FYJC - MATHEMATICS & STATISTICS

PAPER - II

PARTITION VALUES

# PARTITION VALUES : - QUARTILES

## Q1. RAW DATA

# Q - SET

01. Compute all the Quartiles for the following data

    160 , 149 , 115 , 118 , 111 , 145 , 140 , 120 , 109 , 107 , 106 , 105 , 135 , 130 , 126

    ans : $Q_1 = 109$ ; $Q_2 = 120$ ; $Q_3 = 140$

02. Calculate all the quartiles for the following scores obtained by 12 students

    20 , 28 , 31 , 18 , 19 , 17 , 32 , 33 , 22 , 21 , 38 , 40

    ans : $Q_1 = 19.25$ ; $Q_2 = 25$ ; $Q_3 = 32.75$

03. the heights (in cm) of 10 students are given below

    148 , 171 , 158 , 151 , 154 , 159 , 152 , 163 , 171 , 145

    Calculate $Q_1$ and $Q_3$

    ans : $Q_1 = 150.25$ ; $Q_3 = 165$

04. The number of ATM transactions per day recorded at a particular location in a certain city are as follows

    48 , 50 , 132 , 65 , 30 , 75 , 60 , 49 , 58 , 72 , 55

    Obtain the middlemost number of transactions per day

    ans : $Q_2 = 58$

05. Monthly consumption of electricity (in units) of families in certain locality is given below

    305 , 301 , 290 , 288 , 295 , 272 , 310 , 325 , 315 , 332 , 360 , 330

    Calculate electricity consumption below which 75% of the families lie

    ans : 328.75

## Q2. UNGROUPED DATA

01.
| Daily voucher transaction | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |
|---|---|---|---|---|---|---|---|---|
| No. of days | 2 | 8 | 15 | 26 | 17 | 5 | 1 | 1 |

Compute lower and upper Quartiles

ans : $Q_1 = 90$ ; $Q_3 = 110$

02.
| Daily wages (in ▢) | 10 | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|
| No. of workers | 5 | 12 | 16 | 14 | 10 | 2 |

Compute lower and upper Quartiles

ans : $Q_1 = 15$ ; $Q_3 = 25$

03.
| Weight (in kg) | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of Students | 5 | 7 | 13 | 16 | 25 | 14 | 9 | 6 | 3 | 2 |

Calculate all the Quartiles

## Q3. GROUPED DATA

**01.** A highway police department conducted a survey and clocked the speeds of number of cars on a highway . The distribution was obtained

| Speed | 60 – 65 | 65 – 70 | 70 – 75 | 75 – 80 | 80 – 85 | 85 – 90 |
|-------|---------|---------|---------|---------|---------|---------|
| No. of Cars | 10 | 34 | 55 | 85 | 10 | 06 |

Compute the speed (in km/hr) below which 75% of the cars have their speed

ans : $Q_3$ = 78

**02.** Following is the frequency of the dur. of telephonic talks (in sec) for international call from an ISD booth . Find upper quartile for the data

| Dur. Of call | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 |
|--------------|---------|---------|---------|---------|---------|---------|
| No. of calls | 20 | 7 | 6 | 4 | 2 | 1 |

ans : $Q_3$ = 35

**03.** Following is grouped data for duration of fixed deposits of 100 senior citizens from a certain bank

| Fixed Deposit (in days) | 0– 180 | 180 – 360 | 360 – 540 | 540 – 720 | 720– 900 |
|-------------------------|--------|-----------|-----------|-----------|----------|
| No of senior Citizens | 15 | 20 | 25 | 30 | 10 |

Find limits of fixed deposits of central 50% senior citizens

ans : $Q_1$ = 270 ; $Q_3$ = 630

**04.** the following is the frequency distribution of heights of 200 males adults in a factory

| Height (in cm) | 145 –150 | 150 – 155 | 155 – 160 | 160 – 165 | 165 – 170 | 170 – 175 | 175 – 180 | 180 – 185 |
|----------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| No of male Adults | 4 | 6 | 25 | 57 | 64 | 30 | 8 | 6 |

Find limits of heights within which middle 50% adults lie

ans : 161.32cm ; 169.53 cm

**05.**

| Marks less than | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|-----------------|----|----|----|----|----|----|----|----|
| No. of students | 5 | 13 | 20 | 25 | 60 | 80 | 90 | 100 |

Find SEMI INTERQUARTILE RANGLE

ans : $Q_1$ = 40 ; $Q_3$ = 57.5 ,Semi –Interquartile range = 8.75

**06.** a taxi company tested a random sample of 160 steel belted tyres of a certain brand and recorded the following tread wear

| Tread wear (in thousand km) | no of tyres |
|-----------------------------|-------------|
| more that 40 | 160 |
| more that 44 | 155 |
| more that 48 | 145 |
| more that 52 | 20 |
| more that 56 | 12 |
| more that 60 | 5 |

Compute Q1 & Q3

ans : 48.8 , 51.36

07.

| Wages (in ) | no of workers |
|---|---|
| more that 8000 | 160 |
| more that 9000 | 155 |
| more that 10000 | 137 |
| more that 11000 | 103 |
| more that 12000 | 60 |
| more that 13000 | 40 |
| more that 14000 | 10 |
| more that 15000 | 1 |
| more that 16000 | 0 |

The following is the distribution of 160 workers according to their wages .

Find the upper and lower Quartiles

ans :

$Q_1 = 10500$ , $Q_3 = 13000$

08. For the following frequency distribution value of $Q_2$ is 22 . Find the missing frequency

| Class | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| Frequency | 5 | 8 | ? | 4 | 3 |

ans : 10

09. the following is the distribution of monthly sales of 50 shops on a certain street in the city

| Sales (000) | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| Shops | 3 | ? | 20 | 12 | ? |

If the value of $Q_1 = 20.75$ , find the missing frequencies

ans : 8 , 7

10. the following is the data of pocket expenditure per week of 50 students in a class . It is known that the median of the distribution is Rs 120 . Find the missing frequencies

| Expenditure | 0 – 50 | 50 – 100 | 100 – 150 | 150 – 200 | 200 – 250 |
|---|---|---|---|---|---|
| No.of students | 7 | ? | 15 | ? | 3 |

ans : 12 , 13

# SOLUTION SET

**01.** Compute all the Quartiles for the following data

160 , 149 , 115 , 118 , 111 , 145 , 140 , 120 , 109 , 107 , 106 , 105 , 135 , 130 , 126

**SOLUTION**

| obs no. : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| value : | 105 | 106 | 107 | 109 | 111 | 115 | 118 | 120 | 126 | 130 | 135 | 140 | 145 | 149 | 160 |

$q_1 = \dfrac{N+1}{4} = \dfrac{16}{4} = 4$    $\therefore Q_1 =$ value of the 4th observation
$= 109$

$q_2 = \dfrac{N+1}{2} = \dfrac{16}{2} = 8$    $\therefore Q_2 =$ value of the 8th observation
$= 120$

