Unit 12 Information Handling

EXERCISE 12.1

1. The following distribution represents the scores achieved by a group of chemistry students in the chemistry laboratory.

Scores	24 – 28	29 – 33	34 – 38	39 – 43	44 – 48	49 – 53	Total
No. of students	3	6	12	23	15	6	65

Answer the following questions.

(i) What is the upper limit of the last class?

(ii) What is the lower limit of the class 39 – 43?

(iii) What is the midpoint of the class (34 – 38)?

(iv) What are the class frequencies of the classes 29 – 33 and 44 – 48?

(v) What is the size of the class limits in the above frequency distribution?

(vi) In which class or group does minimum number of students fall?

(vii) What is the lower limit of the class having 15 as its class frequency?

(viii) What is the number of students having scores between 24 and 43?

Solution

(i) 53 (ii) 39 (iii)

$$\text{Midpoint} = \frac{\text{Lower class limit} + \text{Upper class limit}}{2}$$

$$= \frac{34 + 38}{2} = \frac{72}{2}$$

$$= 36$$

(iv) 6 and 15 (v) 5 (vi) (24 – 28) (vii) 44 (viii) $3 + 6 + 12 + 23 = 44$

2. For a school staff, the following expenditures (rupees in hundred) are required for the repair of chairs.

145, 152, 153, 156, 158, 160, 146, 152, 155, 159,
161, 163, 165, 147, 148, 151, 154, 156, 158, 160,
144, 167, 151, 150, 152, 149, 145, 153, 152, 155

Prepare a frequency distribution by tally bar method using 3 as the size of class limits and also write down what are the frequencies of the last three classes?

Solution: Smallest value = 144, Largest value = 167

Class limits	Tally marks	f
144 – 146	𝍸	4
147 – 149	𝍸	3
150 – 152	𝍸 ||	7
153 – 155	𝍸	5
156 – 158	𝍸	4
159 – 161	𝍸	4
162 – 164	|	1
165 – 167	||	2
Total		**$\Sigma f = 30$**

Frequencies of last three classes are

4,1,2

3. Given below are the weights in kg of 30 students of a high school.

30, 33, 24, 21, 15, 39, 37, 44, 42, 33,
33, 28, 29, 32, 31, 28, 26, 32, 34, 35,
38, 36, 41, 30, 35, 41, 23, 26, 18, 34

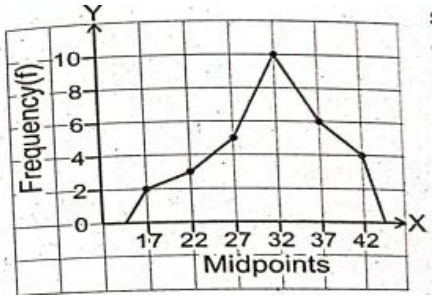
Taking 5 as the size of the class limit, prepare a frequency table and construct a frequency polygon.

Solution: Smallest value = 15, Largest value =44

Class limits	Tally marks	f
15 – 19	||	2
20 – 24	𝍸	3
25 – 29	𝍸	5
30 – 34	𝍸 𝍸	10
35 – 39	𝍸 |	6
40 – 44	𝍸	4
Total		**$\Sigma f = 30$**

Frequency Polygon

Scale:
On x-axis: 1 box = 5 units
on y-axis: 1 box = 2 units



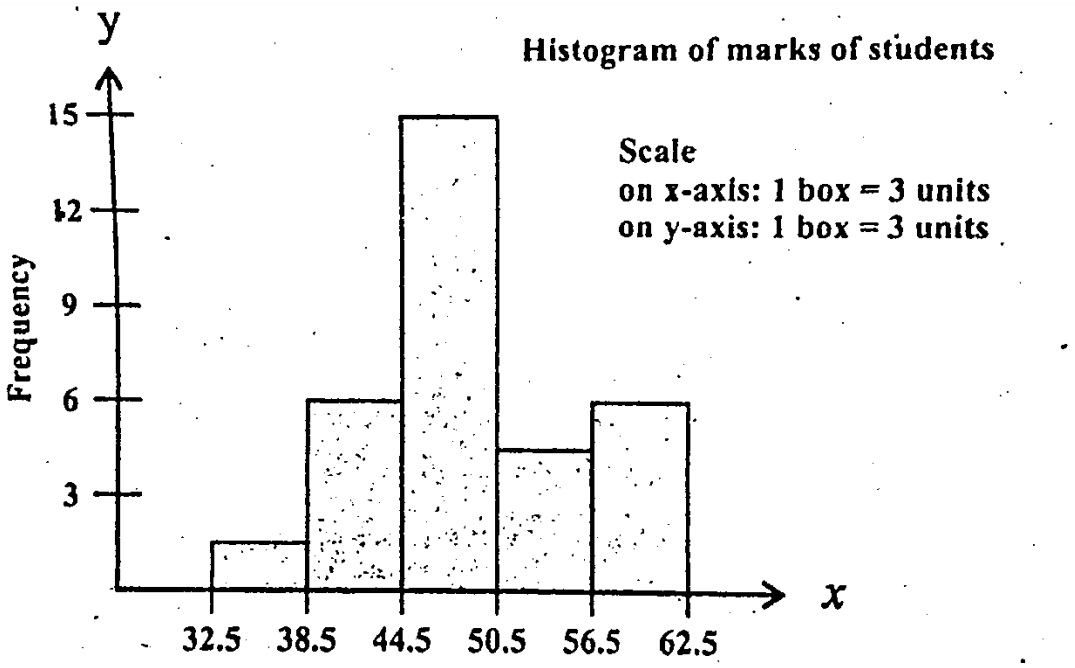
4. A group of Grade - 10 students obtained the following marks out of 100 marks in English test.

