

Chapter 14: Statistics

Exercise: 14.1

1. The class mark of class 90-120 is:

- (A) 90**
- (B) 105**
- (C) 15**
- (D) 120**

Solution: (B) 105

Explanation:

Class mark = (upper limit + lower limit) / 2

Then,

Class mark = $120 + 90 / 2$

= $210 / 2$

= 105.

Hence, option (B) is the correct answer.

2. The range of the data:

25, 18, 20, 22, 16, 6, 17, 15, 12, 30, 32, 10, 19, 8, 11, 20 is

- (A) 10**
- (B) 15**
- (C) 18**
- (D) 26**

Solution: (D) 26

Explanation:

According to the question,

The minimum and maximum values of the given data are 6 and 32 respectively.

Hence,

Range of the data = $32 - 6$

= 26

Hence, the option (D) is the correct answer.

3. In a frequency distribution, the mid-value of a class is 10 and the width of the class is 6. The lower limit of the class is:

- (A) 6**
- (B) 7**
- (C) 8**
- (D) 12**

Solution: (B) 7

Explanation:

According to the question,

Mid value = 10 cm

Width = 6

We know that,

Lower Limit = mid-value of class – (width/2)

= 10 – (6/2)

= 10 – 3

= 7

Hence, option (B) is the correct answer.

4. The width of each of five continuous classes in a frequency distribution is 5 and the lower class-limit of the lowest class is 10. The upper class-limit of the highest class is:

(A) 15

(B) 25

(C) 35

(D) 40

Solution: (C) 35

Explanation:

According to the question,

Since the width of each five consecutive classes = 5

And, the lower limit of the lowest class = 10

We get the data as follows,

10-15

15-20

20-25

25-30

30-35

Hence, we get the upper limit of the highest class = 35

Hence, option (C) is the correct answer.

5. Let m be the mid-point and l be the upper-class limit of a class in a continuous frequency distribution. The lower class limit of the class is:

(A) $2m + l$

(B) $2m - l$

(C) $m - l$

(D) $m - 2l$

Solution: (B) $2m - l$

Explanation:

Let x be the lower class limit of a continuous frequency distribution

Let y be the upper-class limit of a continuous frequency distribution

Now, according to the question,

Mid-point of a class = $(x+y) / 2$

= m

$x+y = 2m$ or, $x+l=2m$

It is given that, $y = l =$ upper-class limit

$x=2m-l$

Hence, the lower class limit of the class = $2m-l$

Hence, option (B) is the correct answer.

6. The class marks of a frequency distribution are given as follows:

15, 20, 25, ...

The class corresponding to classmark 20 is:

(A) 12.5 – 17.5

(B) 17.5 – 22.5

(C) 18.5 – 21.5

(D) 19.5 – 20.5

Solution: (B) 17.5 – 22.5

Explanation:

According to the question,

Difference between class marks = 5

The classes for these class marks are as follows:

2.5 – 7.5

7.5 – 12.5

12.5 – 17.5

17.5 – 22.5

22.5 – 27.5

Hence, the class corresponding to classmark 20 = 17.5 – 22.5

Hence, option (B) is the correct answer.

7. In the class intervals 10-20, 20-30, the number 20 is included in:

(A) 10-20

(B) 20-30

- (C) both the intervals
- (D) none of these intervals

Solution: (B) 20-30

Explanation:

20 belongs to the group 20-30.

Hence, option (B) is the correct answer.

8. A grouped frequency table with class intervals of equal sizes using 250-270 (270 not included in this interval) as one of the class interval is constructed for the following data :

268, 220, 368, 258, 242, 310, 272, 342,

310, 290, 300, 320, 319, 304, 402, 318,

406, 292, 354, 278, 210, 240, 330, 316,

406, 215, 258, 236.

The frequency of class 310-330 is:

- (A) 4
- (B) 5
- (C) 6
- (D) 7

Solution: (C) 6

Explanation:

Arranging the following data in a table, we get,

Class Interval	Frequency
210 – 230	3
230 – 250	3
250 – 270	3
270 – 290	2
290 – 310	4
310 – 330	6
330 – 350	2
350 – 370	2
370 – 390	0
390 – 410	3

Therefore, we get from the above table,

The frequency of the class 310-330 is = 6

Hence, option (C) is the correct answer.