$q_3 = \dfrac{3(N+1)}{4} = \dfrac{3(16)}{4} = 12$    $\therefore Q_3 =$ value of the 12th observation
$= 140$

**02.** Calculate all the quartiles for the following scores obtained by 12 students

20 , 28 , 31 , 18 , 19 , 17 , 32 , 33 , 22 , 21 , 38 , 40

**SOLUTION**

| obs . no.: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| value : | 17 | 18 | 19 | 20 | 21 | 22 | 28 | 31 | 32 | 33 | 38 | 40 |

$q_1 = \dfrac{N+1}{4} = \dfrac{13}{4} = 3.25$    $\therefore Q_1 =$ value of the 3.25th observation

$= 19 + 0.25 (20 - 19)$

$= 19 + 0.25 \qquad = 19.25$

$q_2 = \dfrac{N+1}{2} = \dfrac{13}{2} = 6.5$    $\therefore Q_2 =$ value of the 6.5th observation

$= 22 + 0.5 (28 - 22)$

$= 19 + 0.5(6)$

$= 19 + 3 \qquad = 22$

$q_3 = \dfrac{3(N+1)}{4} = \dfrac{3(3.25)}{4} = 9.75$    $\therefore Q_3 =$ value of the 9.75th observation

$= 32 + 0.75(33 - 32)$

$= 32 + 0.75 \qquad = 32.75$

**03.** the heights (in cm) of 10 students are given below

148 , 171 , 158 , 151 , 154 , 159 , 152 , 163 , 171 , 145          Calculate $Q_1$ and $Q_3$

**SOLUTION**

| obs no. : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| value : | 145 | 148 | 151 | 152 | 154 | 158 | 159 | 163 | 171 | 171 |

$q_1 = \dfrac{N+1}{4} = \dfrac{11}{4} = 2.75$     $\therefore Q_1 =$ value of the $2.75^{th}$ observation

$= 148 + 0.75(151 - 148)$

$= 148 + 0.75(3)$

$= 148 + 2.25$          $= 150.25$

$q_3 = \dfrac{3(N+1)}{4} = 3(2.75) = 8.25$     $\therefore Q_3 =$ value of the $8.25^{th}$ observation

$= 163 + 0.25(171 - 163)$

$= 163 + 0.25(8)$

$= 163 + 2$          $= 165$

**04.** The number of ATM transactions per day recorded at a particular location in a certain city are as follows    48 , 50 , 132 , 65 , 30 , 75 , 60 , 49 , 58 , 72 , 55

Obtain the middlemost number of transactions per day

| obs no. : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| value : | 30 | 48 | 49 | 50 | 55 | 58 | 60 | 65 | 72 | 75 | 132 |

$q_2 = \dfrac{N+1}{2} = \dfrac{12}{2} = 6$   $\therefore Q_2 =$ value of the $6^{th}$ observation   $= 58$

**05.** Monthly consumption of electricity (in units) of families in certain locality is given below

305 , 301 , 290 , 288 , 295 , 272 , 310 , 325 , 315 , 332 , 360 , 330

Calculate electricity consumption below which 75% of the families lie

**SOLUTION**

| Obs no. : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Value : | 272 | 288 | 290 | 295 | 301 | 305 | 310 | 315 | 325 | 330 | 332 | 360 |

$q_3 = \dfrac{3(N+1)}{4} = \dfrac{3(13)}{4} = \dfrac{39}{4} = 9.75$

$\therefore Q_3 =$ value of the $9.75^{th}$ observation

$= 325 + 0.75(330 - 325)$

$= 325 + 0.75(5)$

$= 325 + 3.75(5)$          $= 328.75$ (in units )

## Q2. UNGROUPED DATA

**01.**

| Daily voucher transaction | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |
|---|---|---|---|---|---|---|---|---|
| No. of days | 2 | 8 | 15 | 26 | 17 | 5 | 1 | 1 |

Compute lower and upper Quartiles

**SOLUTION :**

| x | f | cf | |
|---|---|---|---|
| 70 | 2 | 2 | |
| 80 | 8 | 10 | ← $q_1$ = 19 |
| 90 | 15 | 25 | |
| 100 | 26 | 51 | |
| 110 | 17 | 68 | ← $q_3$ = 57 |
| 120 | 5 | 73 | |
| 130 | 1 | 74 | |
| 140 | 1 | 75 = N | |

LOWER & UPPER QUARTILES

$$q_1 = \frac{N+1}{4} = \frac{76}{4} = 19 \quad \therefore Q_1 = 90$$

$$q_3 = 3\frac{N+1}{4} = 3(19) = 57 \quad \therefore Q_3 = 110$$

**02.**

| Daily wages (in □) | 10 | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|
| No. of workers | 5 | 12 | 16 | 14 | 10 | 2 |

Compute lower and upper Quartiles

**SOLUTION :**

| x | f | cf | |
|---|---|---|---|
| 10 | 5 | 5 | ← $q_1$ = 15 |
| 15 | 12 | 17 | |
| 20 | 16 | 33 | ← $q_3$ = 45 |
| 25 | 14 | 47 | |
| 30 | 10 | 57 | |
| 35 | 2 | 59 | |

LOWER & UPPER QUARTILES

$$q_1 = \frac{N+1}{4} = \frac{60}{4} = 15 \quad \therefore Q_1 = 15$$

$$q_3 = 3\frac{N+1}{4} = 3(15) = 45 \quad \therefore Q_3 = 25$$

**03.**

| Weight (in kg) | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of Students | 5 | 7 | 13 | 16 | 25 | 14 | 9 | 6 | 3 | 2 |

Calculate all the Quartiles

ALL THREE QUARTILES

| x | f | cf |
|---|---|---|
| 58 | 5 | 5 |
| 59 | 7 | 12 |
| 60 | 13 | 25 |
| 61 | 16 | 41 |
| 62 | 25 | 66 |
| 63 | 14 | 80 |
| 64 | 9 | 89 |
| 65 | 6 | 95 |
| 66 | 3 | 98 |
| 67 | 2 | 100 = N |

$$q_1 = \frac{N+1}{4} = \frac{101}{4} = 25.25 \qquad \therefore Q_1 = 61$$

$$q_2 = \frac{N+1}{2} = \frac{101}{2} = 50.5 \qquad \therefore Q_2 = 62$$

$$q_3 = \frac{3(N+1)}{4} = 3(25.25) = 75.75 \qquad \therefore Q_3 = 63$$

## Q3. GROUPED DATA

**01.** A highway police department conducted a survey and clocked the speeds of number of cars on a highway . The following distribution was obtained

| Speed | 60 – 65 | 65 – 70 | 70 – 75 | 75 – 80 | 80 – 85 | 85 – 90 |
|---|---|---|---|---|---|---|
| No. of Cars | 10 | 34 | 55 | 85 | 10 | 06 |

