

Practice Challenge - Objective

Subject: Mathematics

Topic : Statistics Exam Prep 1

Class: X

1. Find the median of the following data:

Class interval	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85	85 – 95
Frequency	12	16	17	15	8	19	13

- ☒ A. 58.33
☐ B. 54.3
☐ C. 32.33
☐ D. 51.67

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Class Interval	Frequency	Cumulative <i>Frequency</i>
25 – 35	12	12
35 – 45	16	28
45 – 55	17	45
55 – 65	15	60
65 – 75	8	68
75 – 85	19	87
85 – 95	13	100

In the above distribution the total number of observations is 100.

Hence, $n = 100$.

$$\frac{n}{2} = 50.$$

The cumulative frequency that is greater than 50 but closest to 50 is 60. The class corresponding to this frequency is 55 - 65. This is the median class.

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

where,

l is lower class limit of median class.

n is total number of observations.

cf is the cumulative frequency of the class preceding the median class.

f is the frequency of the median class and h is the class size.

$$\therefore \text{Median} = 55 + \frac{50-45}{15} \times 10 = 58.33$$

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2. Consider the following distribution of the number of mangoes being packed in cardboard boxes where these boxes contain varying number of mangoes. Find the mean number of mangoes kept in a packing box using assumed mean method?

<i>Number of mangoes</i>	50 – 52	53 – 55	56 – 58	59 – 61	62 – 64
<i>Number of boxes</i>	15	110	135	115	25

- ☒ A. 53.87
☒ B. 59.95
☒ C. 57.18
☒ D. 54.99

The class intervals are not continuous. There is a gap of 1 between 2 intervals. So 0.5 has to be added to the upper class limit of each interval and 0.5 has to be subtracted from the lower class limit of each interval to make class intervals continuous.

Let the assumed mean(a) be 57 (Choose the number in order to get minimum deviation(d) in table shown below)

<i>Class Interval</i>	<i>Number of Mangoes(f_i)</i>	<i>Class mark(x_i)</i>	$d_i = x_i - a$	$f_i d_i$
49.5 – 52.5	15	51	–6	–90
52.5 – 55.5	110	54	–3	–330
55.5 – 58.5	135	57	0	0
58.5 – 61.5	115	60	3	345
61.5 – 64.5	25	63	6	150
<i>Total</i>	$\sum f_i = 400$			$\sum f_i d_i = 75$

$$\begin{aligned}
 \text{Mean } (\bar{x}) &= a + \frac{\sum f_i d_i}{\sum f_i} \\
 &= 57 + \frac{75}{400} \\
 &= 57.1875
 \end{aligned}$$

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3. Find the mode from the given data.

1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4, 5, 5, 1, 5, 5, 5, 3, 5, 1, 2, 4, 5, 6, 1, 2, 4, 2, 1

- ☒ A. 1
- ☐ B. 2
- ☐ C. 3
- ☐ D. 4

We know that,

The mode is defined as the value which has the maximum frequency in the given data.

In the given set,

1 appears 11 times, 2 appears 10 times, 3 appears 8 times, 4 appears 8 times, and 5 appears 7 times.

Thus, the mode is 1.

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4. Find the mean age in years from the frequency distribution given below:

Class interval of age in years	Frequency(f_i)
25 – 29	4
30 – 34	14
35 – 39	22
40 – 44	16
45 – 49	6
50 – 54	5
55 – 59	3
Total	70

- ☒ A. 39.35
☐ B. 29.39
☐ C. 40.15
☐ D. 40.39

Class mark for first class interval =

$$\frac{\text{Upper class limit} + \text{Lower class limit}}{2} = \frac{25+29}{2} = 27$$

Similarly the class mark for each class interval can be found.

Class interval	Frequency(f_i)	Class mark(x_i)	$f_i x_i$
25 – 29	4	27	108
30 – 34	14	32	448
35 – 39	22	37	814
40 – 44	16	42	672
45 – 49	6	47	282
50 – 54	5	52	260
55 – 59	3	57	171
Total	$\sum f_i = 70$		$\sum f_i x_i = 2755$

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2755}{70} = 39.4$$

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5. The following data shows the warranty period of different components. Find the modal warranty period.

Warranty period (years)	0 – 1	1 – 2	2 – 3	3 – 4	4 – 5	5 – 6
Number components	6	10	16	25	16	20

- ☒ A. 3
☐ B. 3.25
☒ C. 3.5
☐ D. 4.5

Modal class is 3 – 4 since it is the class with highest frequency.

$$Mode = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$$

f_1 represents the frequency of the modal class.

Also,

l = lower boundary of the modal class

h = size of the modal class interval

f_0 = frequency of the class preceding the modal class

f_2 = frequency of the class succeeding the modal class

Here, $f_1 = 25$, $f_0 = 16$, $f_2 = 16$, $l = 3$, $h = 1$

$$Mode = 3 + \left[\frac{25 - 16}{2 \times 25 - 16 - 16} \right] \times 1$$

$\therefore Mode = 3.5$

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6. The marks obtained by 40 students in class X of a certain school in a math paper of maximum marks '100' are presented in the table. Find the mean using direct method.

<i>Class Interval</i>	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
<i>Number of students</i>	3	4	13	15	5

- ☒ A. 28.75
☐ B. 25.2
☐ C. 26.4
☐ D. 29.9

Class mark for first class interval = 5

Similarly the class mark for each class interval can be found. Look at the table.

