Chapter 3: Partition Values

EXERCISE 1 [PAGE 22]

Exercise 1 | Q 1 | Page 22

QUESTION

Give the correct option:

Statements that do not apply to Quartiles.

1. First, arrange the values in ascending or descending order.
2. Observation can be divided into 4 parts.
3. They are represented as Q_1, Q_2 and Q_3.
4. Q_2 is also known as a median.

- a
- b and c
- a, b and c
- None of these

SOLUTION

None of these

Exercise 1 | Q 2 | Page 22

QUESTION

Give the correct option:

D_7 From the given data.

Data - 4, 5, 6, 7, 8, 9, 10, 1 1, 12

- 7
- 9
- 10
- 12

SOLUTION

10

Exercise 1 | Q 3 | Page 22

QUESTION

Give the correct option:

Statements related to partition values that are correct.

1. Exact divisions of percentiles into 100 parts gives 99 points
2. Deciles have total 9 parts
3. Quartiles are shown by Q_1, Q_2 and Q_3
4. symbolically, percentiles and Deciles are shown by P and D

- a and c
- a and b
- a, b and c
- a ,c and d

SOLUTION

a ,c and d

EXERCISE 2 [PAGE 22]

Exercise 2 | Q 1 | Page 22

Choose the correct pair:

Group A	Group B
1) Quartiles	a) D_j = size of j$\left(\frac{n+1}{10}\right)^{\text{th Observation}}$
2) Deciles	b) $P_k = l + \left(\frac{\frac{kn}{100} - cf}{f}\right) \times h$
3) Percentiles	c) $Q_i = l + \left(\frac{\frac{in}{4} - cf}{f}\right) \times h$

- 1-b, 2-c, 3-a
- 1-c, 2-a, 3-b
- 1- c, 2-b, 3-a
- 1-a, 2-b, 3-c

SOLUTION

1-c, 2-a, 3-b

Group A	Group B
1) Quartiles	c) $\mathrm{Q}_i = l + \left(\frac{\frac{\mathrm{in}}{4} - cf}{f} \right) \times \mathrm{h}$
2) Deciles	a) $\mathrm{D_j}$ = size of j$\left(\frac{n+1}{10} \right)^{\text{th Observation}}$
3) Percentiles	b) $\mathrm{P}_k = l + \left(\frac{\frac{kn}{100} - cf}{f} \right) \times \mathrm{h}$

EXERCISE 3 [PAGE 22]

Exercise 3 | Q 1 | Page 22

QUESTION

Give economic term:

Procedure for dividing the data into equal parts

SOLUTION

Partitioning.

Exercise 3 | Q 2 | Page 22

QUESTION

Give economic term:

value that divides the Series into ten equal parts.

SOLUTION

Deciles.

Exercise 3 | Q 3 | Page 22

QUESTION

Give economic term:

Value that divides the whole set of observations into four equal parts.

SOLUTION

Quartiles.

EXERCISE 4 [PAGES 22 - 23]

Exercise 4 | Q 1 | Page 22

QUESTION

Solve the following

Calculate Q_1, D_4, and P_{26} for the following data.

18, 24, 45, 29, 4, 7, 28, 49, 16, 26, 25,12, 10 , 9, 8

SOLUTION

$$Q_1 = \text{size of } 1\left(\frac{n+1}{4}\right)^{\text{th observation}}$$

$$Q_1 = \text{size of } 1\left(\frac{15+1}{4}\right)^{\text{th observation}}$$

$$Q_1 = \text{Size of } 1\left(\frac{16}{4}\right)^{\text{th observation}}$$

$$Q_1 = \text{Size of } 1(4)^{\text{th observation}}$$

$$\text{Size of the } 4^{\text{th observation}} = 9$$

$$\mathbf{Q_1 = 9}$$

$$D_4 = \text{Size of } 4\left(\frac{n+1}{10}\right)^{\text{th observation}}$$

$$D_4 = \text{Size of } 4\left(\frac{15+1}{10}\right)^{\text{th observation}}$$

D_4 = Size of $4\left(\frac{16}{10}\right)^{\text{th observation}}$

D_4 = Size of $4(1.6)^{\text{th observation}}$

= Size of $6.4^{\text{th observation}}$

= Size of $6.4^{\text{th observation}}$ + 0.4 ($7^{\text{th observation}}$ – $6^{\text{th observation}}$)