58, 59, 58, 33, 40, 58, 45, 46, 43, 45, 45,
50, 52, 49, 50, 57, 52, 55, 49, 50, 62, 49,
48, 44, 42, 47, 46, 47, 46, 53, 40, 44

Classify the data into a frequency distribution by (direct method) taking 6 as the size of class limit. Also find the class limit with least class frequency and construct histogram for the data.

Solution

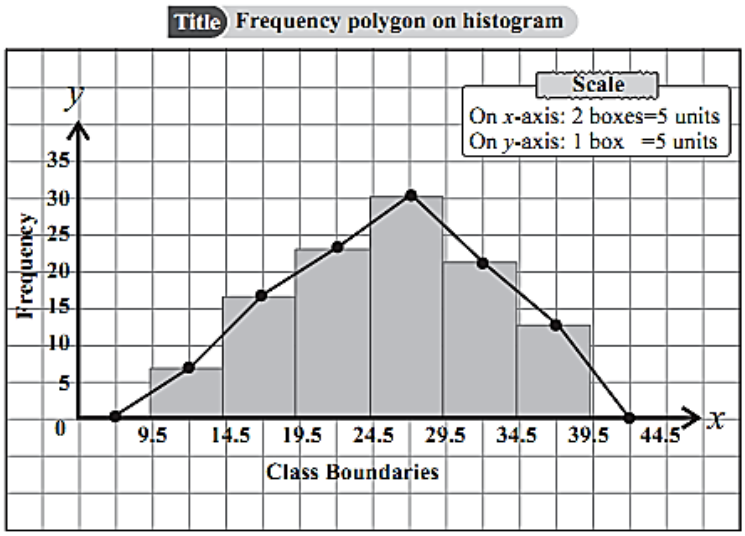
Class limits	Tally marks	f
33 – 38	|	1
39 – 44	𝍸 |	6
45 – 50	𝍸 𝍸 𝍸	15
51 – 56	||||	4
57 – 62	𝍸 |	6
Total		$\Sigma f = 32$



5. From the table given below. Draw a frequency polygon on histogram for the given frequency distribution.

Weight (kg)	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39
Frequency (*f*)	06	17	23	30	22	13

Solution



6. The following data shows the number of heads in an experiment of 50 sets of tossing a coin 5 times. Make a discrete frequency distribution from the information.

3, 3, 4, 0, 5, 4, 3, 3, 1, 2, 4, 5, 0, 3, 2, 4, 4, 0, 0, 0, 5, 5, 3, 2, 1
4, 3, 2, 5, 3, 2, 1, 3, 5, 4, 3, 2, 1, 3, 2, 1, 3, 1, 3, 1, 4, 3, 2, 2, 4

Solution

No. of heads	**Tally marks**	***F***
0	𝍸	5
1	𝍸 ||	7
2	𝍸 ||||	9
3	𝍸 𝍸 ||||	14
4	𝍸 ||||	9
5	𝍸 |	6
Total		**$\sum f = 50$**

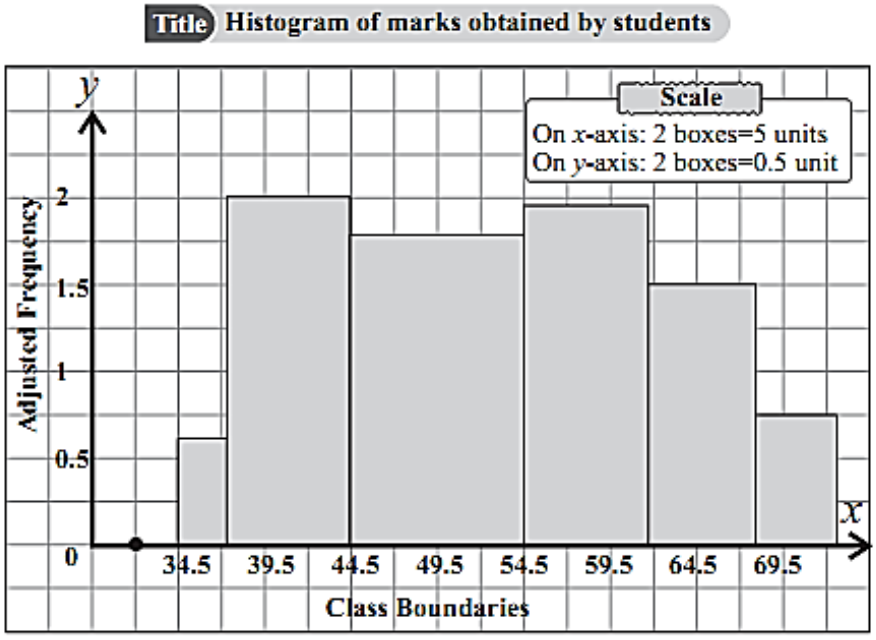
7. The marks obtained by the students of Grade - 10 in mathematics test were grouped into the following frequency distribution.

Marks	35 – 37	38 – 44	45 – 54	55 – 61	62 – 67	68 – 72
Frequency	2	12	16	13	9	3

Draw a histogram for the above distribution.

Solution

Marks	Class boundaries	Frequency (f)	Width of Class	Height of rectangles
35 – 37	34.5 – 37.5	2	37.5 – 34.5 = 3	$\frac{2}{3} = 0.67$
38 – 44	37.5 – 44.5	12	44.5 – 37.5 = 7	$\frac{12}{7} = 1.71$
45 – 54	44.5 – 54.5	16	54.5 – 44.5 = 10	$\frac{16}{10} = 1.6$
55 – 61	54.5 – 61.5	13	61.5 – 54.5 = 7	$\frac{13}{7} = 1.86$
62 – 67	61.5 – 67.5	9	67.5 – 61.5 = 6	$\frac{9}{6} = 1.5$
68 – 72	67.5 – 72.5	3	72.5 – 67.5 = 5	$\frac{3}{5} = 0.6$