9. A grouped frequency distribution table with classes of equal sizes using 63-72 (72 included) as one of the class is constructed for the following data:

30, 32, 45, 54, 74, 78, 108, 112, 66, 76, 88,

40, 14, 20, 15, 35, 44, 66, 75, 84, 95, 96,
102, 110, 88, 74, 112, 14, 34, 44.

The number of classes in the distribution will be :

- (A) 9
- (B) 10
- (C) 11
- (D) 12

Solution: (B) 10

Explanation:

According to the question,

The given frequency varies from 14 to 112.

So the class intervals are as follows:

13-22, 23-32, 33-42, 43-52, 53-62, 63-72, 73-82, 83-92, 93-102, 103-112.

The number of class interval = 10.

Hence, option (B) is the correct answer.

10. To draw a histogram to represent the following frequency distribution:

Class interval	5 – 10	10 – 15	15 – 25	25 – 45	45 – 75
Frequency	6	12	10	8	15

the adjusted frequency for the class 25-45 is :

- (A) 6
- (B) 5
- (C) 3
- (D) 2

Solution: (D) 2

Explanation:

Adjusted frequency of a class is given by,

(Minimum class size of frequency distribution × Frequency of given class) / Class size of the given class

Therefore, Adjusted frequency for the class 25 – 45 = $(5 \times 8) / 20 = 2$

Hence, the option (D) is the correct answer.

11. The mean of five numbers is 30. If one number is excluded, their mean becomes 28. The excluded number is:

- (A) 28
- (B) 30
- (C) 35
- (D) 38

Solution: (D) 38

Explanation:

Let a,b,c,d and e are five numbers

Average of a data = sum of total observations / total number of observations

According to the question, Mean = 30

$$(a + b + c + d + e) / 5 = 30$$

$$\Rightarrow (a + b + c + d + e) = 150 \dots\dots\dots(1)$$

Let the number excluded be a

$$\text{Then, new mean} = (b + c + d + e) / 4 = 28$$

$$\Rightarrow (b + c + d + e) = 112$$

Substituting this in equation (1),

$$\Rightarrow a + 112 = 150$$

$$\Rightarrow a = 150 - 112 = 38$$

Therefore, the excluded number = 38

Hence, the option (D) is the correct answer.

12. If the mean of the observations:

x, x + 3, x + 5, x + 7, x + 10 is 9, the mean of the last three observations is

(A) $10\frac{1}{3}$

(B) $10\frac{2}{3}$

(C) $11\frac{1}{3}$

(D) $11\frac{2}{3}$

Solution:

(C) $11\frac{1}{3}$

Explanation:

We know that,

Average of a data = sum of total observations / total number of observations

According to the question,

$$\frac{x + x + 3 + x + 5 + x + 7 + x + 10}{5} = 9$$

$$\text{or, } (5x + 15) / 5 = 9$$

$$\text{or, } x + 3 = 9$$

$$\text{or, } x = 6$$

Now, the terms become

$$6, 6 + 3, 6 + 5, 6 + 7, 6 + 10 = 6, 9, 11, 13, 16$$

So, the mean of the last three observations = $(11 + 13 + 16) / 3$

$$= 40 / 3 = 11\frac{1}{3}$$

Hence, option (C) is the correct answer.

Exercise 14.2

1. The frequency distribution:

<u>Marks</u>	0 – 20	20 – 40	40 – 60	60 – 100
<u>No. of students</u>	10	15	20	25

has been represented graphically as follows :

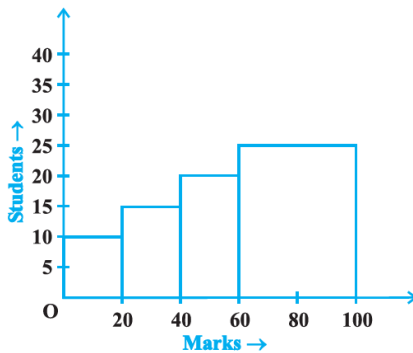


Fig. 14.1

Do you think this representation is correct? Why?

Solution: No, the above representation is not correct.

Reason: The classes 0 – 20, 20 – 40, 40 – 60 and 60 – 100 are not of uniform width but varying widths.

