—60	60—70	70—80	Total
Frequency	12	30	?	65	?	25	19	?

You are given that median value is 46.
(a) Using the median formula, fill up the missing frequencies.
(b) Calculate the Arithmetic Mean of the completed table.
Ans. (a) 34, 45
(b) 45·96

Marks	No. of students
15—19	14
20—24	12
25—29	10
30—34	10
35—39	9
40—44	

	No. of students
45—49	9
50—54	16
55—59	5
60—64	4
65—69	1

Ans. Mean = 37·12, $Md = 36$, $Mo = 23.5$.

12. Find out the median and mode from the following table :

No. of days absent	No. of students
Less than 5	29
Less than 10	224
Less than 15	465
Less than 20	582
Less than 25	634

No. of days absent	No. of students
Less than 30	644
Less than 35	650
Less than 40	653
Less than 45	655

Ans. $Md = 12.75$, $Mo = 11.35$.

13. Find out the Mean, Median and the Mode in the following series—

Size (below)	5	10	15	20	25	30
Frequency	1	3	13	17	27	36

(Andhra Pradesh Univ. B.Com.)

Ans. Mean = 19·74, $Md = 21$, $Mo = 24.3$.

14. In 500 small scale industrial units, the return on investment ranged from 0 to 30%, no unit sustaining any 5% of industrial units had returns exceeding 0% but not exceeding 5%. 15% of units had returns exceeding 5% but exceeding 10%. Median and upper quartile rate of return was 15% and 20% respectively. The uppermost layer returns exceeding 25% but not exceeding 30% was earned by 25%. Present this information in the form of frequency table with intervals as follows :

Exceeding 0% but not exceeding 5%   ;   Exceeding 5% but not exceeding 10%

Exceeding 10% but not exceeding 15% ;   Exceeding 15% but not exceeding 20%

Exceeding 20% but not exceeding 25% ;   Exceeding 25% but not exceeding 30%.

Use $N/4$, $2N/4$, $3N/4$ as ranks of lower, middle and upper quartiles respectively. Find the rate of return around which there is maximum concentration of units.

[Delhi Univ. B.Com. (Hons.)]

Return in %	0—5	5—10	10—15	15—20	20—25	25—30
No. of units	25	75	150	125	0	125

Mode = 13·75; Rate of return around which there is maximum concentration of units is 13.75%.

15. Calculate the arithmetic mean and the median of the frequency distribution given below. Hence calculate mode using the empirical relation between the three.

Class limits	130—134	135—139	140—144	145—149	150—154	155—159	160—
Frequency	5	15	28	24	17	10	1

Ans. $M = 145.35$, $Md = 144.92$, $Mo = 144.06$.

16. (a) Briefly explain the role of grouping and analysis table in calculation of mode.

[Delhi Univ. B.Com. (Pass)]

(b) From the following data of weight of 122 persons determine the modal weight by the method of grouping.

Weight (in lbs.)	100—110	110—120	120—130	130—140	140—150	150—160	160—170	170—
No. of persons	4	6	20	32	33	17	8	

[Osmania Univ. B.Com.]

Hint. Method of grouping gives two modal classes 130—140 and 140—150 i.e., the distribution is bimodal. Locate the value of mode by using the empirical relation $Mo = 3Md - 2M$.

Ans. Mean $(M) = 139.51$; Median $(Md) = 139.69$; Mode $(Mo) = 140.05$.

17. Calculate the Mode, Median and Arithmetic average from the following data

Class	f		Class	f
0—2	8		25—30	45
2—4	12		30—40	60
4—10	20		40—50	20
10—15	10		50—60	13
15—20	16		60—80	15
20—25	25		80—100	4

Hint. Rewrite the frequency distribution with classes of equal magnitude 10.

Ans. $Mo = 28·15$, $Md = 28·29$, $Mean = 30·08$.

18. In the following data, two class frequencies are missing.

Class	Frequency	Class	Frequency
100—110	4	150—160	?
110—120	7	160—170	16
120—130	15	170—180	10
130—140	?	180—190	6
140—150	40	190—200	3

However, it was possible to ascertain that the total number of frequencies was 150 and that the median has been correctly found to be 146·25.