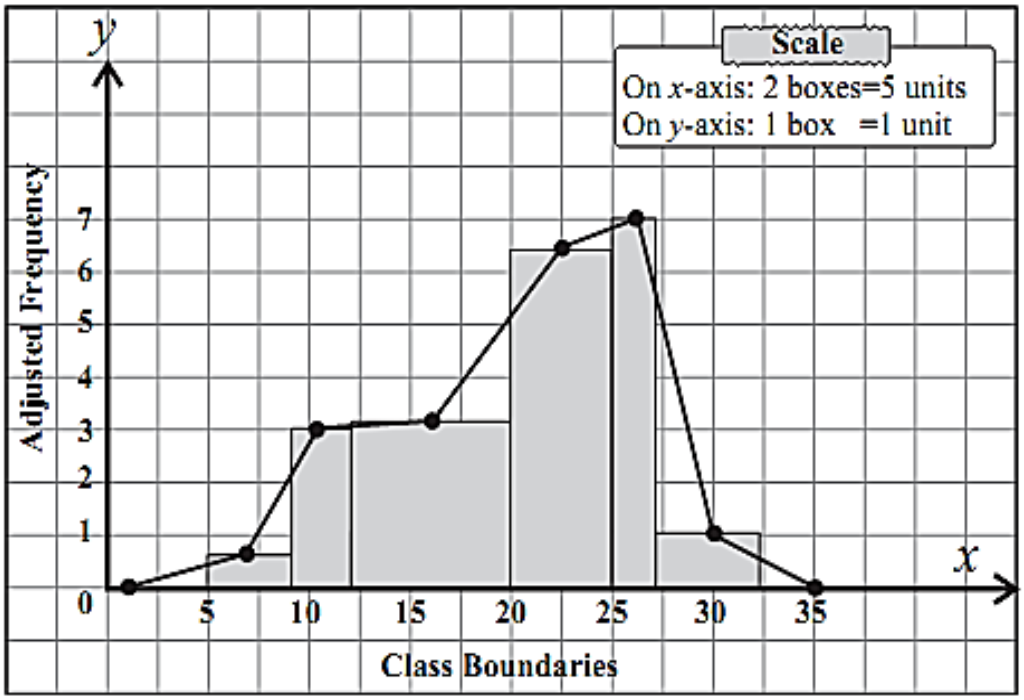
8. Make a frequency polygon on histogram for the following grouped data:

Class limits	5 – 8	8 – 12	12 – 20	20 – 25	25 – 27	27 – 32
Frequency (f)	2	12	25	32	14	5

Solution

Marks	Frequency(f)	Width of class	Height of rectangle
5 – 8	2	8 – 5 = 3	$\frac{2}{3} = 0.67$
8 – 12	12	12 – 8 = 4	$\frac{12}{4} = 3$
12 – 20	25	20 – 12 = 8	$\frac{25}{8} = 3.125$
20 – 25	32	25 – 20 = 5	$\frac{32}{5} = 6.4$
25 – 27	14	27 – 25 = 2	$\frac{14}{2} = 7$
27 – 32	5	32 – 27 = 5	$\frac{5}{5} = 1$

- **Title** Frequency polygon on histogram



EXERCISE 12.2

1. Find the arithmetic mean in each of the following:

(i) 4, 6, 10, 12, 15, 20, 25, 28, 30.

(ii) 12, 18 19, 0, –19, –18, –12

(iii) 6.5, 11, 12.3, 9, 8.1, 16, 18, 20.5, 25

(iv) 8, 10, 12, 14, 16, 20, 22

Solution

(i) $\overline{X} = \frac{\sum X}{n} = \frac{4+6+10+12+15+20+25+28+30}{9} = \frac{150}{9} = 16.67$

(ii) $\overline{X} = \frac{\sum X}{n} = \frac{12+18+19+0-19-18-12}{7} = \frac{0}{7} = 0$

(iii) $\overline{X} = \frac{\sum X}{n} = \frac{6.5+11+12.3+9+8.1+16+18+20.5+25}{9} = \frac{126.4}{9} = 14.04$

(iv) $\overline{X} = \frac{\sum X}{n} = \frac{8+10+12+14+16+20}{7} = \frac{102}{7} = 14.57$

2. Following are the heights in (inches) of 12 students. Find the median height.

55, 53, 54, 58, 60, 61, 62, 56, 57, 52, 51, 63.

Solution

51,52,53,54,55,**56,57**,58,60,61,62,63

Median height $= \frac{1}{2}\left(6^{\text{th}} \text{ term} + 7^{\text{th}} \text{ term}\right) = \frac{1}{2}(56 + 57) = \frac{113}{2} = 56.5$

3. Following are the earnings (in Rs.) of ten workers:

88, 70, 72, 125, 115, 95, 81, 90, 95, 90. Calculate

(i) Arithmetic Mean (ii) Median (iii) Mode

Solution

70,72,81,88,90,90,95,95,115,125

(i) Arithmetic Mean $= \overline{X} = \frac{\sum X}{n} = \frac{70+72+81+88+90+90+95+95115+125}{10} = \frac{921}{10} = 92.1$

(ii) Median $= \frac{1}{2}\left(5^{\text{th}} \text{ term} + 6^{\text{th}} \text{ term}\right) = \frac{1}{2}(90 + 90) = \frac{180}{2} = 90$

(iii) Modes $= 90,95$ **most repeated values in data**

4. The Marks obtained by the students in the subject of English are given below.

Marks obtained	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39
Frequency	9	18	35	17	5

Find: (i) Arithmetic mean of their marks by direct and short formula.

(ii) Median of their marks.