Compute the speed (in km/hr) below which 75% of the cars have their speed

**SOLUTION :**

| CI | f | cf |
|---|---|---|
| 60 – 65 | 10 | 10 |
| 65 – 70 | 34 | 44 |
| 70 – 75 | 55 | 99 |
| 75 – 80 | 85 | 184 |
| 80 – 85 | 10 | 194 |
| 85 – 90 | 06 | 200 |

$$q_3 = \frac{3N}{4} = \frac{3(200)}{4} = 150$$

$$Q_3 = L_1 + \frac{q_3 - c}{f}(L_2 - L_1)$$

$$= 75 + \frac{150 - 99}{85}(80 - 75)$$

$$= 75 + \frac{\cancel{51}^{17}(5)}{\cancel{85}}$$

$$= 75 + 3$$

$$= 78 \text{ km/hr}$$

**02.** Following is the frequency of the duration of telephonic talks (in sec) for international call from an ISD booth . Find the upper quartile for the data

| Dur. Of call | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 |
|---|---|---|---|---|---|---|
| No. of calls | 20 | 7 | 6 | 4 | 2 | 1 |

**SOLUTION :**

| CI | f | cf |
|---|---|---|
| 10 – 20 | 20 | 20 |
| 20 – 30 | 7 | 27 |
| 30 – 40 | 6 | 33 |
| 40 – 50 | 4 | 37 |
| 50 – 60 | 2 | 39 |
| 60 – 70 | 1 | 40 |

$$q_3 = \frac{3N}{4} = \frac{3(40)}{4} = 30$$

$$Q_3 = L_1 + \frac{q_3 - c}{f}(L_2 - L_1)$$

$$= 30 + \frac{30 - 27}{6}(40 - 30)$$

$$= 30 + \frac{3}{6}(10)$$

$$= 30 + 5$$

$$= 35 \text{ sec}$$

**03.** Following is grouped data for duration of fixed deposits of 100 senior citizens from a bank

| Fixed Deposit (in days) | 0– 180 | 180 – 360 | 360 – 540 | 540 – 720 | 720– 900 |
|---|---|---|---|---|---|
| No of senior Citizens | 15 | 20 | 25 | 30 | 10 |

Find limits of fixed deposits of central 50% senior citizens

| CI | f | cf | |
|---|---|---|---|
| 0 – 180 | 15 | 15 | |
| **180 – 360** | **20** | **35** | Q1 class |
| 360 – 540 | 25 | 60 | |
| **540 – 720** | **30** | **90** | Q3 class |
| 720 – 900 | 10 | 100 | |

$$q_1 = \frac{N}{4} = \frac{100}{4} = 25$$

$$Q_1 = L_1 + \frac{q_1 - c}{f}(L_2 - L_1)$$

$$= 180 + \frac{25 - 15}{20}(360 - 180)$$

$$= 180 + \frac{10}{20}(180)$$

$$= 180 + 90 = 270 \text{ days}$$

$$q_3 = \frac{3N}{4} = \frac{3(100)}{4} = 75$$

$$Q_3 = L_1 + \frac{q_3 - c}{f}(L_2 - L_1)$$

$$= 540 + \frac{75 - 60}{30}(720 - 540)$$

$$= 540 + \frac{15}{30}(180)$$

$$= 540 + 90$$

$$= 630 \text{ days}$$

**04.** the following is the frequency distribution of heights of 200 males adults in a factory

| Height (in cm) | 145 −150 | 150 − 155 | 155 − 160 | 160 − 165 | 165 − 170 | 170 − 175 | 175 − 180 | 180 − 185 |
|---|---|---|---|---|---|---|---|---|
| No of male Adults | 4 | 6 | 25 | 57 | 64 | 30 | 8 | 6 |

Find limits of heights within which middle 50% adults lie

| CI | f | cf | |
|---|---|---|---|
| 145 − 150 | 4 | 4 | |
| 150 − 155 | 6 | 10 | |
| 155 − 160 | 25 | 35 | |
| **160 − 165** | **57** | **92** | **Q₁ class** |
| **165 − 170** | **64** | **156** | **Q₃ class** |
| 170 − 175 | 30 | 186 | |
| 175 − 180 | 8 | 194 | |
| 180 − 185 | 6 | 200 | |

$q_1 = \dfrac{N}{4} = \dfrac{200}{4} = 50$

$Q_1 = L_1 + \dfrac{q_1 - c}{f}(L_2 - L_1)$

$\quad = 160 + \dfrac{50 - 35}{57}(165 - 160)$

$\quad = 160 + \dfrac{15}{57}(5)$

$\quad = 160 + \dfrac{75}{57}$

$\quad = 160 + 1.32 = 161.32$ cm

$q_3 = \dfrac{3N}{4} = \dfrac{3 \cdot 200}{4} = 150$

$Q_3 = L_1 + \dfrac{q_3 - c}{f}(L_2 - L_1)$

$\quad = 165 + \dfrac{150 - 92}{64}(170 - 165)$

$\quad = 165 + \dfrac{58}{64}(5)$

$\quad = 165 + \dfrac{145}{32}$

$\quad = 165 + 4.53 = 169.53$ cm

**05.**

| Marks less than | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|
| No. of students | 5 | 13 | 20 | 25 | 60 | 80 | 90 | 100 |

Find SEMI INTERQUARTILE RANGE

**SOLUTION :**

| Marks Less than | No of students | CI | f | cf | |
|---|---|---|---|---|---|
| 10 | 5 | 0 − 10 | 5 | 5 | |
| 20 | 13 | 10 − 20 | 8 | 13 | |
| 30 | 20 | 20 − 30 | 7 | 20 | |
| 40 | 25 | **30 − 40** | **5** | **25** | **Q₁ class** |
| 50 | 60 | 40 − 50 | 35 | 60 | |
| 60 | 80 | **50 − 60** | **20** | **80** | **Q₃ class** |
| 70 | 90 | 60 − 70 | 10 | 90 | |
| 80 | 100 | 70 − 80 | 10 | 100 | |

$q_1 = \dfrac{N}{4} = \dfrac{100}{4} = 25$ 　　　　　　　　　$q_3 = \dfrac{3N}{4} = \dfrac{3 \; 100}{4} = 75$

$Q_1 = L_1 + \dfrac{q_1 - C}{f}(L_2 - L_1)$ 　　　　　$Q_3 = L_1 + \dfrac{q_3 - C}{f}(L_2 - L_1)$

$\quad = 30 + \dfrac{25 - 20}{5}(40 - 30)$ 　　　　　$\quad = 50 + \dfrac{75 - 60}{20}(60 - 50)$

$\quad = 30 + \dfrac{5(10)}{5}$ 　　　　　　　　　$\quad = 50 + \dfrac{15(10)}{20}$

$\quad = 30 + 10$ 　　　　　　　　　　　$\quad = 50 + 7.5$

$\quad = 40$ marks 　　　　　　　　　　$\quad = 57.5$ marks

Semi Interquartile range $= \dfrac{Q_3 - Q_1}{2} = \dfrac{57.5 - 40}{2} = \dfrac{17.5}{2} = 8.75$