= 12 + 0.4 (16 -12)

= 12 + 0.4 (4)

= 12 + 1.6

= 13.6

D4 = 13.6

P_{26} = Size of $26\left(\frac{n+1}{100}\right)^{\text{th observation}}$

P_{26} = Size of $26\left(\frac{15+1}{100}\right)^{\text{th observation}}$

P_{26} = Size of $26\left(\frac{16}{100}\right)^{\text{th observation}}$

= size of 26 $(0.16)^{\text{th observation}}$

= Size of $4.16^{\text{th observation}}$

= size of $4^{\text{th observation}}$ + 0.16($5^{\text{th observation}}$ - $4^{\text{th observation}}$)

= 9 + 0.16 (10 - 9)

= 9 + 0.16(1)

= 9 + 0.16

= 9.16

P_{26} = 9.16

Exercise 4 | Q 2 | Page 23

QUESTION

Solve the following :

Calculate of Q_3, D_5, and P_{35} for the given data

Income (in lakhs ₹)	1	2	3	4	5	6
No. of family	2	5	20	25	15	12

SOLUTION

Arrange the data of the income in ascending order.
(i.e. from lowest number to highest as shown below) and the out the cumulative frequency.

Income (in lakhs RS)	**no. of family**	**cumulative frequency(cf)**
1	2	2
2	5	7
3	20	27
4	25	52
5	15	67
6	12	79
	N = 79	

$$Q_3 = \text{Size of } 3\left(\frac{n+1}{4}\right)^{\text{th observation}}$$

$$= \text{size of } 3\left(\frac{79+1}{4}\right)^{\text{th observation}}$$

$$= \text{size of } 3\left(\frac{80}{4}\right)^{\text{th observation}}$$

$$= \text{size of } 3\ (20)^{\text{th observation}}$$

$$= \text{size of } 60^{\text{th observation}} \text{ lies in cf } 67$$

Hence, quartile value = Rs .5 lakhs Q_3 = Rs. 5 Lakhs

D_5 = size of $5\left(\frac{n+1}{10}\right)^{\text{th observation}}$

=size of $5\left(\frac{79+1}{10}\right)^{\text{th observation}}$

= size of $5\left(\frac{80}{10}\right)^{\text{th observation}}$

= size of $5(8)^{\text{th observation}}$

= size of $(40)^{\text{th observation}}$

Size of $40^{\text{th observation}}$ lies in cf 52 , hence decile value =Rs. 4 Lakhs

D_5 =Rs. 4 Lakhs

P_{35} =Size of $35\left(\frac{n+1}{100}\right)^{\text{th observation}}$

P_{35} =Size of $35\left(\frac{79+1}{100}\right)^{\text{th observation}}$

P_{35} =Size of $35\left(\frac{80}{100}\right)^{\text{th observation}}$

=Size of $35\ (0.80)^{\text{th observation}}$

=Size of $28^{\text{th observation}}$ lies in cf 52

Hence, percentile value = Rs.4 lakhs P_{35} = Rs. 4 lakhs.

Exercise 4 | Q 3 | Page 23

QUESTION

Solve the following :

Find out P_{50} for the following data.

Wages (in ₹) (x)	Number of workers
0-20	4
20-40	6
40-60	10
60-80	25
80-100	15

SOLUTION

Wages (in ₹) (x)	Number of workers	cf
0-20	4	4
20-40	6	10
40-60	10	20
60-80	25	45
80-100	15	60
	N=60	

