3. PARTITION VALUES

Q.1 Give the correct option :

(1) Statements that do not apply to Quartiles.

(a) First arrange the values in ascending or descending order.

(b) Observation can be divided into 4 parts.

(c) They are represented as Q1 , Q2 and Q3.

(d) Q2 is also know as median.

Option:

(1) a (2) b and c

(3) a, b and c **(4) None of these**

(2) D from the given data.

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

Options : (1) 7 (2) 9 **(3) 10** (4) 12

(3) Statements related to partition values that are correct.

(a) Exact divisions of percentiles into 100 parts gives 99 points

(b) Deciles have total 9 parts

(c) Quartiles are shown by Q1, Q2 and Q3

(d) symbolically , percentiles and Deciles are shown by P and D

Option: (1) a and c (2) a and d

(3) a, b and c **(4) a ,c and d**

Q.2 Choose the correct pair :

Group 'A'	Group 'B'

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

Option :
(1) 1-b, 2-c, 3-a (2) 1-c, 2-a, 3-b
(3) 1-c, 2-b, 3-a (4) 1-a, 2-b, 3-c

Q.3 Give economic terms:

(1) Procedure for dividing the data into equal parts.

Ans: partitioning.

(2) Value that divides the Series into ten equal parts.

Ans: Deciles.

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

Ans: Quartiles.

Q.4 Solve the following :

(1) Calculate Q1, D4 and P26 for the following data:

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

Solution :

Organize this data in an ascending order (i.e. from lowest number to highest number as shown below)
4, 7, 8, 9, 10, 12, 16, 18, 24, 25, 25, 26, 28, 29, 45, 49

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

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

$Q_1 = size\ of\ 1\left(\frac{16}{4}\right)^{th}\ Observation$

$Q_1 = size\ of\ 1(4)^{th} Observation$

Size of 4th observation =9

Q1 =9

$\boldsymbol{D_4 = size\ of\ 4\left(\frac{n+1}{10}\right)^{th}\ Observation}$

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

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

$D_4 = \text{size of } 4(1.6)^{\text{th}} \text{Observation}$

=Size of 6.4th observation

= Size of 6.4th observation+0.4(7th observation – 6th observation)

=12+0.4 (16-12)

=12+0.4 (4)

=12+1.6

=13.6

D4= 13.6

$\boldsymbol{P_{26} = size\ of\ 26\left(\frac{n+1}{100}\right)^{th}\ Observation}$

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

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

=size of 26 (0.16)th observation

=Size of 4.16 th observation

=size of 4th observation +0.16(5th observation -4th observation)

=9+0.16 (10-9)

=9+0.16(1)

=9+0.16

=9.16
P26=9.16

ANS: Q1 = 9, D4 =13.6, P26 =9.16

2. Calculate Q3 ,D5 and P35 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 an 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	

$$Q_3 = size\ of\ 3\left(\frac{n+1}{4}\right)^{th}\ Observation$$
$$= size\ of\ 3\left(\frac{79+1}{4}\right)^{th}\ Observation$$
$$= size\ of\ 3\left(\frac{80}{4}\right)^{th}\ Observation$$
$$= size\ of\ 3(20)^{th} Observation$$
$$= size\ of\ 60^{th} Observation$$ lies in cf 67

Hence , quartile value = RS. 5 Lakhs
Q3 = RS. 5 lakhs

$$D_5 = size\ of\ 5\left(\frac{n+1}{10}\right)^{th}\ Observation$$
$$= size\ of\ 5\left(\frac{79+1}{10}\right)^{th}\ Observation$$
$$= size\ of\ 5\left(\frac{80}{10}\right)^{th}\ Observation$$
$$= size\ of\ 5(8)^{th} Observation$$

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

Size of 40th observation lies in cf 52 , hence decile value =RS. 4 Lakhs

D5 =R.S 4 Lakhs

$$\mathbf{P_{35} = size\ of\ 35\left(\frac{n+1}{100}\right)^{th}\ Observation}$$

$$= size\ of\ 35\left(\frac{79+1}{100}\right)^{th}\ Observation$$

$$= size\ of\ 35\left(\frac{80}{100}\right)^{th}\ Observation$$

$$= size\ of\ 35(0.80)^{th} Observation$$

$$= size\ of\ 28^{th} Observation$$

Size of 28th observation lies in cf 52

Hence , percentile value =RS. 4 lakhs

P35 = RS. 4 lakhs

ANS: Q3 =RS. 5 lakhs, D5 = RS. 4 Lakhs , P35 = RS. 4 Lakhs

3. Find out P50 for the following :

Wages (in RS.) (x)	Number of Workers
0-20	4
20-40	6
40-60	10
60-80	25
80-100	15

Solution :

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

$$P_{50} = \text{size of } 50\left(\frac{n}{100}\right)^{th} \text{Observation}$$
$$= \text{size of } 50\left(\frac{60}{100}\right)^{th} \text{Observation}$$
$$= \text{size of } 50(0.6)^{th} \text{Observation}$$
$$= \text{size of } 30^{th} \text{Observation}$$

Size of 30th observation liea in cf 45
Hence , percentile class =60-80
L =60, f =25 , cf= 20, n=60, h=20