06.　a taxi company tested a random sample of 160 steel belted tyres of a certain brand and recorded the following tread wear

| Tread wear (in thousand km) | no of tyres |
|---|---|
| more that 40 | 160 |
| more that 44 | 155 |
| more that 48 | 145 |
| more that 52 | 20 |
| more that 56 | 12 |
| more that 60 | 5 |

SOLUTION :

| CI | f | cf | |
|---|---|---|---|
| 40 – 44 | 5 | 5 | |
| 44 – 48 | 10 | 15 | |
| 48 – 52 | 125 | 140 | $Q_1$ & $Q_3$ CLASS |
| 52 – 56 | 8 | 148 | |
| 56 – 60 | 7 | 155 | |
| 60 – 64 | 5 | 160 | |

$q_1 = \dfrac{N}{4} = \dfrac{160}{4} = 40$ 　　　　　　　　$q_3 = \dfrac{3N}{4} = \dfrac{3 \; 160}{4} = 120$

$Q_1 = L_1 + \dfrac{q_1 - C}{f}(L_2 - L_1)$ 　　　　　$Q_3 = L_1 + \dfrac{q_3 - C}{f}(L_2 - L_1)$

$\quad = 48 + \dfrac{40 - 15}{125}(52 - 48)$ 　　　　　$\quad = 48 + \dfrac{120 - 15}{125}(52 - 48)$

$\quad = 48 + \dfrac{25}{125}(4)$ 　　　　　　　　$\quad = 48 + \dfrac{105}{125}(4)$

$\quad = 48 + \dfrac{4}{5}$ 　　　　　　　　　　$\quad = 48 + \dfrac{21}{25}(4)$

$\quad = 48 + 0.8$ 　　　　　　　　　　　$\quad = 48 + 3.36$

$\quad = 48.8$ ( in thousand km) 　　　　　$\quad = 51.36$ ( in thousand km )

**07**   following is the distribution of 160 workers according to wages . Find upper & lower Quartiles

| Wages (in □) | no of workers |
|---|---|
| more that 8000 | 160 |
| more that 9000 | 155 |
| more that 10000 | 137 |
| more that 11000 | 103 |
| more that 12000 | 60 |
| more that 13000 | 40 |
| more that 14000 | 10 |
| more that 15000 | 1 |
| more that 16000 | 0 |

| CI | f | cf | |
|---|---|---|---|
| 8000 – 9000 | 5 | 5 | |
| 9000 – 10000 | 18 | 23 | |
| **10000 – 11000** | **34** | **57** | $Q_1$ class |
| 11000 – 12000 | 43 | 100 | |
| **12000 – 13000** | **20** | **120** | $Q_2$ class |
| 13000 – 14000 | 30 | 150 | |
| 14000 – 15000 | 9 | 159 | |
| 15000 – 16000 | 1 | 160 | |

$q_1 = \dfrac{N}{4} = \dfrac{160}{4} = 40$

$Q_1 = L_1 + \dfrac{q_1 - c}{f}(L_2 - L_1)$

$= 10000 + \dfrac{40 - 23}{34}(1000)$

$= 10000 + \dfrac{17}{34}(1000)$

$= 10000 + 500$

$= 10,500$ (in □)

$q_3 = \dfrac{3N}{4} = \dfrac{3(160)}{4} = 120$

$Q_3 = L_1 + \dfrac{q_3 - c}{f}(L_2 - L_1)$

$= 12000 + \dfrac{120 - 100}{20}(1000)$

$= 12000 + \dfrac{20}{20}(1000)$

$= 120000 + 1000$

$= 13,000$ (in □)

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**08.**   For the following frequency distribution value of $Q_2$ is 22 . Find the missing frequency

| Class | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| Frequency | 5 | 8 | ? | 4 | 3 |

| CI | f | cf | |
|---|---|---|---|
| 0 – 10 | 5 | 5 | |
| 10 – 20 | 8 | 13 | |
| **20 – 30** | **a** | **13 + a** | $Q_2$ class |
| 30 – 40 | 4 | 17 + a | |
| 40 – 50 | 3 | 20 + a = N | |

$q_2 = \dfrac{N}{2} = \dfrac{20 + a}{2}$

$Q_2 = L_1 + \dfrac{q_2 - c}{f}(L_2 - L_1)$

$22 = 20 + \dfrac{\frac{20 + a}{2} - 13}{a}.(30 - 20)$

$2 = \dfrac{\frac{20 + a - 26}{2}}{a}.(\cancel{10})\,5$

$2 = \dfrac{a - 6}{a}.(5)$

$2a = 5a - 30$       $\therefore a = 10$

**09.** the following is the distribution of monthly sales of 50 shops on a certain street in the city

| Sales (000) | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| Shops | 3 | ? | 20 | 12 | ? |

If the value of $Q_1 = 20.75$ , find the missing frequencies

| CI | f | cf | |
|---|---|---|---|
| 0 – 10 | 3 | 3 | |
| 10 – 20 | a | 3 + a | |
| **20 – 30** | **20** | **23 + a** | Q1 class |
| 30 – 40 | 12 | 35 + a | |
| 40 – 50 | b | 35 + a + b | |
| | N = 50 | | |

$N = 50$

$35 + a + b = 50$

$a + b = 15 \ldots (1)$

$$q_1 = \frac{N}{4} = \frac{50}{4} = 12.5$$

$$Q_1 = L_1 + \frac{q_1 - c}{f}(L_2 - L_1)$$

$$20.75 = 20 + \frac{12.5 - (3 + a)}{20}(30 - 20)$$

$$0.75 = \frac{12.5 - 3 - a}{20} \cdot (10)$$

$$0.75 = \frac{9.5 - a}{2}$$

$$1.5 = 9.5 - a \qquad \therefore a = 8 \quad \text{subs in (1)} \quad b = 7$$

**10.** the following is the data of pocket expenditure per week of 50 students in a class . It is known that the median of the distribution is Rs 120 . Find the missing frequencies

| Expenditure | 0 – 50 | 50 – 100 | 100 – 150 | 150 – 200 | 200 – 250 |
|---|---|---|---|---|---|
| No.of students | 7 | ? | 15 | ? | 3 |

| CI | f | cf | |
|---|---|---|---|
| 0 – 50 | 7 | 7 | |
| 50 – 100 | a | 7 + a | |
| **100 – 150** | **15** | **22 + a** | Q2 class |
| 150 – 200 | b | 22 + a + b | |
| 200 – 250 | 3 | 25 + a + b | |
| | N = 50 | | |

$N = 50$

$25 + a + b = 50$

$a + b = 25 \ldots (1)$

$$q_1 = \frac{N}{2} = \frac{50}{2} = 25$$

$$Q_2 = L_1 + \frac{q_2 - c}{f}(L_2 - L_1)$$

$$120 = 100 + \frac{25 - (7 + a)}{15}(150 - 100)$$

$$20 = \frac{25 - 7 - a}{\cancel{15}\,3} \cdot (50)\cancel{10}$$

$$20 = \frac{18 - a}{3}(10)$$

$$6 = 18 - a \qquad \therefore a = 12 \quad \text{subs in (1)} \quad b = 13$$

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# PARTITION VALUES : - DECILES

