

Statistics Exercise 2

Question 1

The following table shows the ages of the patients admitted in a hospital during a year

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
Number of patients	6	11	21	23	14	5

Find the mode and the mean of the data given above. Compare and interpret the two measures of central tendency.

Solution

$$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

f_1 = frequency of the modal class,

f_0 = frequency of the class preceding the modal class,

f_2 = frequency of the class succeeding the modal class.

Modal class = 35 – 45, $l = 35$, class width (h) = 10, $f_1 = 23$, $f_0 = 21$ and $f_2 = 14$

Substituting the values, we get

Mode = 36.8 year

Now Calculation of Mean

Class Interval	Frequency (f_i)	Mid-point (x_i)	$f_i x_i$
5-15	6	10	60

15-25	11	20	220
25-35	21	30	630
35-45	23	40	920
45-55	14	50	700
55-65	5	60	300
	$\Sigma f_i = 80$		$\Sigma f_i x_i = 2830$

$$M = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$= 2830/80 = 35.37 \text{ yr}$$

So, Maximum number of patients are of age 36.8 year and Mean age of the patient is 35.37 year

Question 2

The following data gives the information on the observed lifetimes (in hours) of 225 electrical components:

Lifetime (in hours)	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	10	35	52	61	38	29

Determine the modal lifetimes of the components.

Solution

$$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

f_1 = frequency of the modal class,

f_0 = frequency of the class preceding the modal class,

f_2 = frequency of the class succeeding the modal class.

Modal class of the given data is 60–80.

Modal class = 60-80, $l = 60$, $f_1 = 61$, $f_0 = 52$, $f_2 = 38$ and $h = 20$

Substituting these values, we get

Mode = 65,625

Question 3

The following data gives the distribution of total monthly household expenditure of 200 families of a village. Find the modal monthly expenditure of the families. Also, find the mean monthly expenditure:

Expenditure	Number of families
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	30
3500-4000	22
4000-4500	16
4500-5000	7

Solution

$$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

f_1 = frequency of the modal class,

f_0 = frequency of the class preceding the modal class,

f_2 = frequency of the class succeeding the modal class.

Modal class = 1500-2000, $l = 1500$, $f_1 = 40$, $f_0 = 24$, $f_2 = 33$ and $h = 500$

Substituting these values, we get

Calculation for mean

Class Interval	f_i	x_i	$d_i = x_i - a$	$u_i = d_i/h$	$f_i u_i$
1000-1500	24	1250	-1500	-3	-72
1500-2000	40	1750	-1000	-2	-80
2000-2500	33	2250	-500	-1	-33
2500-3000	28	2750	0	0	0
3000-3500	30	3250	500	1	30
3500-4000	22	3750	1000	2	44
4000-4500	16	4250	1500	3	48
4500-5000	7	4750	2000	4	28
	$\sum f_i = 200$				$\sum f_i u_i = -35$

$$M = a + \frac{\sum f_i u_i}{\sum f_i} h$$

$$= 2750 + (35/200) \times 500$$

$$= 2750 - 87.50 = 2662.50$$

Question 4

The following distribution gives the state-wise teacher-student ratio in higher secondary schools of India. Find the mode and mean of this data. Interpret the two measures.

Number of students per teacher	Number of states/U.T
15 – 20	3
20 - 25	8

25 - 30	9
30 - 35	10
35 - 40	3
40 - 45	0
45 - 50	0
50 - 55	2

Solution

$$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

f_1 = frequency of the modal class,

f_0 = frequency of the class preceding the modal class,

f_2 = frequency of the class succeeding the modal class.

Modal class = 30-35, $l = 30$, $f_1 = 10$, $f_0 = 9$, $f_2 = 3$ and $h = 500$

Substituting these values, we get

Mode= 30.6

Calculation for mean by step deviation method (Assumed mean 32.5)

Class Interval	f_i	x_i	$d_i = x_i - a$	$u_i = d_i/h$	$f_i u_i$
15 - 20	3	17.5	-15	-3	-9
20 - 25	8	22.5	-10	-2	-16
25 - 30	9	27.5	-5	-1	-9
30 - 35	10	32.5	0	0	0
35 - 40	3	37.7	5	1	3

40 – 45	0	42.5	10	2	0
45 – 50	0	47.5	15	3	0
50 - 55	2	52.5	20	4	8
	$\Sigma f_i = 35$				$\Sigma f_i u_i = -23$

$$M = a + \frac{\Sigma f_i u_i}{\Sigma f_i} h$$

$$= 29.2$$

Question 5

The given distribution shows the number of runs scored by some top batsmen of the world in one-day international cricket matches.

Runs scored	Number of batsmen
3000-4000	4
4000-5000	18
5000-6000	9
6000-7000	7
7000-8000	6
8000-9000	3
9000-1000	1
1000-1100	1

Find the mode of the data.

Solution

$$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

f_1 = frequency of the modal class,

f_0 = frequency of the class preceding the modal class,

f_2 = frequency of the class succeeding the modal class.

From the given data, it can be observed that the maximum class frequency is 18, belonging to class interval 4000 – 5000. Therefore, modal class = 4000 – 5000

Lower limit (l) of modal class = 4000

Frequency (f_1) of modal class = 18

Frequency (f_0) of class preceding modal class = 4

Frequency (f_2) of class succeeding modal class = 9

Class size (h) = 1000

Substituting these values, we get

Mode = 4608.7 runs

Question 6

A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarized it in the table given below. Find the mode of the data:

Number of cars	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	7	14	13	12	20	11	15	8

Solution

$$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

f_1 = frequency of the modal class,

f_0 = frequency of the class preceding the modal class,

f_2 = frequency of the class succeeding the modal class.

Here maximum class frequency is 20, belonging to 40 – 50 class intervals. Therefore,
modal class = 40 – 50

Lower limit (l) of modal class = 40

Frequency (f_1) of modal class = 20

Frequency (f_0) of class preceding modal class = 12

Frequency (f_2) of class succeeding modal class = 11

Substituting these values, we get

Mode = 44.7