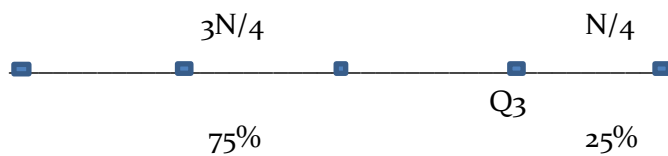
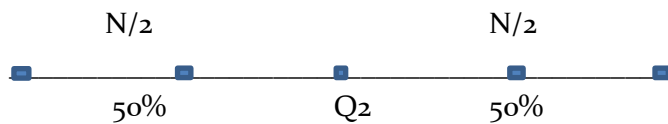
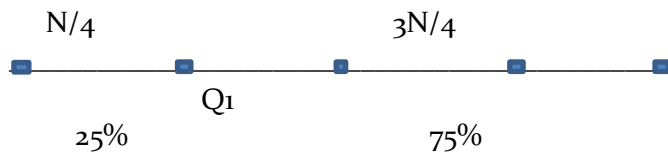
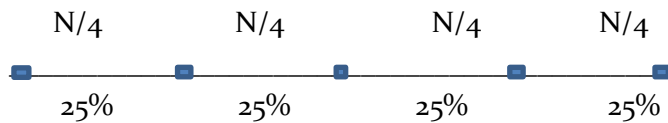


Quartiles :

Three points which divide the distribution into four equal parts are known as Quartiles.

Q_1 – first Quartile , Q_2 – second Quartile , Q_3 – third Quartile



Quartiles for ungrouped data:

Steps:

- Arrange the observations in ascending or descending order.

If n is odd

- $Q_1 =$ value of $\frac{n+1}{4}$ th observation

- $Q_2 = \text{value of } \frac{2(n+1)}{4} = \frac{n+1}{2} \text{ th observation}$
- $Q_3 = \text{value of } \frac{3(n+1)}{4} \text{ th observation}$

If n is even

- $Q_1 = \text{value of } \frac{n}{4} \text{ th observation}$
- $Q_2 = \text{value of } \frac{2n}{4} = \frac{n}{2} \text{ th observation}$
- $Q_3 = \text{value of } \frac{3n}{4} \text{ th observation}$

$Q_2 = \text{Median}$

Q1. Calculate quartiles for following data

Marks	No. of. Students	l.c.f.
20	4	4
30	16	20
40	20	40
50	18	58
60	11	69

$N = 69$, Odd

$$Q_1 = \text{Value of } \frac{N+1}{4} \text{th observation, } N \text{ is odd}$$

$$= \text{Value of } \frac{69+1}{4} \text{th} = \frac{70}{4} \text{th observation} = 17.5^{\text{th}} = 18^{\text{th}} \text{ observation} = 30$$

$$Q_2 = \text{Value of } \frac{N+1}{2} \text{th observation, } N \text{ is odd}$$

$$= \text{Value of } \frac{69+1}{2} \text{th} = \frac{70}{2} \text{th observation} = 35^{\text{th}} \text{ observation} = 40$$

$$Q_3 = \text{Value of } \frac{3(N+1)}{4} \text{th observation, } N \text{ is odd}$$

$$= \text{Value of } \frac{3(69+1)}{4} \text{th} = \frac{3(70)}{4} \text{th observation} = 52.5^{\text{th}} = 53^{\text{rd}} \text{ observation} = 50$$

Q2. Calculate quartiles for following data

Daily Profit	No.of. Shops	l.c.f.
75	13	13
76	20	33
77	30	63
78	35	98
79	29	127
80	22	149
81	11	160