## Q1.   RAW DATA

01.   Compute $D_4$ , $D_5$ and $D_9$ for the following data

70 , 75 , 80 , 73 , 75 , 76 , 71 , 73 , 72

ans : $D_4 = 73$  ;  $D_5 = 73$  ;  $D_9 = 80$

02.   Calculate the $5^{th}$ Decile for the following data

841 , 289 , 325 , 225 , 784 , 729 , 625 , 400 , 324 , 169

ans : $D_5 = 362.5$

## Q2.   UNGROUPED DATA

01.

| No. of defect. products | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|
| No. of firms | 12 | 35 | 20 | 15 | 8 | 7 | 8 |

Compute $D_4$        ans :  $D_4 = 35$

02.

| House Rent (in □) | 1100 | 1120 | 1130 | 1170 | 1200 | 1250 | 1280 | 1300 |
|---|---|---|---|---|---|---|---|---|
| No. of houses | 25 | 17 | 13 | 15 | 14 | 8 | 6 | 2 |

Compute $D_8$        ans :  $D_8 = 1200$

## Q3.   GROUPED DATA

01.   Calculate the fourth Decile

| Profit | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 |
|---|---|---|---|---|---|
| No. of firms | 7 | 18 | 25 | 30 | 20 |

(Profit in lacs)        ans :  $D_4 = 13$ lacs

02.   the ages of 100 persons are tabulated below . Above what age do we have the oldest 10% people

| Age (in yrs) | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 |
|---|---|---|---|---|---|---|---|
| No. of persons | 16 | 20 | 21 | 28 | 10 | 3 | 2 |

ans : 55yrs

03.   for the following data calculate the $7^{th}$ Decile

| Wt (in kg) | 30 – 34 | 35 – 39 | 40 – 44 | 45 – 49 | 50 – 54 | 55 – 59 | 60 – 64 |
|---|---|---|---|---|---|---|---|
| No. of persons | 3 | 5 | 12 | 18 | 14 | 6 | 2 |

ans : 50.93 kg

04.   following table shows the distribution of marks of students in Math

| Marks | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 | 25 – 30 |
|---|---|---|---|---|---|---|
| No. of Students | 3 | 7 | 12 | 18 | 14 | 06 |

Find the minimum marks of the highest 30% of students

ans :  $D_7 = 20.71$

05.   a study related to the journey of office files through various departments was conducted . The distribution of time ( in months ) taken by a file to come back to the initiating dept. is given below .

| Time | 1 – 2 | 2 – 3 | 3 – 4 | 4 – 5 | 5 – 6 | 6& above |
|---|---|---|---|---|---|---|
| No. of files | 30 | 45 | 40 | 50 | 6 | 4 |

Find the time by which at most 60% of the files come back
ans :  $D_6 = 3.75$

| 06. | Monthly Bal. less than | 1000 | 900 | 800 | 700 | 600 | 500 | 400 | 300 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|
| | No of A/c holder | 500 | 498 | 480 | 475 | 440 | 374 | 300 | 125 | 25 |

Find the 7th decile     ans : D7  =   467.5

| Mid value | 5 | 15 | 25 | 35 | 45 |
|---|---|---|---|---|---|
| Frequency | 2 | ? | 10 | 3 | 2 |

ans : 8

| 07. | Marks | no of students |
|---|---|---|
| | more that 0 | 50 |
| | more that 10 | 46 |
| | more that 20 | 40 |
| | more that 30 | 20 |
| | more that 40 | 10 |
| | more that 50 | 3 |

The following is the distribution of marks in statistics obtained by 50 students .

if 60% students passed the examination , find the min. marks required to pass exam.

ans  : 25 marks

08.    daily wages for a group of 100 workers are given below .

| Daily Wages | 0 – 50 | 50 – 100 | 100 – 150 | 150 – 200 | 200 – 250 |
|---|---|---|---|---|---|
| No.of persons | 7 | ? | 25 | 30 | ? |

The   third  decile  for  this  group  is  Rs  110 . Calculate  the  missing frequencies

ans :  18 . 20

09.    if  the  second  decile  of  the  distribution  given  below  is  13.75 ,  find  the

missing value

01.   Compute $D_4$, $D_5$ and $D_9$ for the following data

70 , 75 , 80 , 73 , 75 , 76 , 71 , 73 , 72

solution

| obs no. : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| value    : | 70 | 71 | 72 | 73 | 73 | 75 | 75 | 76 | 80 |

$d_4$ = 4 $\dfrac{N+1}{10}$ = $\dfrac{4.10}{10}$ = 4   $\therefore$ $D_4$ = value of the 4th observation

= 73

$d_5$ = 5 $\dfrac{N+1}{10}$ = $\dfrac{5.10}{10}$ = 5   $\therefore$ $D_5$ = value of the 5th observation

= 73

$d_9$ = 9 $\dfrac{N+1}{10}$ = $\dfrac{9.10}{10}$ = 9   $\therefore$ $D_9$ = value of the 9th observation

= 80

02.   Calculate the 5th Decile for the following data

841 , 289 , 325 , 225 , 784 , 729 , 625 , 400 , 324 , 169

Solution

| Obs no. : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Value    : | 169 | 225 | 289 | 324 | 325 | 400 | 625 | 729 | 784 | 841 |

$d_5$ = 5 $\dfrac{N+1}{10}$ = $\dfrac{5.11}{10}$ = 5.5

$D_5$ = value of the 5.5th observation

= 325 + 0.5 (400 − 325)

= 325 + 0.5(75)

= 325 + 37.5

= 362.5

## Q2. UNGROUPED DATA

**01.**

| No. of defect. products | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|
| No. of firms | 12 | 35 | 20 | 15 | 8 | 7 | 8 |

Compute $D_4$

**SOLUTION :**

| x | f | cf |
|---|---|---|
| 30 | 12 | 12 |
| 35 | 35 | 47 |
| 40 | 20 | 67 |
| 45 | 15 | 82 |
| 50 | 8 | 90 |
| 55 | 7 | 97 |
| 60 | 8 | 105 = N |

$$d_4 = 4 \frac{N+1}{10} = 4 \frac{106}{10} = 4(10.6) = 42.4$$

$D_4$ = value of 42.4th observation

= 35

**02.**

| House Rent (in ▯) | 1100 | 1120 | 1130 | 1170 | 1200 | 1250 | 1280 | 1300 |
|---|---|---|---|---|---|---|---|---|
| No. of houses | 25 | 17 | 13 | 15 | 14 | 8 | 6 | 2 |

Compute $D_8$

**SOLUTION :**

| x | f | cf |
|---|---|---|
| 1100 | 25 | 25 |
| 1120 | 17 | 42 |
| 1130 | 13 | 55 |
| 1170 | 15 | 70 |
| 1200 | 14 | 84 |
| 1250 | 8 | 92 |
| 1280 | 6 | 98 |
| 1300 | 2 | 100 = N |

$$d_8 = 8 \frac{N+1}{8} = 8 \frac{101}{10} = 8(10.1) = 80.8$$

$D_4$ = value of 80.8th observation

= 1200

## Q3.    GROUPED DATA

01.    Calculate the fourth Decile

| Profit | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 |
|--------|-------|--------|---------|---------|---------|
| No. of firms | 7 | 18 | 25 | 30 | 20 |