You are required to find out with the help of the information given :

(i)   Two missing frequencies.
(ii) Having found the missing frequencies, calculate arithmetic mean.
(iii) Without using the direct formula, find the value of the mode.

Ans. (i) 24, 25 ;   (ii) $\overline{X} = 147·33$;   (iii) Mode = 144·08

19. The median and mode of the following hourly wage distribution are known to be Rs. 33·5 and Rs. 34 respectively. Three frequency values from the table are, however, missing. You are required to find out those values.

Wages in Rs. :	0—10	10—20	20—30	30—40	40—50	50—60	60—70	Total
No. of persons :	4	16	?	?	?	6	4	230

Ans. 60, 100, 40.

20. You are given the following incomplete frequency distribution. It is known that the total frequency is 1000 and that the median is 413·11. Estimate by calculation the missing frequencies and find the value of the mode.

Value (X)	Frequency (f)	Value (X)	Frequency (f)
300—325	5	400—425	326
325—350	17	425—450	?
350—375	80	450—475	88
375—400	?	475—500	9

Ans. Missing frequencies are 227 and 248 respectively. $Mo = 413·98$.

21. "Hari put the jar of water and the packet of sweets on the ground and sat down in the shade of the tree and waited."

Prepare a frequency distribution for the words in the above sentence taking the number of letters in words as the variable. Calculate the mean, median and mode.

Ans. Mean = 3·56,   Median = Mode = 3.

22. Treating the number of letters in each word in the following passage as the variable x, prepare the frequency distribution table and obtain its mean, median, mode.

"The reliability of data must always be examined before any attempt is made to base conclusions upon them. This is true of all data, but particularly so of numerical data, which do not carry their quality written large on them. It is a waste of time to apply the refined theoretical methods of Statistics to data which are suspect from the beginning."

Ans. Mean = 4·565,   Median = 4,   Mode = 3.

6·8

	4	5	6	7	8	9	
	73	185	619	280	115	870	

(c) Coefficient of Range = 0·84

Ans. (b) G = Rs. 252·4.

3. The index numbers of prices of cotton shares (I_1) and coal shares (I_2) in a given year are as under—

Month	Jan	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov
I_1	188	178	173	164	172	183	184	185	211	217	232
I_2	131	130	130	129	129	120	127	127	130	137	140

Calculate range for each share. Hence, discuss which share do you consider more variable in price.

Ans. Range (I_1) = 76, Coefficient of Range (I_1) = 0·19 ; Range (I_2) = 22, Coefficient of Range (I_2) = 0·084

Cotton shares are more variable in prices.

4. Find the value of third quartile if the values of first quartile and quartile deviation are 104 and 18 respectively. [Delhi Univ. B.Com. (Pass)]

Ans. Q_3 = 140.

5. Age distribution of 200 employees of a firm is given below : Construct a 'less than ogive curve, and hence otherwise calculate semi-interquartile range $\frac{Q_3 - Q_1}{2}$ of the distribution :

Age in years (less than)	25	30	35	40	45	50	55
No. of employees	10	25	75	130	170	189	200

Ans. Q_1 = 33·5 years, Q_3 = 43 years, $\frac{Q_3 - Q_1}{2}$ = 4·75 years

6. Find the mode, median, lower quartile (Q_1) and upper quartile (Q_3) and Coeff. of Q.D. from the following data :

Wages	0—10	10—20	20—30	30—40	40—50
No. of workers	22	38	46	35	20

[Maharishi Dayanand Univ. B.Com. 19

Ans. Mode = 24·21 ; Median = 24·46, Q_1 = 14·803, Q_3 = 24·21 ; Coeff. of Q.D. = 0·396.