Solution

(i) Arithmetic Mean by direct method:

Class limits	**Frequency f**	**mid-point x**	fx
15 – 19	9	17	153
20 – 24	18	22	396
25 – 29	35	27	945
30 – 34	17	32	544
35 – 39	5	37	185
Total	**84**		**2223**

$$\overline{X} = \frac{\sum fX}{\sum f} = \frac{2223}{84} = 24.46$$

Arithmetic Mean by short formula:

Take A = 27

Class Limits	**frequency f**	**mid-points x**	$y = x - A$	fy
15 – 19	9	17	– 10	– 90
20 – 24	18	22	– 5	– 90
25 – 29	35	27	0	0
30 – 34	17	32	5	85
35 – 39	5	37	10	50
Total	**84**			**– 45**

$$\overline{Y} = \frac{\sum fY}{\sum f} = \frac{-45}{84} = -0.54$$

$$\overline{X} = \overline{Y} + A - 0.54 + 27$$

$$\overline{X} = 24.46$$

(ii) Median of the Marks:

The formula are explained after the table.

Class Boundaries	frequency f	cumulative frequency
14.5 – 19.5	9	9
19.5 – 24.5	18	27 → C
24.5 – 29.5	35	62 → median class
29.5 – 34.5	17	79
34.5 – 39.5	5	84

For median class: $\frac{\mathrm{n}}{2} = \frac{\Sigma f}{2} = \frac{84}{2} = 42$

class containing 42 is median class. i.e. 24.5 – 29.5

Median $= l + \frac{h}{f}\left(\frac{\mathrm{n}}{2} - c\right) = 24.5 + \frac{5}{35}\left(\frac{84}{2} - 27\right) = 26.64$

5. Given below is a frequency distribution.

Class Interval	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29
Frequency	1	8	18	11	2

Find the mode of the frequency distribution.

Solution

Class Limits	frequency
5 – 9	1
10 – 14	8 → f_1
15 – 19	18 → modal class
20 – 24	11 → f_2
25 – 29	2

Mode $= l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times \mathrm{h} = 14.5 + \frac{18-8}{(18-8)+(18-11)} \times 5$

Mode $= 17.44$

6. Ten boys work on a petrol pump station. They get weekly wages as follows: Wages (in Rs.) 4250, 4350, 4400, 4250, 4350, 4410,4500, 4300, 4500, 4390. Find the arithmetic mean by short formula, median and mode of their wages.

Solution

4250,4250,4300,4350,4350,4390,4400,4410,4500,4500

Arithmetic Mean by Short Formula

Let A = 4350

$Y = X - A$ is $-100, -100, -50, 0, 0, 40, 50, 60, 150, 150$

$$\overline{Y} = \frac{\sum fY}{\sum f} = \frac{-100-100-50+40+50+60+150+150}{10} = \frac{200}{10} = 20$$

$$\overline{X} = \overline{Y} + A = 20 + 4350 = 4370$$

Median

$$\text{Median} = \frac{1}{2}\left(5^{\text{th}} \text{ term} + 6^{\text{th}} \text{ term}\right) = \frac{1}{2}(4350 + 4390) = \frac{8740}{2} = 4370$$

Mode

$\text{Modes} = 4250, 4350, 4500$ **most repeated values in data**

7. The arithmetic mean of 45 numbers is 80. Find their sum.

Solution

$$\overline{X} = \frac{\sum X}{n} \Rightarrow 80 = \frac{\sum X}{45} \Rightarrow \sum X = 80 \times 45 \Rightarrow \text{Sum} = 3600$$

8. Five numbers are 1, 4, 0, 7, 9. Find their mean, median and mode.

Solution

0,1,**4**,7,9

$$\text{Mean} = \overline{X} = \frac{\sum X}{n} = \frac{0+1+4+7+9}{5} = \frac{21}{5} = 4.2$$

Median = 4 (middle term out of 5)

Mode = no mode (no entry is repeated)

9. A set of data contains the values as 148, 145, 160. 157, 156, 160. Show that Mode > Median > Mean.

Solution

145,148,156,157,160,160

$\text{Mean} = \overline{\text{X}} = \frac{\sum \text{X}}{\text{n}} = \frac{145+148+156+157+160+160}{6} = \frac{926}{6} = 154.33$

$\text{Median} = \frac{1}{2}\left(3^{\text{rd}}\ \text{term} + 4^{\text{th}}\ \text{term}\right) = \frac{1}{2}(156 + 157) = \frac{313}{2} = 156.5$

Mode = 160

As, $160 > 156.5 > 154.33$

So, Mode > Median > Mean

10. The monthly attendance of 10 students for their lunch in the hostel is recorded as: 21, 15, 16, 18, 14, 17, 15, 12, 13, 11.

Find the median and mode of the attendance. Also find the mean if $D = A - 20$.

Solution

11,12,13,14,**15,15,**16,17,18,21

$\text{Median} = \frac{1}{2}\left(5^{\text{th}}\ \text{term} + 6^{\text{th}}\ \text{term}\right) = \frac{1}{2}(15 + 15) = \frac{30}{2} = 15$

Mode = 15

Let A = 20

$\text{Y} = \text{X} - 20$ is $-9, -8, -7, -6, -5, -5, -4, -3, -2, 1$

$\overline{\text{Y}} = \frac{\sum f\text{Y}}{\sum f} = \frac{-1-9-8-7-6-5-5-4-3-2+1}{10} = -\frac{48}{10} = -4.8$

$\overline{\text{X}} = \overline{\text{Y}} + \text{A} = -4.8 + 20 = 20.2$

11. On a prize distribution day, 50 students brought pocket money as under:

Rupees	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
Frequency (*f*)	12	9	18	7	4

(i) Find the median and mode of the above data.

(ii) Find the arithmetic mean of the data given above using coding method.