(Profit in lacs)

**SOLUTION :**

| CI | f | cf | |
|----|---|----|---|
| 0 – 5 | 7 | 7 | |
| 5 – 10 | 18 | 25 | |
| **10 – 15** | **25** | **50** | D4 class |
| 15 – 20 | 30 | 80 | |
| 15 – 20 | 20 | 100 | |

$$d_4 = 4 \frac{N}{10} = \frac{4(100)}{10} = 40$$

$$D_4 = L_1 + \frac{d_4 - c}{f}(L_2 - L_1)$$

$$= 10 + \frac{40 - 25}{25}(15 - 10)$$

$$= 10 + \frac{15 \,(\cancel{5})}{\cancel{25}_5}$$

$$= 10 + 3$$

$$= 13 \text{ (Profit in lacs)}$$

02.    the ages of 100 persons are tabulated below . Above what age do we have the oldest 10% people

| Age (in yrs) | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 |
|--------------|---------|---------|---------|---------|---------|---------|---------|
| No. of persons | 16 | 20 | 21 | 28 | 10 | 3 | 2 |

**SOLUTION :**

| CI | f | cf | |
|----|---|----|---|
| 10 – 20 | 16 | 16 | |
| 20 – 30 | 20 | 36 | |
| 30 – 40 | 21 | 57 | |
| 40 – 50 | 28 | 85 | |
| **50 – 60** | **10** | **95** | D9 class |
| 60 – 70 | 3 | 98 | |
| 70 – 80 | 2 | 100 | |

$$d_9 = 9 \frac{N}{10} = \frac{9(100)}{10} = 90$$

$$D_9 = L_1 + \frac{d_9 - c}{f}(L_2 - L_1)$$

$$= 50 + \frac{90 - 85}{10}(50 - 40)$$

$$= 50 + \frac{5}{10}(10)$$

$$= 50 + 5$$

$$= 55 \text{ years}$$

03. following table shows the distribution of marks of students in Math

| Marks | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 | 25 – 30 |
|---|---|---|---|---|---|---|
| No. of Students | 3 | 7 | 12 | 18 | 14 | 06 |

Find the minimum marks of the highest 30% of students

**SOLUTION :**

| CI | f | cf | |
|---|---|---|---|
| 0 – 5 | 3 | 3 | |
| 5 – 10 | 7 | 10 | |
| 10 – 15 | 12 | 22 | |
| 15 – 20 | 18 | 40 | |
| **20 – 25** | **14** | **54** | D7 class |
| 25 – 30 | 6 | 60 | |

$$d_7 = 7 \frac{N}{10} = \frac{7(60)}{10} = 42$$

$$D_7 = L_1 + \frac{d_7 - c}{f} (L_2 - L_1)$$

$$= 20 + \frac{42 - 40}{14} (25 - 20)$$

$$= 20 + \frac{2}{14} (5)$$

$$= 20 + \frac{5}{7}$$

$$= 20.71 \text{ marks}$$

04. for the following data calculate the 7th Decile

| Wt (in kg) | 30 – 34 | 35 – 39 | 40 – 44 | 45 – 49 | 50 – 54 | 55 – 59 | 60 – 64 |
|---|---|---|---|---|---|---|---|
| No. of persons | 3 | 5 | 12 | 18 | 14 | 6 | 2 |

**SOLUTION :**

| CI | f | cf | |
|---|---|---|---|
| 29.5 – 34.5 | 3 | 3 | |
| 34.5 – 39.5 | 5 | 8 | |
| 39.5 – 44.5 | 12 | 20 | |
| 44.5 – 49.5 | 18 | 38 | |
| **49.5 – 54.5** | **14** | **52** | D7 class |
| 54.5 – 59.5 | 6 | 58 | |
| 59.5 – 64.5 | 2 | 60 | |

$$d_7 = 7 \frac{N}{10} = \frac{7(60)}{10} = 42$$

$$D_7 = L_1 + \frac{d_7 - c}{f} (L_2 - L_1)$$

$$= 49.5 + \frac{42 - 38}{14} (54.5 - 49.5)$$

$$= 49.5 + \frac{4}{14} (5)$$

$$= 49.5 + \frac{10}{7}$$

$$= 49.5 + 1.43$$

$$= 50.93 \text{ kg}$$

05.  a study related to the journey of office files through various departments was conducted . The distribution of time ( in months ) taken by a file to come back to the initiating dept. is given below .

| Time | 1 – 2 | 2 – 3 | 3 – 4 | 4 – 5 | 5 – 6 | 6& above |
|------|-------|-------|-------|-------|-------|----------|
| No. of files | 30 | 45 | 40 | 50 | 6 | 4 |

Find the time by which at most 60% of the files come back

**SOLUTION :**

| CI | f | cf | |
|------|------|------|------|
| 1 – 2 | 30 | 30 | |
| 2 – 3 | 45 | 75 | |
| **3 – 4** | **40** | **115** | $D_6$ class |
| 4 – 5 | 50 | 165 | |
| 5 – 6 | 6 | 171 | |
| 6 & above | 4 | 175 | |

$d_6 = 6 \dfrac{N}{10} = \dfrac{6(175)}{10} = 105$

$D_6 = L_1 + \dfrac{d_6 - c}{f}(L_2 - L_1)$

$= 3 + \dfrac{105 - 75}{40}(4 - 3)$

$= 3 + \dfrac{30}{40}$

$= 3 + 0.75$

$= 3.75$ (months)

06.

| Monthly Bal. less than | 1000 | 900 | 800 | 700 | 600 | 500 | 400 | 300 | 200 |
|------|------|------|------|------|------|------|------|------|------|
| No of A/c holder | 500 | 498 | 480 | 475 | 440 | 374 | 300 | 125 | 25 |

Find the 7th decile   ans : $D_7 = 467.5$

**SOLUTION :**

| CI | f | cf | |
|------|------|------|------|
| 100 – 200 | 25 | 25 | |
| 200 – 300 | 100 | 125 | |
| 300 – 400 | 175 | 300 | |
| 400 – 500 | 74 | 374 | $D_7$ class |
| 500 – 600 | 66 | 440 | |
| 600 – 700 | 35 | 745 | |
| 700 – 800 | 5 | 480 | |
| 800 – 900 | 18 | 498 | |
| 900 – 1000 | 2 | 500 | |

$d_7 = 7 \dfrac{N}{10} = \dfrac{7(500)}{10} = 350$

$D_7 = L_1 + \dfrac{d_7 - c}{f}(L_2 - L_1)$

$= 400 + \dfrac{350 - 300}{74}(500 - 400)$

$= 400 + \dfrac{50}{74}(100)$

$= 400 + 0.675(100)$

$= 467.5$ (Rs)