2. In a diagnostic test in mathematics given to students, the following marks (out of 100) are recorded:

46, 52, 48, 11, 41, 62, 54, 53, 96, 40, 98, 44

Which 'average' will be a good representative of the above data and why?

Solution: Median will be a good representative of the data given in the question, because

- a) each value occurs once.
- b) the data is influenced by extreme values.

3. A child says that the median of 3, 14, 18, 20, 5 is 18. What doesn't the child understand about finding the median?

Solution: Since the child says that the median of 3, 14, 18, 20, 5 is 18, it is clear that the child doesn't understand the fact that the given data should be arranged in ascending or descending order before finding the middle term, i.e., median.

Once the child is familiar with the concept,

He/she will understand that,

Arranging the given data in ascending order, we get,

3, 5, 14, 18, 20

And hence,

The median = 14

**4. A football player scored the following number of goals in the 10 matches:
1, 3, 2, 5, 8, 6, 1, 4, 7, 9**

**Since the number of matches is 10 (an even number), therefore, the median
= (5th observation + 6th observation)/2 = (8+6)/2 = 7**

Is it the correct answer and why?

Solution: No.

The obtained data solution in the question, not the correct answer, because the data has to be arranged in either ascending or descending order before finding the median.

Now,

Arranging the data in ascending order, we get,

1, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Here, a number of observations is 10, which is even.

So, median = $((n/2)^{\text{th}} \text{ observation} + ((n/2)+1)^{\text{th}} \text{ observation})/2$

= $((10/2)^{\text{th}} \text{ observation} + ((10/2)+1)^{\text{th}} \text{ observation})/2$

= $((5)^{\text{th}} \text{ observation} + (6)^{\text{th}} \text{ observation})/2$

= $(4 + 5)/2$

= $9/2$

= 4.5

5. Is it correct to say that in a histogram, the area of each rectangle is proportional to the class size of the corresponding class interval? If not, correct the statement.

Solution:

The statement "in a histogram, the area of each rectangle is proportional to the class size of the corresponding class interval" is not correct. Because in a histogram, the area of each rectangle is proportional to the corresponding frequency of its class.

Exercise 14.3

1. The blood groups of 30 students are recorded as follows:

**A, B, O, A, AB, O, A, O, B, A, O, B, A, AB, B, A, AB, B,
A, A, O, A, AB, B, A, O, B, A, B, A**

Prepare a frequency distribution table for the data.

Solution:

The frequency distribution table for the data is as follows:

Blood group	Frequency
A	12
AB	4
B	8
O	6
Total	30

2. The value of π up to 35 decimal places is given below:

3. 14159265358979323846264338327950288

Make a frequency distribution of the digits 0 to 9 after the decimal point.

Solution:

The frequency distribution of the digits 0 to 9 after the decimal point is as follows:

Digits	Frequency
0	1
1	2
2	5
3	6
4	3
5	4
6	3
7	2
8	5
9	4

3. The scores (out of 100) obtained by 33 students in a mathematics test are as follows:

69, 48, 84, 58, 48, 73, 83, 48, 66, 58, 84 000

66, 64, 71, 64, 66, 69, 66, 83, 66, 69, 71

81, 71, 73, 69, 66, 66, 64, 58, 64, 69, 69

Represent this data in the form of a frequency distribution.

Solution:

The given data in the question in a frequency distribution table can be represented as:

Scores	N/O Students Frequency
48	3
58	3
64	4
66	7
69	6
71	3
73	2
81	1
83	2
84	2

4. Prepare a continuous grouped frequency distribution from the following data:

Midpoint	Frequency
5	4
15	8
25	13
35	12
45	6

Also, find the size of the class intervals.

Solution: If m is the mid-point of a class and h is the class size,

We know that,

Lower limits of the class intervals = $m - h/2$

Upper limits of the class intervals = $m + h/2$.

Class size (h) = $15 - 5 = 10 \dots(i)$

Then, the class interval formed for the mid-point 5 = $(5 - 10/2) - (5 + 10/2) = 0 - 10$

Continuing in the same manner, the continuous class table is:

Midpoint	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	4	8	13	12	6

The size of class intervals = 10 (from equation 1)

5. Convert the given frequency distribution into a continuous grouped frequency distribution:

Class interval	Frequency
150-153	7
154-157	7
158-161	15
162-165	10
166-169	5
170-173	6

In which intervals would 153.5 and 157.5 be included?