7. Compute the Coefficient of Quartile Deviation of the following data :

Size	Frequency	Size	Frequency
4—8	6	24—28	12
8—12	10	28—32	10
12—16	18	32—36	6
16—20	30	36—40	2
20—24	15		

Ans. Q_1 = 14·5, Q_3 = 24·92, Coefficint of Q.D. = 0·2643

8. Find (i) Inter-quartile range, (ii) Semi-inter-quartile range, and (iii) Coefficient of quartile deviation, from the following frequency distribution :

Marks	10—20	20—30	30—40	40—50	50—60	60—70	70—80	80—90
No. of students	60	45	120	25	90	80	120	60

[C.A. (Foundation), Dec. 19

Ans. (i) 38·75, (ii) 19·375, (iii) 0·3647

9. From the following data,
(i) Calculate the 'percentage' of workers getting wages : (a) more than Rs. 44 ; (b) between Rs. 22 and Rs
(ii) Find the quartile deviation.

Wages (Rs.)	0—10	10—20	20—30	30—40	40—50	50—60	60—70	70—80
No. of workers	20	45	85	160	70	55	35	30

Ans. (i) (a) 32·4%, (b) 68·4%; (ii) Q_1 = 27·06, Q_3 = 49·29, Q.D. = 11·115.

10. Calculate the appropriate measure of dispersion from the following data :

Wages in Rs. per week :	Less than 35	35—37	38—40	41—43	Over 43
No. of wage earners :	14	62	99	18	7

Ans. Coefficient of Q.D. = 0·046.

11. Find out middle 50%, middle 80% and coefficient of Q.D. from the following table :

Size of items	2	4	6	8	10	12
Frequency	3	5	10	12	6	4

Ans. Quartile range = 4 ; Percentile range = 8, Coefficient of Q.D. = 0·25

EXERCISE 6.2

1. What do you mean by 'mean deviation'. Discuss its relative merits over range and quartile deviation as a measure of dispersion. Also point out its limitations.

2. Calculate mean deviation about A.M. from the following :

Value (x)	10	11	12	13
Frequency (f)	3	12	18	12

Ans. A.M. = 11·87 ; M.D. = 0·71.

3. Calculate the mean deviation about meadian of the series :

x	2·5	3·5	4·5	5·5	6·5	7·5	8·5	9·5	10·5
f	2	3	5	6	6	4	6	4	14

Ans. M.D. (about median) = 2·22.

4. Compute the quartile deviation and mean deviation from median for the following data.

Height in inches	No. of students	Height in inches	No. of students
58	15	63	22
59	20	64	22
60	32	65	10
61	35	66	8
62	33	—	—

Ans. Q.D. = 1·5 ; M.D. (about median) = 1·73.

5. With median as the base, calculate the mean deviation and compare the variability of the two series A and B.

Series A :	3484	4572	4124	3682	5624	4388	3680	4308
Series B :	487	508	620	382	408	266	186	218

Ans. Series A : Md = 4216 ; M.D. = 490·25 ; Coeff. of M.D. = 0·116;
Series B : Md = 395 ; M.D. = 121·38 ; Coeff. of M.D. = 0·307. Series B is more variable.

6. Compare the dispersion of the following series by using the co-efficient of mean deviation.

Age (years) :	16	17	18	19	20	21	22	23	24	Total
No. of boys :	4	5	7	12	20	13	5	0	4	70
No. of girls :	2	0	4	8	15	10	6	3	2	50

Ans. Coeff. of M.D. about median (boys) = 0·0685 ; Coeff. of M.D. about median (girls) = 0·0630.

7. Calculate the mean deviation from the mean for the following data :

Marks :	0—10	10—20	20—30	30—40	40—50	50—60	60—70
No. of Students :	6	5	8	15	7	6	3

[C.A. (Foundation), May 1999]

Ans. Mean = 33·4 ; M.D. about mean = 13·184.

8. (a) Mean deviation may be calculated from the arithmetic mean or the median or the mode ? Which of these three measures is the minimum ?

(b) Find out mean deviation and its coefficient from median from the following series :

Size of items :	4	6	8	10	12	14	16
Frequency :	2	1	3	6	4	3	1

Ans. 2·4 ; 0·24

9. Calculate the mean deviation about the mean for the following data :

x :	5	15	25	35	45	55	65
f :	8	12	10	8	3	2	7

[C.A. (Foundation) May 2001]

Also find the M.D. about median and comment on the results obtained in (a) and (b).