07. The following is the distribution of marks in statistics obtained by 50 students. If 60% students passed the examination , find the min. marks required to pass exam.

| Marks | no of students |
|---|---|
| more that 0 | 50 |
| more that 10 | 46 |
| more that 20 | 40 |
| more that 30 | 20 |
| more that 40 | 10 |
| more that 50 | 3 |

| CI | f | cf |
|---|---|---|
| 0 – 10 | 4 | 4 |
| 10 – 20 | 6 | 10 |
| 20 – 30 | 20 | 30 |
| 30 – 40 | 10 | 40 |
| 40 – 50 | 7 | 47 |
| 50 – 60 | 3 | 50 |

$$d_7 = 4 \frac{N}{10} = \frac{4(50)}{10} = 20$$

$$D_4 = L_1 + \frac{d_4 - c}{f}(L_2 - L_1)$$

$$= 20 + \frac{20 - 10}{20}(30 - 20)$$

$$= 20 + \frac{10}{20}(10)$$

$$= 20 + 5 \qquad = 25 \text{ marks}$$

08. daily wages for a group of 100 workers are given below .

| Daily Wages | 0 – 50 | 50 – 100 | 100 – 150 | 150 – 200 | 200 – 250 |
|---|---|---|---|---|---|
| No.of persons | 7 | ? | 25 | 30 | ? |

The third decile for this group is Rs 110 . Calculate the missing frequencies

| CI | f | cf |
|---|---|---|
| 0 – 50 | 7 | 7 |
| 50 – 100 | a | 7 + a |
| **100 – 150** | **25** | **32 + a** |
| 150 – 200 | 30 | 62 + a + b |
| 200 – 250 | b | 62 + a + b |
| | N = 100 | |

D$_3$ class

N = 50

$$62 + a + b = 100$$
$$a + b = 38 \ \dots \ (1)$$

$$d_3 = \frac{3N}{10} = \frac{300}{10} = 30$$

$$D_3 = L_1 + \frac{d_3 - c}{f}(L_2 - L_1)$$

$$110 = 100 + \frac{30 - (7 + a)}{25}(150 - 100)$$

$$10 = \frac{30 - 7 - a}{\cancel{25}}\cdot(\cancel{50})\,2$$

$$5 = 23 - a$$

$$a = 18$$

subs in (1)  b = 20

09. if the second decile of the distribution given below is 13.75 , find the missing value

| Mid value | 5 | 15 | 25 | 35 | 45 |
|-----------|---|----|----|----|----|
| Frequency | 2 | ? | 10 | 3 | 2 |

| CI | f | cf | |
|----|---|-----|---|
| 0 – 10 | 2 | 2 | |
| 10 – 20 | a | 2 + a | $D_2$ class |
| 20 – 30 | 10 | 12 + a | |
| 30 – 40 | 3 | 15 + a | |
| 40 – 50 | 2 | 17 + a = N | |

$$d_2 = \frac{2N}{10} = \frac{2(17 + a)}{10} = \frac{34 + 2a}{10}$$

$$D_2 = L_1 + \frac{d_2 - c}{f}(L_2 - L_1)$$

$$13.75 = 10 + \frac{\frac{34 + 2a}{10} - 2}{a} \cdot (20 - 10)$$

$$3.75 = \frac{\frac{34 + 2a - 20}{10}}{a} \cdot (10)$$

$$3.75 = \frac{14 + 2a}{a}$$

$$3.75a = 14 + 2a$$

$$1.75a = 14$$

$$a = \frac{14}{1.75}$$

$$a = \frac{14 \times 100}{175} = 8$$

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# PARTITION VALUES : - PERCENTILES

## Q1. GROUPED DATA

## Q - SET

01. Calculate the 21$^{st}$ percentile

| Class | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 |
|-------|-------|--------|---------|---------|---------|
| Frequency | 7 | 18 | 25 | 30 | 20 |

ans : P$_{21}$ = 8.89

02. Calculate P$_{43}$

| Mid val. | 2.5 | 7.5 | 12.5 | 17.5 | 22.5 |
|----------|-----|-----|------|------|------|
| Freq. firms | 7 | 18 | 25 | 30 | 20 |

ans : P$_{43}$ = 13.6

04. Calculate the 82$^{nd}$ percentile

| wages (in □) | 10 – 19 | 20 – 29 | 30 – 39 | 40 – 49 | 50 – 59 | 60 – 69 | 70– 79 |
|--------------|---------|---------|---------|---------|---------|---------|--------|
| No. of Workers | 4 | 6 | 10 | 20 | 10 | 6 | 4 |

ans : P$_{82}$= 58.7

05. The following data gave the weight of fish caught on a fishing boat

| Wt (in gms) | 0 – 9 | 9 – 19 | 20 – 29 | 30 – 39 | 40 – 49 |
|-------------|-------|--------|---------|---------|---------|
| No.of fish | 22 | 38 | 40 | 35 | 25 |

Find twenty third percentile

ans : P$_{23}$ = 13.39 (in gms)

06. Calculate 77$^{th}$ percentile for the following data regarding the age of people in a city

| Age Less than | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---------------|----|----|----|----|----|----|----|----|
| No. of persons | 15 | 30 | 53 | 75 | 100 | 110 | 115 | 125 |

ans : : P$_{77}$ = 48.50

## Q1. GROUPED DATA

01. Calculate the 21$^{st}$ percentile

| Class | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 |
|---|---|---|---|---|---|
| Frequency | 7 | 18 | 25 | 30 | 20 |

**SOLUTION :**

| CI | f | cf | |
|---|---|---|---|
| 0 – 5 | 7 | 7 | |
| **5 – 10** | **18** | **25** | $P_{21}$ class |
| 10 – 15 | 25 | 50 | |
| 15 – 20 | 30 | 80 | |
| 15 – 20 | 20 | 100 | |

$$p_{21} = 21 \frac{N}{100} = \frac{21(100)}{100} = 21$$

$$P_{21} = L_1 + \frac{p_{21} - c}{f}(L_2 - L_1)$$

$$= 5 + \frac{21 - 7}{18}(10 - 5)$$

$$= 5 + \frac{14}{18}(5)$$

$$= 5 + \frac{35}{9}$$

$$= 5 + 3.89$$

$$= 8.89$$

02. Calculate $P_{43}$

| Mid val. | 2.5 | 7.5 | 12.5 | 17.5 | 22.5 |
|---|---|---|---|---|---|
| Freq. firms | 7 | 18 | 25 | 30 | 20 |

**SOLUTION :**

| CI | f | cf | |
|---|---|---|---|
| 0 – 5 | 7 | 7 | |
| 5 – 10 | 18 | 25 | |
| **10 – 15** | **25** | **50** | $P_{43}$ class |
| 15 – 20 | 30 | 80 | |
| 15 – 20 | 20 | 100 | |

$$p_{43} = 43 \frac{N}{100} = \frac{43(100)}{100} = 43$$

$$P_{43} = L_1 + \frac{p_{43} - c}{f}(L_2 - L_1)$$

$$= 10 + \frac{43 - 25}{25}(15 - 10)$$

$$= 10 + \frac{18}{25}(5)$$

$$= 10 + \frac{18}{5}$$

$$= 10 + 3.6$$

$$= 13.6$$

03. Calculate the 82nd percentile

| wages (in $\square$) | 10 – 19 | 20 – 29 | 30 – 39 | 40 – 49 | 50 – 59 | 60 – 69 | 70– 79 |
|---|---|---|---|---|---|---|---|
| No. of Workers | 4 | 6 | 10 | 20 | 10 | 6 | 4 |