<i>Class Interval</i>	<i>Number of students (f_i)</i>	<i>Classmark (x_i)</i>	<i>$f_i x_i$</i>
0 – 10	3	5	15
10 – 20	4	15	60
20 – 30	13	25	325
30 – 40	15	35	525
40 – 50	5	45	225
<i>Total</i>	$\sum f_i = 40$		$\sum f_i x_i = 1150$

$$\begin{aligned}
 \therefore \text{Mean} &= \frac{\sum f_i x_i}{\sum f_i} \\
 &= \frac{5 \times 3 + 15 \times 4 + 25 \times 13 + 35 \times 15 + 45 \times 5}{40} \\
 &= \frac{1150}{40} \\
 &= 28.75
 \end{aligned}$$

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7. If the mean of the data is 60, find the value of p

<i>Class mark</i>	<i>frequency</i>
25 – 35	12
35 – 45	16
45 – 55	p
55 – 65	15
65 – 75	8
75 – 85	19
85 – 95	13

☒ A. 17

☐ B. 23

☐ C. 12

☐ D. 44

<i>Class mark(x_i)</i>	<i>Frequency(f_i)</i>	<i>($x_i f_i$)</i>
30	12	360
40	16	640
50	p	$50p$
60	15	900
70	8	560
80	19	1520
90	13	1170

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

$$\sum f_i = 83 + p$$

$$\sum f_i x_i = 5150 + 50p$$

$$\frac{5150 + 50p}{83 + p} = 60$$

$$5150 + 50p = 4980 + 60p$$

$$170 = 10p$$

$$p = 17$$

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8. The following data shows monthly savings of 100 families. Find the difference of modal and mean monthly savings in rupees.

<i>Monthly savings (₹)</i>	<i>Number of families</i>
1000 – 2000	14
2000 – 3000	15
3000 – 4000	21
4000 – 5000	27
5000 – 6000	25

- ☒ A. ₹ 916.67
☒ B. ₹ 600.77
☒ C. ₹ 945.55
☒ D. ₹ 840

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Modal Class (class with highest frequency) is 4000 - 5000.

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

where f_1 represents the frequency of the modal class.

Also,

l = lower boundary of the modal class

h = size of the modal class interval

f_0 = frequency of the class preceding the modal class

f_2 = frequency of the class succeeding the modal class

$\therefore$ Here, $f_1 = 27, f_0 = 21, f_2 = 25, I = 4000, h = 1000$

$$\begin{aligned} \Rightarrow \text{Mode} &= 4000 + \frac{6}{8} \times 1000 \\ &= 4750 \end{aligned}$$

For finding mean, we use Direct method

(We used Direct method to find the mean because the numbers are very easy even though they are large. You could use any of the three methods.)

$$\begin{aligned} \text{Mean} &= \frac{\Sigma fx}{\Sigma f} \\ &= 3910 \end{aligned}$$

$\therefore$ Difference between mode and mean is:

$$\begin{aligned} &= 4750 - 3910 \\ &= ₹840 \end{aligned}$$

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9. If the median of the following data is 50, then find the value of p .

Class	Frequency
0 - 20	10
20 - 40	7
40 - 60	16
60 - 80	p
80 - 100	8

- ☒ A. 6
☒ B. 7
☒ C. 8
☒ D. 9

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The cumulative frequency distribution table is given below:

Class	Frequency	Cumulative Frequency
0 - 20	10	10
20 - 40	7	17
40 - 60	16	33
60 - 80	p	33+p
80 -100	8	41+p

Since median is 50, median class is 40-60.

Using;

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h,$$

$$\text{Here, } n = 41 + p,$$

$$\Rightarrow \frac{n}{2} = \frac{(41+p)}{2}$$

$$\text{Now, } 50 = 40 + \left[\frac{\frac{(41+p)}{2} - 17}{16} \times 20 \right]$$

$$\Rightarrow 10 = \left[\frac{\frac{(41+p-34)}{2}}{16} \times 20 \right]$$

$$\Rightarrow 10 = \left[\frac{(7+p)}{16 \times 2} \times 20 \right]$$

$$\text{Simplifying, we get } \frac{(7+p)}{16} = 1$$

$$\Rightarrow 7 + p = 16$$

$$\Rightarrow p = 9$$

$\therefore$ the value of p is 9.

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10. Find the mode of the given data.

<i>Class</i>	<i>Frequency</i>
0 – 5	200
5 – 10	250
10 – 15	225
15 – 20	300
20 – 25	275

- ☒ A. 19
☒ B. 18.75
☐ C. 18.50
☐ D. 18.25

Modal class is 15-20 since it is the class with highest frequency.

Now, $f_1 = 300$, $f_0 = 225$, $f_2 = 275$, $l = 15$, $h = 5$

$$Mode = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$$

f_1 represents the frequency of the modal class.

Also,

l = lower boundary of the modal class

h = size of the modal class interval

f_0 = frequency of the class preceding the modal class

f_2 = frequency of the class succeeding the modal class

$$Mode = 15 + \left[\frac{300 - 225}{2 \times 300 - 225 - 275} \right] \times 5$$

$$\therefore Mode = 18.75$$