Solution

(i) Median and Mode of the data

Classes	*f*	C.*f*.
5 – 10	12	12
10 – 15	9	21
15 – 20	18	39
20 – 25	7	46
25 – 30	4	50
Total	**50**	

$$\text{Median} = l + \frac{h}{f}\left(\frac{\text{n}}{2} - c\right) = 15 + \frac{5}{18}(25 - 21) = 16.11$$

$$\text{Mode} = l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times \text{h} = 15 + \frac{9}{9+11} \times 5 = 17.25$$

(ii) Arithmetic Mean using Coding method

Classes	*f*	mid point *x*	y = *x* – 17.5	*f*y
5 – 10	12	7.5	– 10	– 120
10 – 15	9	12.5	– 5	– 45
15 – 20	18	17.5	0	0
20 – 25	7	22.5	5	35
25 – 30	4	27.5	10	40
Total	**50**			– 90

Let A = 17.5

$$\overline{\text{Y}} = \frac{\sum f\text{Y}}{\sum f} = -\frac{90}{50} = -1.8$$

$$\overline{\text{X}} = \overline{\text{Y}} + \text{A} = -1.8 + 17.5 = 15.70$$

12. The arithmetic mean of the ages of 20 boys is 13 years, 4 months and 5 days. Find the sum of their ages. If one of the boys is of age exactly 15 years. What is the average age of the remaining boys?

Solution

Sum of all ages = 20(13 years 4 months and 5 days)

Sum of all ages = 20×13 years $+ 20 \times 4$ months $+ 20 \times 5$ days

Sum of all ages = 260 years $+ 6$ years 8 months $+$ 3months 10 days

Sum of all ages = 266 years 11 months and 10 days

Total age of remaining students excluding age of 15 years old one

= 251 years 11 months and 10 days

Total age of remaining 19 students = $251 \times 360 + 11 + 30 + 10 = 90700$ days

Average age of remaining 19 students = $\frac{\text{total age}}{\text{no. of students}} = \frac{90700}{19} \approx 4774$ days

Average age of remaining 19 students = 13 years 3 months and 4 days

13. Calculate the arithmetic mean from the following information:

(i) If $D = X - 140$, $\Sigma D = 500$ and $n = 10$

(ii) If $U = \frac{x-130}{6}$, $\Sigma U = -150$ and $n = 15$

(iii) If $D = x - 25$, $\Sigma fD = 300$ and $\Sigma f = 20$

(vi) If $U = \frac{x-120}{5}$, $\Sigma fU = 60$ and $\Sigma f = 100$

Solution

(i) $\overline{\mathrm{D}} = \frac{\Sigma \mathrm{D}}{\mathrm{n}} = \frac{500}{10} = 50$ then we have $\overline{\mathrm{X}} = \overline{\mathrm{D}} + 140 = 50 + 140 = 190$

(ii) $\overline{\mathrm{U}} = \frac{\Sigma \mathrm{U}}{\mathrm{n}} = -\frac{150}{50} = -10$ then we have $\overline{\mathrm{X}} = 6\overline{\mathrm{U}} + 30 = -60 + 130 = 70$

(iii) $\overline{\mathrm{D}} = \frac{\Sigma f\mathrm{D}}{\Sigma f} = \frac{300}{20} = 15$ then we have $\overline{\mathrm{X}} = \overline{\mathrm{D}} + 25 = 15 + 25 = 40$

(iv) $\overline{\mathrm{U}} = \frac{\Sigma f\mathrm{U}}{\Sigma f} = \frac{60}{100} = 0.6$ then we have $\overline{\mathrm{X}} = 5\overline{\mathrm{U}} + 120 = 3 + 120 = 123$

14. The three children Haris, Maham and Minal made the following scores in a game conducted by a group of teachers in the school.

Haris scores	50	55	70	85	90
Maham scores	75	60	60	45	53
Minal scores	80	77	66	42	48

It is decided that the candidate who gets the highest average score will be awarded rupees 1000. Who will get the awarded amount?

Solution

Average of Haris $= \frac{50+55+70+85+90}{5} = \frac{350}{5} = 70$ **winner with highest average**

Average of Maham $= \frac{75+60+60+45+53}{5} = \frac{293}{5} = 58.6$

Average of Minal $= \frac{80+77+66+42+48}{5} = \frac{313}{5} = 62.6$

15. Given below is a frequency distribution derived by making a substitution as $D = X - 20$. Calculate the arithmetic mean.

D	–6	–4	–2	0	2	4	6
f	1	3	6	20	26	12	2

Solution

D	***f***	***f*D**
– 6	1	– 6
– 4	3	– 12
– 2	6	– 12
0	20	0
2	26	52
4	12	48
6	2	12
Total	**70**	**82**

$\overline{D} = \frac{\sum fD}{\sum f} = \frac{82}{70} = 1.17$

$\overline{X} = \overline{D} + 20 = 1.17 + 20 = 21.17$

16. Being partners Hafsa and Fatima took part in a quiz programme. They made the following number of points 45, 51, 58, 61, 74. 48, 46 and 50. Compute the average number of points using deviation $D = x - 58$.

Solution

$D = X - 58$ is $-13, -7, 0, 3, 16, -10, -12, -8$

$$\overline{D} = \frac{-13-7+0+3+16-10-12-8}{8} = \frac{-31}{8} = -3.87$$

$$\overline{X} = \overline{D} + 58 = -3.87 + 58 = 54.13$$

17. A person purchased the following food items:

Food item	Quantity (in Kg)	Cost per Kg (in Rs.)
Rice	10	96
Flour	12	48
Ghee	4	190
Sugar	3	49
Mutton	2	650

What is the weighted mean of cost of food items per kg?

Solution

Food Items	Quantity in kg W	Price x	Wx
Rice	10	96	960
Flour	12	48	576
Ghee	4	190	760
Sugar	3	49	147
Mutton	2	650	1300
Total	**31**		**3743**

$$\overline{X} = \frac{\sum wX}{\sum w} = \frac{3743}{31} = 120.74$$

18. For the following data, find the weighted mean.

Item	Quantity	Cost of item (in thousands)
Washing Machine	5	35
Heater	3	5
Stove	2	13
Dispenser	6	18

Solution

Item	Quantity w	Cost (in thousands) x	wx
Working Machine	5	35	175
Heater	3	5	15
Stove	2	13	26
Dispenser	6	18	108
Total	**16**		**324**

$$\overline{X} = \frac{\sum wX}{\sum w} = \frac{324}{16}$$
$$\overline{X} = 20.25 \text{ thousands}$$

19. A company is planning its next year marketing budget across five years: yearly budgets (in million) are: 5, 7, 8, 6, 7. Find the average budget for the next year.