P_{50} = size of $50\left(\frac{n}{100}\right)^{\text{th observation}}$

= size of $50\left(\frac{60}{100}\right)^{\text{th observation}}$

= size of $50(0.6)^{\text{th observation}}$

size of $30^{\text{th observation}}$

Size of $30^{\text{th observation}}$ lies in cf 45

Hence , percentile class = 60-80

L= 60 , f= 25, cf= 20 ,n= 60, h= 20

$$P_{50} = 1+\frac{\left(\frac{50n}{100} - cf\right)}{f} \times h$$

$$P_{50} = 60+\frac{\frac{50(60)}{100} - 20}{25} \times 20$$

$$P_{50} = 60 + \frac{\left(\frac{3000}{100} - 20\right)}{25} \times 20$$

$$P_{50} = 60 + \frac{(30 - 20)}{25} \times 20$$

$$P_{50} = 60 + \frac{(10)}{25} \times 20$$

$$P_{50} = 60 + \frac{(200)}{25} \times 20$$

$$P_{50} = 60 + 8$$

$$P_{50} = 68$$

Exercise 4 | Q 4 | Page 23

QUESTION

Calculate Q_3 for the following data.

Sales (in lakhs ₹)	10-20	20-30	30-40	40-50	50-60	60-70
No. of firms	20	30	70	48	32	50

SOLUTION

Sales (in lakhs Rs)	**Number of firms**	**cf**
10-20	20	20
20-30	30	50
30-40	70	120
40-50	48	168
50-60	32	200
60-70	50	250
	N = 250	

$$Q_3 = \text{Size of } 3\left(\frac{n}{4}\right)^{\text{th observation}}$$

$$= \text{Size of } 3\left(\frac{250}{4}\right)^{\text{th observation}}$$

$$= \text{Size of } 3(62.5)^{\text{th observation}}$$

= Size of 187.5^{th} observation

= Size of 187.5^{th} observation lies in cf 200

Hence, quartile class is 50-60

L = 50, F = 32, CF = 168, N = 250, H = 10

$$Q_3 = 1+\frac{\left(\frac{3n}{4}-cf\right)}{f}\times h$$

$$Q_3 = 50+\frac{\frac{3(250)}{4}-168}{32}\times 10$$

$$Q_3 = 50+\frac{(582)}{32}\times 10$$

$$Q_3 = 50+\frac{(5820)}{32}\times 10$$

$Q_3 = 50+181.875$

$Q_3 = 50+181.875$

$Q_3 = 231.875$

$Q_3 = 231.875$

Exercise 4 | Q 5 | Page 23

QUESTION

Solve the following :

Calculate D_7 for the following data.

Profit (in crores ₹)	10-20	20-30	30-40	40-50	50-60	60-70
No. of firms	20	30	70	48	32	50

SOLUTION

Profit (in crores ₹)	No. of firms	cf
10-20	20	20
20-30	30	50
30-40	70	120
40-50	48	168
50-60	32	200
60-70	50	250
	N = 250	

D_7 = Size of $7\left(\frac{n}{10}\right)^{\text{th observation}}$

= Size of $7\left(\frac{250}{10}\right)^{\text{th observation}}$

= Size of $7(25)^{\text{th observation}}$

= Size of $175^{\text{th observation}}$

Hence, decile class = 50-60

L = 50, F = 32, cf = 168, N = 250, H = 10

$$D_7 = 1+\frac{\left(\frac{7n}{10}-cf\right)}{f}\times h$$

$$D_7 = 50+\frac{\left(\frac{7(250)}{10}-168\right)}{32}\times 10$$

$$D_7 = 50+\frac{\left(\frac{1750}{10}-168\right)}{32}\times 10$$

$$D_7 = 50+\frac{(175-168)}{32}\times 10$$

$$D_7 = 50+\frac{7}{32}\times 10$$

$$D_7 = 50+\frac{70}{32}$$

D_7 = 50 + 2.1875

D_7 = 52.1875.

Exercise 4 | Q 6 | Page 23

QUESTION

Solve the following :

Calculate P_{15} for the following data

Investment (₹ in lakhs)	0-10	10-20	20-30	30-40	40-50	50-60
No. of firms	5	10	25	30	20	10

SOLUTION

Investment (₹ in lakhs)	**No. of firms**	**cf**
0-10	5	5
10-20	10	15
20-30	25	40
30-40	30	70
40-50	20	90
50-60	10	100
	N = 100	