Solution:

Consider the classes 150 – 153 and 154 – 157.

The lower limit of 154 – 157 = 154

The upper limit of 150 – 153 = 153

The difference = 154 – 153 = 1

Half the difference = $1/2 = 0.5$

Therefore,

The new class interval formed from 150 – 153 = $(150 - 0.5) - (153 + 0.5) = 149.5 - 153.5$.

Continuous classes formed can be represented in a table as:

Class interval	Frequency
149.5 – 153.5	7
153.5 – 157.5	7
157.5 – 161.5	15
161.5 – 165.5	10
165.5 – 169.5	5
169.5 – 173.5	6

Hence, from the table,

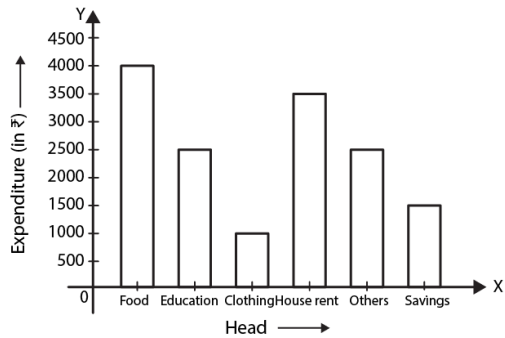
153.5 belongs to the class interval 153.5 – 157.5 and 157.5 belongs to the class interval 157.5 – 161.5.

6. The expenditure of a family on different heads in a month is given below:

Head	Food	Education	Clothing	House rent	Others	Savings
Expenditure (in Rs)	4000	2500	1000	3500	2500	1500

Draw a bar graph to represent the data above.

Solution:



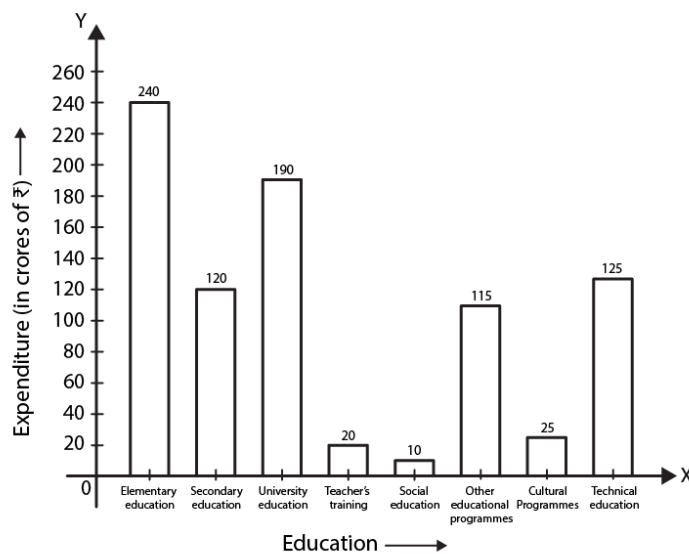
7. Expenditure on Education of a country during five years (2002-2006), in crores of rupees, is given below:

Elementary education	240
Secondary Education	120
University Education	190
Teacher's Training	20
Social Education	10
Other Educational Programmes	115
Cultural programmes	25
Technical Education	125

Represent the information above by a bar graph.

Solution:

The given data can be represented by a bar graph as follows:



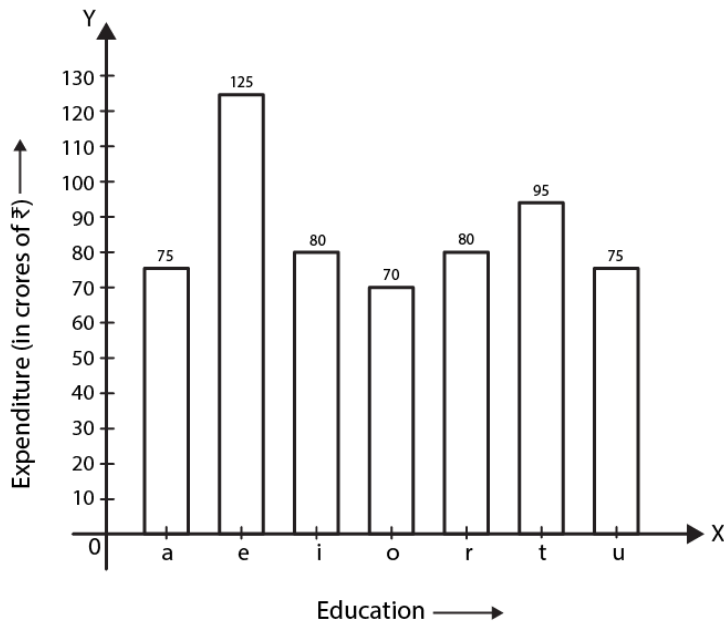
8. The following table gives the frequencies of the most commonly used letters a, e, i, o, r, t, u from a page of a book:

Letters	<i>a</i>	<i>e</i>	<i>i</i>	<i>o</i>	<i>r</i>	<i>t</i>	<i>u</i>
Frequency	75	125	80	70	80	95	75

Represent the information above by a bar graph.

Solution:

The given data can be represented by a bar graph as follows:



9. If the mean of the following data is 20.2, find the value of *p*:

<i>x</i>	10	15	20	25	30
<i>f</i>	6	8	<i>p</i>	10	6

Solution:

According to the question,

$$\text{Mean} = 20.2$$

So,

$$\frac{\sum x_i f_i}{\sum f_i} = 20.2$$

So we get,

$$\sum f_i x_i = (10 \times 6) + (15 \times 8) + (20 \times p) + (25 \times 10) + (30 \times 6) = 610 + 20p$$

We also get,

$$\sum f_i = 6 + 8 + p + 10 + 6 = 30 + p$$

Therefore,

$$\frac{\sum x_i f_i}{\sum f_i} = 20.2$$

$(610 + 20p) / 30 + p = 20.2$
 or, $20.2(30+p) = 610 + 20p$
 or, $606 + 20.2p = 610 + 20p$
 or, $20.2p - 20p = 610 - 606$
 or, $0.2p = 4$
 or, $p = 4/0.2$
 or, $p = 20$

10. Obtain the mean of the following distribution:

Frequency	Variable
4	4
8	6
14	8
11	10
3	12

Solution :

x_i	f_i	$x_i f_i$
4	4	16
6	8	48
8	14	112
10	11	110
12	3	36
Total	40	322

$$\text{Mean} = \frac{\sum x_i f_i}{\sum f_i} = \frac{322}{40} = 8.05$$

Exercise 14.4

1. The following are the marks (out of 100) of 60 students in mathematics.
 16, 13, 5, 80, 86, 7, 51, 48, 24, 56, 70, 19, 61, 17, 16, 36, 34, 42, 34, 35, 72, 55, 75,
 31, 52, 28, 72, 97, 74, 45, 62, 68, 86, 35, 85, 36, 81, 75, 55, 26, 95, 31, 7, 78, 92, 62,
 52, 56, 15, 63, 25, 36, 54, 44, 47, 27, 72, 17, 4, 30.

Construct a grouped frequency distribution table with width 10 of each class starting from 0 – 9.

Solution: Arranging the given data in ascending order

4, 5, 7, 7, 13, 15, 16, 16, 17, 17, 19, 24, 25, 26, 27, 28, 30, 31, 31, 34, 34, 35, 35, 36, 36,
 36, 42, 44, 45, 47, 48, 51, 52, 52, 54, 55, 55, 56, 56, 61, 62, 62, 63, 68, 70, 72, 72,
 72, 74, 75, 75, 78, 80, 81, 85, 86, 86, 92, 95, 97.

Then arrange the given data into groups with 10 as class width in each case.
 The Frequency Distribution Table of the given data can be represented as follows:

Class intervals	Tally marks	Frequency
0 - 9		4
10 - 19		7
20 - 29		5
30 - 39		10
40 - 49		5
50 - 59		8
60 - 69		5
70 - 79		8
80 - 89		5
90 - 99		3

2. Refer to Q1 above. Construct a grouped frequency distribution table with width 10 of each class, in such a way that one of the classes is 10 – 20 (20 not included).