Solution

$$\text{Average Budget} = \frac{5+6+6+7+8}{5} = \frac{33}{5} = 6.6 \text{ millions}$$

20. Ahmad obtained the following marks in a certain examination. Find the weighted mean if weights 5, 4, 2, 3, 2, 4 respectively are allotted to the subjects.

Urdu	English	Science	Math	Islamiyat	Computer
78	65	80	90	85	72

Solution

Subject	Marks x	Weights w	wx
Urdu	78	5	390
English	65	4	260
Science	80	2	160
Math	90	3	270
Islamiat	85	2	170
Computer	72	4	288
Total		**$\Sigma w = 20$**	**$\Sigma wx = 1538$**

$$\overline{X} = \frac{\sum wX}{\sum w} = \frac{1538}{20}$$
$$\overline{X} = 76.9$$

REVIEW EXERCISE 12

1. Four options are given against each statement. Encircle the correct option.

(i) Which data takes only some specific values?

(a) continuous data (b) ✓ discrete data

(c) grouped data (d) ungrouped data

(ii) The number of times a value occurs in a data is called:

(a) ✓ frequency (b) relative frequency

(b) class limit (d) class boundaries.

(iii) Midpoint is also known as:

(a) mean (b) median

(c) class limit (d) ✓ class mark

(iv) Frequency polygon is also drawn /constructed by using:

(a) ✓ histogram (b) bar graph

(c) class boundaries (d) class limit

(v) The difference between the greatest value and the smallest value is called:

(a) class limits (b) midpoint

(c) relative frequency (d) ✓ range

(vi) Measure of central tendency is used to find out the_____ of a data set.

(a) class boundaries (b) cumulative frequency

(c) ✓ middle or centre value (d) frequency

(vii) If the mean of 5, 7, 8, 9 and x is 7.5, what will be the value of x?

(a) 10 (b) 8 (c) ✓ 8.5 (d) 5.8

(viii) Find the mode of the given data: 2, 5, 8, 9, 0, 1, 3, 7 and 10

(a) 5 (b) 7 (c) 0 (d) ✓ no mode

(ix) In a data the values (observations) which appears or occurs most often is called:

(a) mean (b) ✓ mode

(c) median (d) weighted mean

(x) Find the median of the given data: 110, 125, 122, 130, 124, 127 and 120

(a) ✓ 124 (b) 120 (c) 125 (d) 127

2. Define the following:

(i) frequency distribution (ii) histogram (unequal class limits)

(iii) mean (iv) median

Solution

Frequency Distribution

A distribution of table that represents classes or groups along with their respective class frequencies is called frequency distribution.

Histogram (with unequal class limits)

This is a graph of adjacent rectangles constructed on xy – plane.

In this type class intervals have varying width, and the area of each bar represents the frequency density, calculated by dividing the frequency by the class width.

Mean

It is defined as a value of variables which is obtained by dividing the sum of all the values by their numbers. i.e. $\overline{X} = \frac{\sum X}{n}$

Median

Median is the middle most value in an arranged data. i.e.

$$\widetilde{X} = \begin{cases} \left(\frac{n+1}{2}\right)^{th} \text{ term} & ; \textbf{if n is odd} \\ \frac{1}{2}\left(\left(\frac{n}{2}\right)^{th} \text{ term} + \left(\frac{n+2}{2}\right)^{th} \text{ term}\right) & ; \textbf{if n is even} \end{cases}$$

3. Following are the weights of 40 students recorded to the nearest (lbs).

138, 164, 150, 132, 144, 125, 149, 157, 146, 158, 140, 147, 136, 148, 152, 144, 168, 126, 138, 176, 163, 119, 154, 165, 146, 173, 142, 147, 135, 153, 140, 135 161, 145, 135, 142, 150, 156, 145, 128, make a frequency table taking size of class limits as 10. Also draw histogram and frequency polygon of the given data.

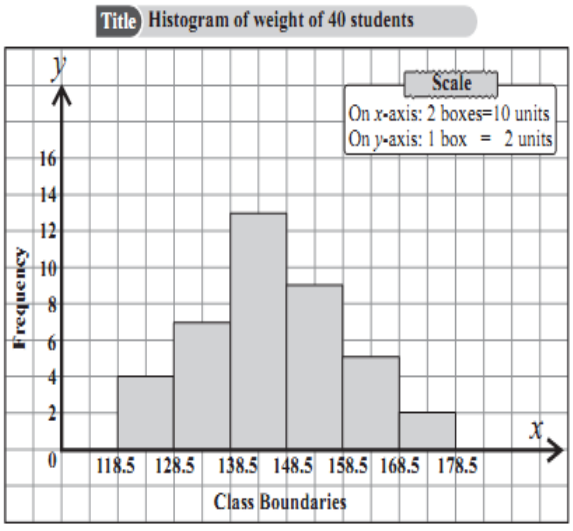
Solution

(a)