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

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

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

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

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

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

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

$$=$$

P50 68 =

Ans: P50 68

4. Calculate Q3 for the following:

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	

$$Q_3 = size\ of\ 3\left(\frac{n}{4}\right)^{th}\ Observation$$
$$= size\ of\ 3\left(\frac{250}{4}\right)^{th}\ Observation$$
$$= size\ of\ 3(62.5)^{th} Observation$$
$$= size\ of\ 187.5^{th} Observation$$
$$= size\ of\ 187.5^{th} Observation\ lies\ in\ cf\ 200$$

Hence , quartile class is 50-60

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

$$Q3 = l + \frac{\left(\frac{3n}{4} - cf\right)}{f} \times h$$
$$Q3 = 50 + \frac{\left(\frac{3(250)}{4} - 168\right)}{32} \times 10$$
$$Q3 = 50 + \frac{(582)}{32} \times 10$$
$$Q3 = 50 + \frac{(5820)}{32} \times 10$$
$$Q3 = 50 + 181.875$$
$$Q3 = 231.875$$

ANS: Q3= 231.875

5. Calculate D7 for the following:

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

Solution :

Profit (in cores 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	

$$D_7 = size\ of\ 7\left(\frac{n}{10}\right)^{th} Observation$$
$$= size\ of\ 7\left(\frac{250}{10}\right)^{th}\ Observation$$
$$= size\ of\ 7(25)^{th} Observation$$
$$= size\ of\ 175^{th} Observation\ lies\ in\ cf\ 200$$

Hence , decile class =50-60
L=50, F=32, CF=168, N=250, H=10

$$D_7 = l + \frac{\left(\frac{7N}{10} - cf\right)}{f} \times h$$
$$D_7 = 50 + \frac{\left(\frac{7(250)}{10} - 168\right)}{32} \times 10$$
$$D_7 = 50 + \frac{\left(\frac{1750}{10} - 168\right)}{32} \times 10$$
$$D_7 = 50 + \frac{(175 - 168)}{32} \times 10$$
$$D_7 = 50 + \frac{(7)}{32} \times 10$$
$$D_7 = 50 + \frac{(70)}{32}$$
$$D_7 = 50 + 2.1875$$
$$D_7 = 52.1875$$

ANS: D7= 52.1875.

6. Calculate P15 For the following :

Investment (RS.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 (RS. I lakhs) (x)	Number of firms (F)	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	

$$P_3 = \text{size of } 15\left(\frac{n}{100}\right)^{th} \text{ Observation}$$
$$= \text{size of } 15\left(\frac{100}{100}\right)^{th} \text{ Observation}$$
$$= \text{size of } 15(1)^{th} \text{Observation}$$
$$= \text{size of } 15^{th} \text{Observation}$$
$$= \text{size of } 15^{th} \text{Observation lies in cf } 15$$

Hence , percentile class =10-20

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

$$P_{15} = l + \frac{\left(\frac{15n}{100} - cf\right)}{f} \times h$$
$$P_{15} = 10 + \frac{\left(\frac{15(100)}{100} - 5\right)}{10} \times 10$$
$$P_{15} = 10 + \frac{\left(\frac{1500}{100} - 5\right)}{10} \times 10$$
$$P_{15} = 10 + \frac{(15-5)}{10} \times 10$$
$$P_{15} = l0 + \frac{(10)}{10} \times 10$$
$$P_{15} = 10 + \frac{(100)}{10}$$
$$P_{15} = 10 + 10$$
$$P_{15} = 20$$

ANS: P15 = 20

Q.6. State with reasons whether you agree or disagree with the following statements :

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

Ans. 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.

2) Average can misinterpret the representative value.

Ans. Yes, I agree With this statement.

Reasons :

(1) Arithmatic mean, mode and median are the types of averages which have certain limitations.

(2) Arithmatic 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 median, the array of huge data is laborious.

(3) Arithmatic mean, mode and median are not amenable to mathematical treatment.
Thus, average can misinterpret the representative value.

(3) Median is also known as second quartile.

Ans. Yes, I agree with this statement.

Reasons :

(1) Median divides data into two equal parts.

(2) Quartile divides data into four equal parts.

(3) Thus, the value of median is equal to value of second quartile.
Therefore, median is also known as second quartile.

Q.6. Answer the following question on the basis at the given data:

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

1. **Write the formula of Q1 and Q3 :**

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:
Arrange the data of marks in an ascending order (i.e from lowest number to highest number as below

Marks	No of student	Cf
10	4	4
20	7	11
30	13	24
40	8	32
50	6	38
	N=38	

Ans:

1. **Formula of Q1**

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

Formula of Q3

$$Q_3 = size\ of\ 3\left(\frac{n+1}{4}\right)^{th}\ Observation$$

1. **Median = Q2**

Median = Q2 =

$$= size\ of\ 2\left(\frac{n+1}{4}\right)^{th}\ Observation$$
$$= size\ of\ 2\left(\frac{38+1}{4}\right)^{th}\ Observation$$
$$= size\ of\ 2\left(\frac{40}{4}\right)^{th}\ Observation$$
$$= size\ of\ 2\ (9.75)^{th} Observation$$
$$= size\ of\ 19.5^{th} Observation$$
$$= size\ of\ 19.5^{th} Observation\ lies\ in\ cf\ 24$$

Hence, quartile value = 30 marks.

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

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