Ans. Mean = 29; M.D. about mean = 16. ; Median = 22 ; M.D. about median = 15·8.

Ans. (i) $\Sigma(X - v)^2$ is minimum when $v = \bar{X} = \frac{1}{5}(1 + 3 + 4 + 5 + 12) = 5$

(ii) $\Sigma|X - v|$ is minimum when $v = $ Median of $(1, 3, 4, 5, 12) = 4$

10. Calculate standard deviation of the following marks obtained by 5 students in a tutorial group

Marks Obtained 8, 12, 13, 15, 22 [Delhi Univ. B.Com. (P...

Ans. $\sigma^2 = \frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2 = \frac{1086}{5} - \left(\frac{70}{5}\right)^2 = 21.2$ $\Rightarrow$ $\sigma = \sqrt{21.2} = 4.6$.

11. Why is standard deviation considered to be the best measure of dispersion ? Find the variance if Σd^2... [Delhi Univ. B.Com. (P...

$X = 6$. Deviations are taken from actual mean.

Ans. $\sigma^2 = \frac{150}{6} = 25$.

12. (a) From the following information, find the standard deviation of x and y variables :

$\Sigma x = 235$, $\Sigma y = 250$, $\Sigma x^2 = 6750$, $\Sigma y^2 = 6840$, $N = 10$. [Delhi Univ. B.Com. (Hon...

Ans. $\sigma_x = 11.08$; $\sigma_y = 7.68$.

(b) You are given the following raw sums in a statistical survey of two variables X and Y :

$\Sigma X = 240$, $\Sigma Y = 250$, $\Sigma X^2 = 6400$ and $\Sigma Y^2 = 7060$.

Ten items are included in each survey. Compute Standard Deviation of the X and Y variables. [Delhi Univ. B.Com. (Pa...

Ans. $\sigma_x = 8$, $\sigma_y = 9$.

13. (a) State a formula for computing standard deviation of n natural numbers 1, 2, ..., n. [Delhi Univ. B.Com. (Pass)...

Ans. $\sigma = \sqrt{(n^2 - 1) / 12}$.

(b) Show that the standard deviation of the natural numbers 1, 2, 3, 4 and 5 is $\sqrt{2}$. [Kerala Univ. B.Com. ...

(c) Mean of 10 items is 50 and S.D. is 14. Find the sum of the squares of all the items.
[Mahatma Gandhi Univ. B.Com., April ...

Ans. $\Sigma x^2 = 26960$

14. Calculate standard deviation of the following series.

Daily Wages of Workers (in Rs.)	No. of Workers	Daily Wages of Workers (in Rs.)	No. of Workers	Daily Wages of Workers (in Rs.)	No. of Workers
100—105	200	120—125	350	140—145	280
105—110	210	125—130	520	145—150	210
110—115	230	130—135	410	150—155	160
115—120	320	135—140	320	155—160	90

Ans. s.d. = 14.244

15. Find out the mean and standard deviation of the following data.

Age under (years) :	10	20	30	40	50	60	70	80
No. of persons dying :	15	30	53	75	100	110	115	125

Ans. Mean = 35.16 years, S.D. = 19.76 years.

16. In the following data, two class frequencies are missing.

Class Interval	Frequency	Class Interval	Frequency
100—110	4	150—160	—
110—120	7	160—170	16
120—130	15	170—180	10
130—140	—	180—190	6
140—150	40	190—200	3

However, it was possible to ascertain that the total number of frequencies was 150 and that the median has been correctly found out as 146·25. You are required to find with the help of information given :

(i) The two missing frequencies.

(ii) Having found the missing frequencies, calculate arithmetic mean and standard deviation.

(iii) Without using the direct formula, find the value of mode.

Ans. (i) 24, 25; (ii) A.M. = 147·33, s.d. = 19·2; (iii) Mode = 144·09