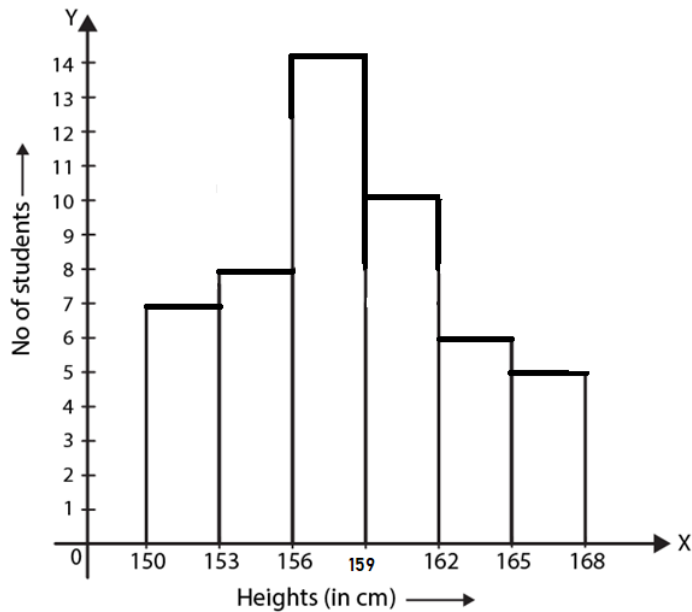
Solution: The grouped frequency distribution table with width 10 of each class, in such a way that one of the classes is 10 – 20 (20 not included) is represented below:

Class interval	Tally marks	Frequency
0 - 10		4
10 - 20		7
20 - 30		5
30 - 40		10
40 - 50		5
50 - 60		8
60 - 70		5
70 - 80		8
80 - 90		5
90 -100		3

3. Draw a histogram of the following distribution:

Heights (in cm)	Number of students
150 - 153	7
153 - 156	8
156 - 159	14
159 - 162	10
162 - 165	6
165 - 168	5

Solution:



4. Draw a histogram to represent the following grouped frequency distribution:

Ages (in years)	Number of teachers
20 - 24	10
25 - 29	28
30 - 34	32
35 - 39	48
40 - 44	50
45 - 49	35
50 - 54	12

Solution: A frequency distribution table is an inclusive form. First, we must convert it to an exclusive form.

Consider the class 20-24, 25-29.

The lower limit of 25-29 is 25

The upper limit of 20-24 is 24

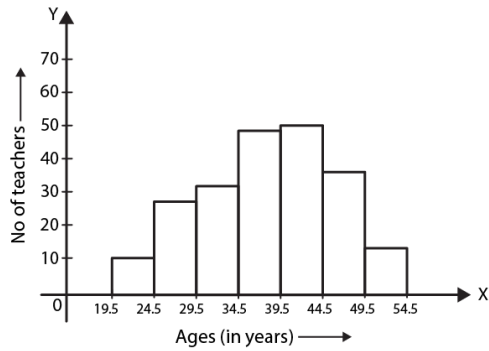
Half of the difference = $(25-24)/2 = 1/2 = 0.5$

We should subtract 0.5 from each lower limit and add 0.5 to each upper limit.

Let us first make the data continuous:

Ages	Number of Teachers
19.5 – 24.5	10
24.5 – 29.5	28
29.5 – 34.5	32
34.5 – 39.5	48
39.5 – 44.5	50
44.5 – 49.5	35
49.5 – 54.5	12

Hence, the histogram can be represented as:



5. The lengths of 62 leaves of a plant are measured in millimetres and the data is represented in the following table:

Length (in mm)	Number of leaves
118 - 126	8
127 - 135	10
136 - 144	12
145 - 153	17
154 - 162	7
163 - 171	5
172 - 180	3

Draw a histogram to represent the data above.

Solution: The frequency distribution table is an inclusive form. First, we must convert it to an exclusive form.

Half of the difference = $(127-126)/2 = 1/2 = 0.5$

We should subtract 0.5 from each lower limit and add 0.5 to each upper limit.

Let us first make the data continuous:

Length (mm)	No. of leaves
117.5 – 126.5	8
126.5 – 135.5	10
135.5 – 144.5	12
144.5 – 153.5	17
153.5 – 162.5	7
162.5 – 171.5	5
171.5 – 180.5	3

Hence, the histogram can be represented as:

