

Age in years C.I.	$x_i$	Number of students ( $f_i$ )	$x_i \times f_i$
16-18	17	2	34
18-20	19	7	133
20-22	21	21	441
22-24	23	17	391
24-26	25	3	75
<b>Total</b>		<b>50</b>	<b>1074</b>

## Answer 2

(i) Direct Method:

Weekly wages (in Rs.)	Mid value $x_i$	No. of worker $f_i$	$f_i x_i$
50-55	52.5	5	262.5
55-60	57.5	20	1150.0
60-65	62.5	10	625.0
65-70	67.5	10	675.0
70-75	72.5	9	652.5
75-80	77.5	6	465.0

80-85	82.5	12	990.0
85-90	87.5	8	700.0
Total		80	5520.0

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{5520.0}{80} = 69.0$$

(ii) Short cut method :

Weekly wages	No of workers	Mid value	A = 72.5	$f_i d$
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Weekly wages (in Rs.)	No. of workers $f_i$	Mid value $x_i$	$A = 725$ $d = x - A$	$f \times d$
50-55	5	52.5	-20	-100
55-60	20	57.5	-15	-300
60-65	10	62.5	-10	-100
65-70	10	67.5	-5	-50
70-75	9	$A = 725$	0	0
75-80	6	77.5	5	30
80-85	12	82.5	10	120
85-90	8	87.5	15	120
<b>Total</b>	<b>80</b>			<b>-280</b>

Marks	No. of Boys $f_i$	Mid value $x_i$	A=65 d=x-A	$f_i d_i$
30-40	10	35	-30	-300
40-50	12	45	-20	-240
50-60	14	55	-10	-140
60-70	12	A=65	0	0
70-80	9	75	10	90
80-90	7	85	20	140
90-100	6	95	30	180
Total	70			-270

$$\bar{x} = A + \frac{\sum f_i d_i}{\sum f_i} = 65 + \frac{-270}{70} = 65 - \frac{27}{7}$$

$$= 65 - 3.86 = 61.14$$

(ii) Step - Deviation Method:

Marks	No. of Boys $f_i$	Mid value $x_i$	A=65 $u = \frac{x - A}{h_i}$	$f_i u_i$
30-40	10	35	-3	-30
40-50	12	45	-2	-24
50-60	14	55	-1	-14
60-70	12	A=65	0	0
70-80	9	75	1	9
80-90	7	85	2	14
90-100	6	95	3	18

ii) Step

Marks	No. of Boys $f_i$	Mid value $x_i$	$A=65$ $u = \frac{x - A}{h_i}$	$f_i u_i$
30-40	10	35	-3	-30
40-50	12	45	-2	-24
50-60	14	55	-1	-14
60-70	12	$A=65$	0	0
70-80	9	75	1	9
80-90	7	85	2	14
90-100	6	95	3	18
Total	70		-	-27

Here  $A = 65$  and  $h = 10$

$$\bar{x} = A + h \times \frac{\sum f_i u_i}{\sum f_i} = 65 + \frac{10 \times (-27)}{70}$$

$$= 65 - \frac{270}{70} = 65 - \frac{27}{7} = 65 - 3.86 = 61.14$$

Marks	No. of Boys	Mid value	A=65 $u = \frac{x - A}{h_i}$	$f_i u_i$
	$f_i$	$x_i$		
30-40	10	35	-3	-30
40-50	12	45	-2	-24
50-60	14	55	-1	-14
60-70	12	A=65	0	0
70-80	9	75	1	9
80-90	7	85	2	14
90-100	6	95	3	18
Total	70		-	-27

Here  $A = 65$  and  $h = 10$

$$\bar{x} = A + h \times \frac{\sum f_i u_i}{\sum f_i} = 65 + \frac{10 \times (-27)}{70}$$

$$= 65 - \frac{270}{70} = 65 - \frac{27}{7} = 65 - 3.86 = 61.14$$

C.I	Frequency $f_i$	Mid value $x_i$	$A=87.50$ $u = \frac{x - A}{h}$	$f_i u_i$
63-70	9	66.50	-3	-27
70-77	13	73.50	-2	-26
77-84	27	80.50	-1	-27
84-91	38	$A=87.50$	0	0
91-98	32	94.50	1	32
98-105	16	101.5	2	32
105-112	15	108.5	3	45
<b>Total</b>	<b>150</b>			<b>29</b>