P_3 = Size of $15\left(\frac{n}{100}\right)^{\text{th observation}}$

= Size of $15\left(\frac{100}{100}\right)^{\text{th observation}}$

= Size of $15(1)^{\text{th observation}}$

= Size of $15^{\text{th observation}}$

= Size of $15^{\text{th observation}}$ lies in cf 15

Hence, percentile class = 10-20

L = 10, f =10, cf = 5, n =100, h =10

$$P_{15} = l + \frac{\left(\frac{15n}{100} - cf\right)}{f} \times h$$

$$P_{15} = 10 + \frac{\left(\frac{15(100)}{100} - 5\right)}{10} \times 10$$

$$P_{15} = 10 + \frac{\left(\frac{1500}{100} - 5\right)}{10} \times 10$$

$$P_{15} = 10 + \frac{(15-5)}{10} \times 10$$

$$P_{15} = 10 + \frac{(10)}{10} \times 10$$

$$P_{15} = 10 + \frac{100}{10}$$

$$P_{15} = 10 + 10$$

$$\mathbf{P_{15} = 20}$$

EXERCISE 5 [PAGE 23]

Exercise 5 | Q 1 | Page 23

QUESTION

State with reasons whether you agree or disagree with the following statement:

Partition values have application only in theory but not in practice.

- Agree
- Disagree

SOLUTION

No, I do not agree with this statement.

Reasons:

1. Partition values like quartiles, deciles, percentiles divide the given set of observations into equal number of parts. So they have application in theory.
2. Quartiles, deciles, percentiles are very useful to study the concepts of population, unemploy ment, poverty, etc.
3. Quartiles, deciles, percentiles are also useful in practice while framing various government policies related to removal of poverty, inequality, measurement of health indicators, etc. Thus, partition values have applications in theory as well as in practice.

Exercise 5 | Q 2 | Page 23

QUESTION

State with reasons whether you agree or disagree with the following statement:

Average can misinterpret the representative value.

- Agree
- Disagree

SOLUTION

Yes, I agree With this statement.

Reasons :

1. The arithmetic mean, mode and median are the types of averages which have certain limitations.

2. Arithmetic mean gets affected by extreme values. Its value may not exist in the given series. Mode does not have any significance When the data given is small and none of the items repeat. In case of the median, the array of huge data is laborious.

3. Arithmetic mean mode and median are not amenable to mathematical treatment.

Thus, the average can misinterpret the representative value.

Exercise 5 | Q 3 | Page 23

QUESTION

State with reasons whether you agree or disagree with the following statement:

Median is also known as the second quartile.

- Agree
- Disagree

SOLUTION

Yes, I agree with this statement.

Reasons :

1. The Median divides data into two equal parts.
2. Quartile divides data into four equal parts.
3. Thus, the value of the median is equal to the value of the second quartile.

Therefore, the median is also known as the second quartile.

EXERCISE 6 [PAGE 23]

Exercise 6 | Q 1 | Page 23

Answer the following questions on the basis of the given data :

Marks	10	20	30	40	50
No. of Students	4	7	13	8	6

1) Write the formula of Q_1 and Q_3.

2) Find out the median of the above data?

3) Find out the cumulative frequency of the last value in the above data.

4) Find out the value of 'n' in the above data

SOLUTION

Marks	No. of Students	cf
10	4	4
20	7	11
30	13	24
40	8	32
50	6	38
	N = 38	

1. Formula of Q_1

$$Q_1 = \text{Size of } 1\left(\frac{n+1}{4}\right)^{\text{th observation}}$$

Formula of Q_3

$$Q_3 = \text{Size of } 3\left(\frac{n+1}{4}\right)^{\text{th observation}}$$

2. Median = Q_2

$$\text{Median} = Q_2 = \text{Size of } 2\left(\frac{n+1}{4}\right)^{\text{th observation}}$$

$$= \text{Size of } 2\left(\frac{38+1}{4}\right)^{\text{th observation}}$$

$$= \text{Size of } 2\left(\frac{40}{4}\right)^{\text{th observation}}$$

$$= \text{Size of } 2\ (9.75)^{\text{th observation}}$$

$$= \text{Size of } 19.5^{\text{th observation}}$$

$$= \text{Size of } 19.5^{\text{th observation}} \text{ lies in cf } 24$$

Hence, quartile value = 30 marks.

3. The cumulative frequency of the last value in the above data is 38.

4. The value of 'n' in the above data is 38.