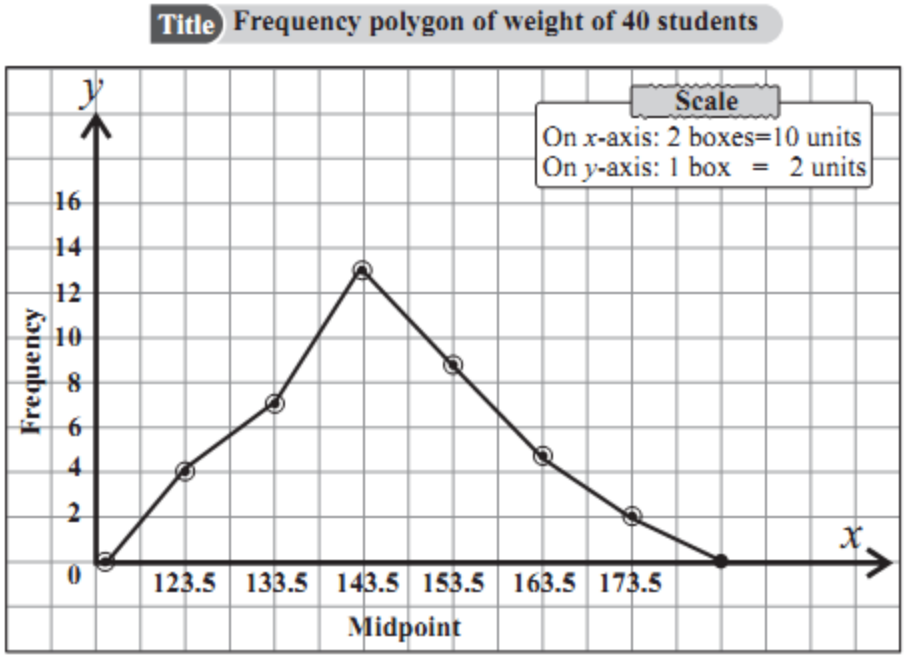
Title: Frequency table taking size of class limits as 10

Class limits	Tally marks	f
119 – 128	||||	4
129 – 138	𝍸 ||	7
139 – 148	𝍸 𝍸 |||	13
149 – 158	𝍸 ||||	9
159 – 168	𝍸	5
169 – 178	||	2
Total		$\sum f = 40$

(b)



(c)

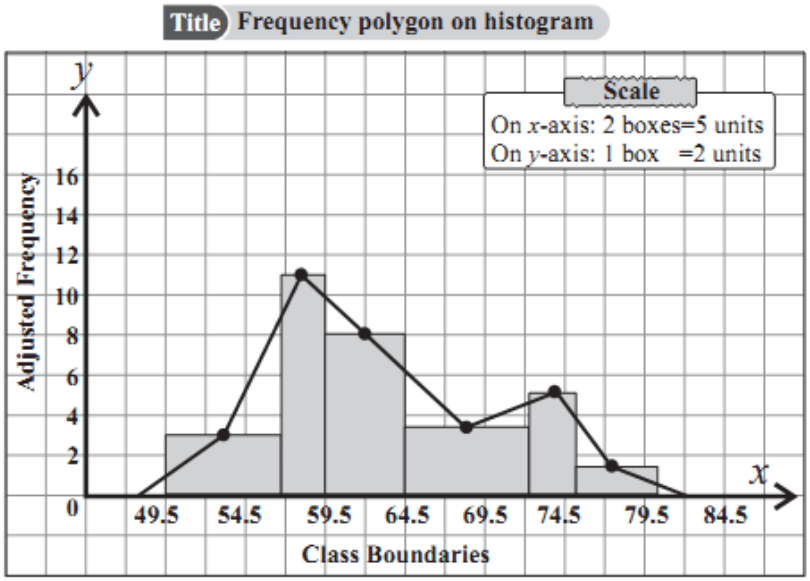


4. From the table given below. Draw a frequency polygon on histogram for the given frequency distribution.

Weight (kg)	50 – 56	57 – 59	60 – 64	65 – 72	73 – 75	76 – 80
Frequency (*f*)	25	32	40	30	15	8

Solution

Class Boundaries	frequency f	Class size h	Adjusted frequency $= \frac{f}{h}$
49.5 – 56.5	25	7	$\frac{25}{7} = 3.86$
56.5 – 59.5	32	3	$\frac{32}{3} = 10.67$
59.5 – 64.5	40	5	$\frac{40}{5} = 8$
64.5 – 72.5	30	8	$\frac{30}{8} = 3.75$
72.5 – 75.5	15	3	$\frac{15}{3} = 5$
75.5 – 80.5	8	5	$\frac{8}{5} = 1.6$



5. Given below are marks obtained by 45 students in the monthly test of Biology:

Marks	20 – 24	25 – 29	30 – 34	35 –39	40 –44	45 – 49
No. of students	05	08	12	15	03	02

With reference to the above table find the following:

(i) upper class boundary of the 5th class.

(ii) lower class boundaries of all the classes.

(iii) midpoint of all the classes.

(iv) the class interval with the least frequency.

Solution

Marks	Class boundaries	Frequency	Mid-Points
20 – 24	19.5 – 24.5	5	$\frac{20+24}{2} = 22$
25 – 29	24.5 – 29.5	8	$\frac{25+29}{2} = 27$
30 – 34	29.5 – 34.5	12	$\frac{30+34}{2} = 32$
35 – 39	34.5 – 39.5	15	$\frac{35+39}{2} = 37$
40 – 44	39.5 – 44.5	3	$\frac{40+44}{2} = 42$
45 – 49	44.5 – 49.5	2	$\frac{45+49}{2} = 47$

(i) upper class boundary of the 5th class

(i) 44 (ii) 19.5, 24.5, 29.5, 34.5, 39.5, 44.5 (iii) 22, 27, 32, 37, 42, 47 (iv) 5