Here  $A = 87.50$  and  $h = 7$

$$\bar{x} = A + h \times \frac{\sum f_i u_i}{\sum f_i}$$

$$= 87.50 + 7 \times \frac{29}{150} = 87.50 + 1.35$$

$$= 88.85$$

C.I.	Frequency $f$	Mid value $x_i$	$f_i x_i$
0-10	8	5	40
10-20	22	15	330
20-30	31	25	775
30-40	$f$	35	$35f$
40-50	2	45	90
Total	$63+f$		$1235+35f$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1235 + 35f}{63 + f}$$

$$\Rightarrow \frac{148}{7} = \frac{1235 + 35f}{63 + f}$$

$$\Rightarrow 9324 + 148f = 8645 + 245f$$

$$\Rightarrow 9324 - 8645 = 245f - 148f$$

$$\Rightarrow 679 = 97f.$$

$$\therefore f = \frac{679}{97} = 7$$



## Answer 6

Let Assumed mean = 72.5

C.I.	$f$	M.V.( $x$ )	$d = x - A$	$f_i d_i$
50-55	5	52.5	-20	-100
55-60	20	57.5	15	-300
60-65	10	62.5	-10	-100
65-70	10	67.5	-5	-50
70-75	9	72.5	0	0
75-80	6	77.5	5	30
80-85	12	82.5	10	120
85-90	8	87.5	15	120
Total	80		-280	

$$\text{Mean} = A + \frac{\sum f_i d_i}{\sum f_i} = 72.5 + \frac{-280}{80} = 72.5 - \frac{7}{2} = 72.5 - 3.5 = 69$$

## Question 7.

Using the information given in the adjoining histogram; calculate the mean.

## Answer 7

C.I.	Frequency $f$	Mid value $x$	$fx$
15-25	10	20	200
25-35	20	30	600
35-45	25	40	1000
45-55	15	50	750
55-65	5	60	300
Total	75		2850



C.I.	Frequency $f$	Mid value $x$	$fx$
15-25	10	20	200
25-35	20	30	600
35-45	25	40	1000
45-55	15	50	750
55-65	5	60	300
<b>Total</b>	<b>75</b>		<b>2850</b>

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Class	Frequency ( $f_i$ )	Class mark ( $x_i$ )	$f_i \times x_i$
0-20	7	10	70
20-40	$p$	30	$30p$
40-60	10	50	500
60-80	9	70	630
80-100	13	90	1170
Total	$39 + p$		$2370 + 30p$

$$\therefore \text{Mean} = \frac{\sum f_i \times x_i}{\sum f_i} \Rightarrow 54 = \frac{2370 + 30p}{39 + p}$$

$$\Rightarrow 2106 + 54p = 2370 + 30p$$

$$\Rightarrow 54p - 30p = 2370 - 2106 \Rightarrow$$

$$24p = 264$$

$$p = \frac{264}{24} = 11$$

Hence  $p = 11$

Class	Frequency ( $f_i$ )	Class mark ( $x_i$ )	$f_i \times x_i$
0-20	5	10	50
20-40	$f_1$	30	$30f_1$
40-60	10	50	500
60-80	$f_2$	70	$70f_2$
80-100	7	90	630
100-120	8	110	880
Total	$30 + f_1 + f_2 = 50$		$2060 + 30f_1 + 70f_2$

$\therefore$  Sum of frequencies = 50

$$\therefore 30 + f_1 + f_2 = 50$$

$$\Rightarrow f_1 + f_2 = 50 - 30 = 20 \quad \dots(i)$$

$$\text{Mean} = \frac{\sum f_i \times x_i}{\sum f_i}$$

$$62.8 = \frac{2060 + 30f_1 + 70f_2}{50}$$

$$\Rightarrow \frac{628}{10} = \frac{2060 + 30f_1 + 70f_2}{50}$$

$$\Rightarrow \frac{628}{1} = \frac{2060 + 30f_1 + 70f_2}{5}$$

$$\Rightarrow 2060 + 30f_1 + 70f_2 = 5 \times 628$$

$$\Rightarrow 2060 + 30f_1 + 70f_2 = 3140$$

$$\Rightarrow 30f_1 + 70f_2 = 3140 - 2060$$

$$\Rightarrow 30f_1 + 70f_2 = 1080$$

$$\Rightarrow 3f_1 + 7f_2 = 108 \quad \dots(ii)$$

(Dividing by 10)

Multiplying (i) by 7 and (ii) by 1

$$7f_1 + 7f_2 = 140$$

$$3f_1 + 7f_2 = 108$$

$$\text{Subtracting } 4f_1 = 32 \quad f_1 = \frac{32}{4} = 8$$

$$\text{But } f_1 + f_2 = 20$$

$$\therefore 8 + f_2 = 20 \quad \Rightarrow f_2 = 20 - 8 = 12$$

$$\text{Hence } f_1 = 8, f_2 = 12$$

Marks	Frequency ( $f$ )	Mid Value ( $x$ )	$d_i = x_i - A$ $A = 45.5$	$u_i = \frac{x_i - A}{10}$	$f_i \times u_i$
11-20	2	15.5	-30	-3	-6
21-30	6	25.5	-20	-2	-12
31-40	10	35.5	-10	-1	-10
41-50	12	$A = 45.5$	0	0	0
51-60	9	55.5	10	1	9
61-70	7	65.5	20	2	14
71-80	4	75.5	30	3	12
	$\Sigma f_i = 50$				$\Sigma f u_i = 7$

$$A = 45.5$$

$$\text{Mean} = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times 10$$

$$= 45.5 + \frac{7}{50} \times 10$$

$$= 45.5 + 1.4 = 46.9$$

## Question 11.

Calculate the mean of the following distribution :

## Answer 11

Class interval	Mid value ( $x$ )	Frequency ( $f$ )	$f \times x$
0-10	5	8	40
10-20	15	5	75
20-30	25	12	300
30-40	35	35	1225
40-50	45	24	1080
50-60	55	16	880
Total		100	3600

## Question 1.

A student got the following marks in 9 questions of a question paper :  
3, 5, 7, 3, 8, 0, 1, 4 and 6.

Find the median of these marks.

## Answer 1

Arranging the given data in descending order, we get:

8, 7, 6, 5, 4, 3, 3, 1, 0

The middle term is 4 which is 5th term

$$\therefore \text{Median} = 4$$



We get 23.5, 28, 27.5, 25.5, 24, 24,  
22, 21, 21, 20.5

the middle terms are 24 and 24,  
5th and 6th terms.

$$\therefore \text{Median} = \frac{24 + 24}{2} = \frac{48}{2} = 24$$

we get

22, 24, 25, 26, 26, 27, 27, 28, 28,  
29, 31, 32, 32, 33, 35, 35, 36, 36, 37

Middle term is 10th term i.e. 29

$\therefore$  Median = 29

(ii) Lower quartile ( $Q_1$ ) =  $\frac{n+1}{4}$  th term

(Here  $x = 19$ , which is odd)

$$= \frac{19+1}{4} \text{ th term or 5th term} = 26$$

(iii) Upper quartile ( $Q_3$ ) =  $\frac{3(n+1)}{4}$  th term

$$= \frac{3(19+1)}{4} \text{ th term} = 15\text{th term} = 35$$

(iv) Inter-quartile range =  $Q_3 - Q_1 = 35 - 26 = 9$



## Answer 4

(i) Arrange in ascending order, we get

0, 7, 10, 18, 25, 36, 38, 40, 45, 56, 60, 65, 77, 83, 88, 95

(ii) Upper quartile  $(Q_3) = \frac{3n}{4}$  th term

(Here  $n = 16$ , which is even)

$$= \frac{3 \times 16}{4} \text{ term} = 12\text{th term} = 65$$

(iii) Lower quartile  $Q_1 = \frac{n}{4}$  th term  $= \frac{16}{4} = 4\text{th term}$   
 $= 18$

$$\therefore \text{Interquartile} = Q_3 - Q_1 \\ = 65 - 18 = 47$$

## Question 5.

The ages of 37 students in a class are given in the following table :

Find the median.

## Answer 5

Age in years	Frequency	Cumulative Frequency
11	2	2
12	4	6
13	6	12
14	10	22
15	8	30
16	7	37

Age in years	Frequency	Cumulative Frequency
11	2	2
12	4	6
13	6	12
14	10	22
15	8	30
16	7	37

No. of terms : 37

$$\text{Median} : \frac{37 + 1}{2} = 19\text{th term}$$

$\therefore$  Median = 14

### Question 6.

The weight of 60 boys are given in the following distribution table :

Find : (i) Median

(ii) Lower quartile

(iii) Upper quartile

(iv) Inter-quartile range

### Answer 6

Weight (kg) $x$	No. of boys $f$	Cumulative Frequency
37	10	10
38	14	24
39	18	42
40	12	54
41	6	60

No. of terms : 60

Weight (kg) $x$	No. of boys $f$	Cumulative Frequency
37	10	10
38	14	24
39	18	42
40	12	54
41	6	60

No. of terms = 60

(i) Median : The mean of 30th and 31st terms is the median

$$\therefore \text{Median} = \frac{39 + 39}{2} = \frac{78}{2} = 39$$

(ii) Lower quartile ( $Q_1$ ) =  $\frac{1 \times n}{4}$  th term

$$= \frac{1 \times 60}{4} \text{ th term (Here } n = 60, \text{ which is even)}$$

$$= 15\text{th term} = 38$$

(iii) Upper quartile ( $Q_3$ ) =  $\frac{3n}{4}$  th term

$$= \frac{3}{4} \times 60 = 45\text{th term} = 40$$

Class	Frequency	Cumulative Frequency
0-10	4	4
10-20	9	13
20-30	15	28
30-40	14	42
40-50	8	50

No. of terms = 50

$$\therefore \text{Median} = \frac{25\text{th} + 26\text{th}}{2} = 25.5 = 25.5 \text{ th term}$$

Through mark of 25.5 on the y-axis, draw a line parallel to x-axis which meets the curve at A. From A, draw a perpendicular to x-axis, which meets x-axis at B.

$\therefore$  The value of B is the median which is 28.