**SOLUTION :**

| CI | f | cf | |
|---|---|---|---|
| 9.5 – 19.5 | 4 | 4 | |
| 19.5 – 29.5 | 6 | 10 | |
| 29.5 – 39.5 | 10 | 20 | |
| 39.5 – 49.5 | 20 | 40 | |
| 49.5 – 59.5 | 10 | 50 | D9 class |
| 59.5 – 69.5 | 6 | 56 | |
| 69.5 – 79.5 | 4 | 60 | |

$$P_{82} = 82 \frac{N}{100} = \frac{82(60)}{100} = \frac{492}{10} = 49.2$$

$$P_{82} = L_1 + \frac{P_{82} - C}{f} (L_2 - L_1)$$

$$= 49.5 + \frac{49.2 - 40}{10} (59.5 - 49.5)$$

$$= 49.5 + \frac{9.2}{10} (10)$$

$$= 49.5 + 9.2$$

$$= 58.7$$

04. The following data gave the weight of fish caught on a fishing boat

| Wt (in gms) | 0 – 9 | 10 – 19 | 20 – 29 | 30 – 39 | 40 – 49 |
|---|---|---|---|---|---|
| No.of fish | 22 | 38 | 40 | 35 | 25 |

Find twenty third percentile

**SOLUTION :**

| CI | f | cf | |
|---|---|---|---|
| 0 – 9.5 | 22 | 22 | |
| 9.5 – 19.5 | 38 | 60 | |
| **19.5 – 29.5** | **40** | **100** | P43 class |
| 29.5 – 39.5 | 35 | 135 | |
| 39.5 – 49.5 | 25 | 160 | |

$$P_{23} = 23 \frac{N}{100} = \frac{23(160)}{100} = 36.8$$

$$P_{23} = L_1 + \frac{P_{23} - C}{f} (L_2 - L_1)$$

$$= 9.5 + \frac{36.8 - 22}{38} (19.5 - 9.5)$$

$$= 9.5 + \frac{14.8}{38} (10)$$

$$= 9.5 + \frac{148}{38}$$

$$= 9.5 + \frac{74}{19}$$

$$= 9.5 + 3.89 = 13.39 \text{ (in gms )}$$

05. Calculate 77$^{th}$ percentile for the following data regarding the age of people in a city

| Age Less than | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|
| No. of persons | 15 | 30 | 53 | 75 | 100 | 110 | 115 | 125 |

**SOLUTION :**

| CI | f | cf |
|---|---|---|
| 0 - 10 | 15 | 15 |
| 10 – 20 | 15 | 30 |
| 20 – 30 | 23 | 53 |
| 30 – 40 | 22 | 75 |
| **40 – 50** | **25** | **100** P77 class |
| 50 – 60 | 10 | 110 |
| 60 – 70 | 5 | 115 |
| 70 – 80 | 10 | 125 |

$P_{77} = 77 \dfrac{N}{100} = \dfrac{77(125)}{100} = \dfrac{77 \times 5}{4} = 96.25$

$P_{77} = L_1 + \dfrac{P_{77} - C}{f} (L_2 - L_1)$

$= 40 + \dfrac{96.25 - 75}{25} (50 - 40)$

$= 40 + \dfrac{21.25}{25} (10)$

$= 40 + \dfrac{21.25}{5} (2)$

$= 40 + \dfrac{42.5}{5}$

$= 40 + 8.5 \qquad = 48.5 \text{ (in years)}$

**SPECIAL QUESTIONS**

01. From the following data , find the percentage of workers who are weighing more than 68 kgs

| Weight (in kg) : | 50 – 55 | 55 – 60 | 60 – 65 | 65 – 70 | 70 – 75 |
|---|---|---|---|---|---|
| No. of worker : | 15 | 18 | 30 | 25 | 12 |

**SOLUTION :**

| CI | f | cf |
|---|---|---|
| 50 – 55 | 15 | 15 |
| 55 – 60 | 18 | 33 |
| 60 – 65 | 30 | 63 |
| **65 – 70** | **25** | **88** ← |
| 70 – 75 | 12 | 100 |

let nth worker weigh 68 kg. This worker is in class 65 – 70

$$68 = 65 + \frac{n - 63}{25}(70 - 65)$$

$$3 = \frac{n - 63}{25} \cdot (5)$$

$$3 = \frac{n - 63}{5}$$

$$15 = n - 63 \qquad \therefore n = 78$$

78$^{th}$ worker weighs 68 kgs

∴ No. of workers weighing more than 68kgs = 100 – 78 = 22

∴ Percentage of workers weighing more than 68kgs = $\frac{22}{100}$ x 100 = 22%

02. following is the distribution of age of 500 workers , find the **percentage** of workers whose age is more than 45 years

| Age | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 |
|---|---|---|---|---|
| No of workers | 80 | 160 | 180 | 80 |

**SOLUTION :**

| CI | f | cf |
|---|---|---|
| 20 – 30 | 80 | 80 |
| 30 – 40 | 160 | 240 |
| 40 – 50 | 180 | 420 ← |
| 50 – 60 | 80 | 500 |

let age of nth worker be 45 . This worker is in class 40 – 50

$$45 = 40 + \frac{n - 240}{180}(50 - 40)$$

$$5 = \frac{n - 240}{180} \cdot (10)$$

$$5 = \frac{n - 240}{18}$$

$$90 = n - 240 \qquad \therefore n = 330$$

∴ age of 330$^{th}$ worker is 45

∴ No. of workers whose age is more than 45 years = 500 – 330 = 170

∴ Percentage of workers with age more than 45 years = $\frac{170}{500}$ x 100 = 34%

03. From the following data , how many values of the given data are more than 28

| CI | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| No. of worker : | 7 | 11 | 20 | 8 | 4 |

**SOLUTION :**

let nth observation have the value '28'

| CI | f | cf |
|---|---|---|
| 0 – 10 | 7 | 7 |
| 10 – 20 | 11 | 18 |
| 20 – 30 | 20 | 38 ← |
| 30 – 40 | 8 | 46 |
| 40 – 50 | 4 | 50 |

Its in the class 20 – 30

$$28 = 20 + \frac{n - 18}{20} (30 - 20)$$

$$8 = \frac{n - 18}{20} . (10)$$

$$8 = \frac{n - 18}{2}$$

$$16 = n - 18 \qquad \therefore n = 34$$

34$^{th}$ observation has the value 28

∴ no. of observations having value more than 28 = 50 – 34 = 16

*Compiled & Conducted@ JKSC*