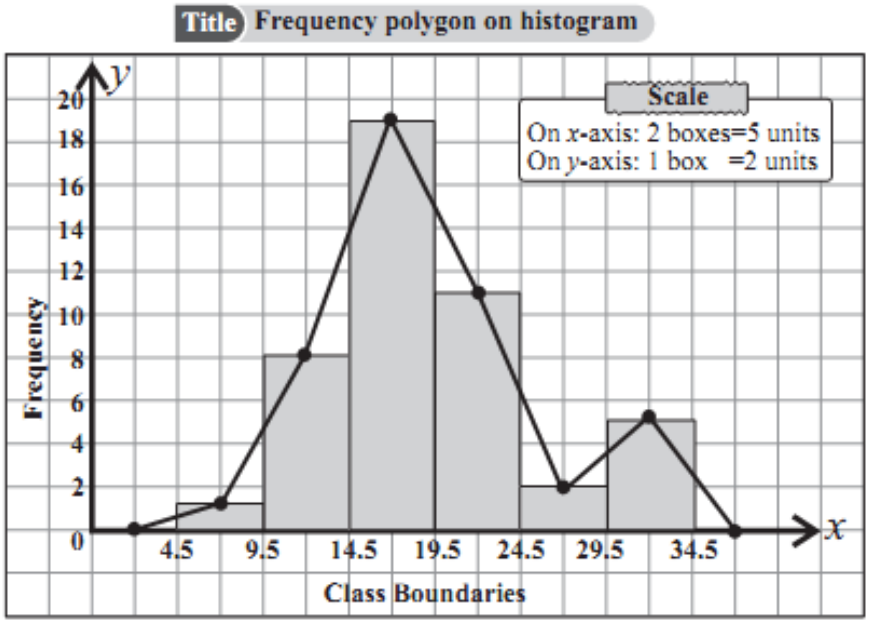
6. Given below is frequency distribution.

Draw frequency polygon and histogram for the distribution.

Class limits	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34
Frequency	1	8	18	11	2	5

Solution

Class Boundaries	Midpoints	Frequency(f)
4.5 – 9.5	7	1
9.5 – 14.5	12	8
14.5 – 19.5	17	18
19.5 – 24.5	22	11
24.5 – 29.5	27	2
29.5 – 34.5	32	5



7. For the following data, find the weighted mean.

Item	Quantity	Cost of item (Rs.)
Chair	20	500
Table	20	400
Black board	10	750
Tube light	25	230
Cupboard	09	950

Solution

Item	Quantity w	Cost of Item x	wx
Chair	20	500	10000
Table	20	400	8000
Black Board	10	750	7500
Tube Light	25	230	5750
Cupboard	9	950	8550
Total	**84**		**39800**

$$\overline{X} = \frac{\sum fX}{\sum f} = \frac{39800}{84} = 473.81 \text{ rupees}$$

8. A principal of a school allocates funds of Rs.50, 000 to five different sectors:

(i) chairs: Rs. 15000 (ii) tables: Rs. 12,000

(iii) black boards: Rs.6,000 (iv) room renovation: Rs. 10,000

(v) gardening: Rs. 7,000

Find the average of funds allocation in each sector of the school.

Solution

$$\overline{X} = \frac{\sum X}{n} = \frac{15000+12000+6000+10000+7000}{5}$$

$$\overline{X} = \frac{50000}{5} = \text{Rs. } 10000$$

9. The marks of a student Saad in six tests were 84, 91, 72, 68, 87, 78. Find the arithmetic mean of his marks.

Solution

$$\overline{X} = \frac{\sum X}{n} = \frac{84+91+72+68+87+78}{6} = \frac{480}{6} = 80 \text{ marks}$$

10. Adjoining distribution showed maximum load (in kg) supported by certain ropes. Find the mean load using short method.

Max-Load kg	93 – 97	98 – 102	103 – 107	108 – 112	113 – 117	118 – 122
No. of ropes	2	5	8	12	6	2

Solution

Let D = 110

Max Load classes	No. of Ropes f	Midpoint x	$y = x - 110$	fy
93 – 97	2	95	– 15	– 30
98 – 102	5	100	– 10	– 50
103 – 107	8	105	– 5	– 40
108 – 112	12	110	0	0
113 – 117	6	115	5	30
118 – 122	2	120	10	20
Total	**35**			**– 70**

$$\overline{Y} = \frac{\sum fY}{\sum f} = \frac{-70}{35} = -2$$

$$\overline{X} = \overline{Y} + 110 = -2 + 110 = 108 \text{ kg}$$

11. Usman rolled a fair dice eight times. Each time their sum was recorded as 8, 5, 6, 6, 9, 4, 3, 11. Find the median and mode of the sum.

Solution

3,4,5,6,6,8,9,11

$$\text{Median} = \frac{1}{2}\left(4^{\text{th}} \text{ term} + 5^{\text{th}} \text{ term}\right) = \frac{1}{2}(6+6) = \frac{12}{2} = 6$$

Mode = 6 **most repeated term**

12. Two partners Mr. Aslam and Mrs. Kalsoom run a company. In the following data the weekly wages (in Rs.) of employees who work in the company are given:

Wages (Rs.)	600 – 700	700 – 800	800 – 900	900 – 1000	1000 – 1100
Employees	3	5	7	21	11

Find mean, median and mode.

Solution

Mean

Wages Classes	No. of Employees f	Mid point x	fx
600 – 700	3	650	1950
700 – 800	5	750	3750
800 – 900	7	850	5950
900 – 1000	21	950	19950
1000 – 1100	11	1050	11550
Total	**47**		**43150**

$$\overline{X} = \frac{\sum fX}{\sum f} = \frac{43150}{47} = 918.09$$

Median

Wages (Rs.)	Frequency (f)	C.f
600 – 700	3	3
700 – 800	5	5 + 3 = 8
800 – 900	7	7 + 8 = 15 → c
900 – 1000	21	21 + 15 = 36 Median class
1000 – 1100	11	11 + 36 = 47 → n
Total	$\Sigma f = 47$	

$$\text{Median} = l + \frac{h}{f}\left(\frac{n}{2} - c\right) = 900 + \frac{100}{21}(23.5 - 15) = 940.48$$

Mode

Wages (Rs.)	Frequency
600 – 700	3
700 – 800	5
800 – 900	7 → f_1
900 – 1000	21 → f_m, here h = 100
1000 – 1100	11 → f_2
Total	$\Sigma f = 47$

$$\text{Mode} = l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times h = 900 + \frac{14}{14+10} \times 100 = 958.33$$