$N = 160$, Even

$Q_1 =$ Value of $\frac{N}{4}$ th observation, N is even

$=$ Value of $\frac{160}{4}$ th $= 40^{\text{th}}$ observation $= 77$

$Q_2 =$ Value of $\frac{N}{2}$ th observation, N is even

$=$ Value of $\frac{160}{2}$ th $= 80^{\text{th}}$ observation $= 78$

$Q_3 =$ Value of $\frac{3N}{4}$ th observation, N is even

$=$ Value of $\frac{3(160)}{4}$ th $= 120^{\text{th}}$ observation $= 79$

Quartiles for grouped data:

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$Q_2 = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

Which is same as Median

$$Q_3 = l_1 + \frac{\left(\frac{3N}{4} - cf\right) * (l_2 - l_1)}{f}$$

Q3. Calculate quartiles for following data

Wages	No. of. workers	l.c.f.
200-250	11	11
250-300	13	24
300-350	27	51
350-400	25	76
400-450	18	94
450-500	6	100

$N = 100$, Even

Q1 Class is the class containing $\frac{N}{4}$ th = $\frac{100}{4}$ th = 25th observation ie 300-350

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 300 + \frac{\left(\frac{100}{4} - 24\right) * (350 - 300)}{27}$$

$$Q_1 = 300 + \frac{(25 - 24) * (350 - 300)}{27}$$

$$Q_1 = 300 + \frac{(1) * (50)}{27} = 300 + 1.85 = 301.85$$

Q2 Class is the class containing $\frac{N}{2}$ th = $\frac{100}{2}$ th = 50th observation ie 300-350

$$Q_2 = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

$$= 300 + \frac{\left(\frac{100}{2} - 24\right) * (350 - 300)}{27}$$

$$Q_2 = 300 + \frac{(50 - 24) * (350 - 300)}{27}$$

$$Q_2 = 300 + \frac{(26) * (50)}{27} = 300 + 48.148 = 348.148$$

Q3. Class is the class containing $\frac{3N}{4}$ th = $\frac{3(100)}{4}$ th = 75th observation ie 350-400

$$Q_3 = l_1 + \frac{\left(\frac{3N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 350 + \frac{\left(\frac{3(100)}{4} - 51\right) * (400 - 350)}{25}$$

$$Q_3 = 350 + \frac{(75 - 51) * (400 - 350)}{25}$$

$$Q_3 = 350 + \frac{(24) * (50)}{25} = 300 + 48 = 398$$

Q4. Calculate quartiles for following data

Income (thousands)	No. of. families	l.c.f.
Below 75	19	19
75 - 150	27	46
150 - 225	26	72
225 - 300	35	107
300-375	18	125
375-450	15	140
450 & above	10	150

N = 150, Even

Q1 Class is the class containing $\frac{N}{4}$ th = $\frac{150}{4} = 37.5 = 38^{\text{th}}$ observation ie 75-150

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 75 + \frac{\left(\frac{150}{4} - 19\right) * (150 - 75)}{27}$$

$$Q_1 = 75 + \frac{(37.5 - 19) * (75)}{27}$$

$$Q_1 = 75 + \frac{(18.5) * (75)}{27} = 75 + 51.38 = 126.38$$

Q2 Class is the class containing $\frac{N}{2}$ th = $\frac{150}{2}$ th = 75th observation ie 225-300

$$Q_2 = l_1 + \frac{\left(\frac{N}{2}-cf\right)*(l_2-l_1)}{f}$$

$$= 225 + \frac{\left(\frac{150}{2}-72\right)*(300-225)}{35}$$

$$Q_2 = 225 + \frac{(75-72)*(75)}{35}$$

$$Q_2 = 225 + \frac{(3)*(75)}{35} = 225 + 6.42 = 231.42$$

Q₃. Class is the class containing $\frac{3N}{4}$ th = $\frac{3(150)}{4}$ th = 112.5 = 113th observation ie 300-375

$$Q_3 = l_1 + \frac{\left(\frac{3N}{4}-cf\right)*(l_2-l_1)}{f}$$

$$= 300 + \frac{\left(\frac{3(150)}{4}-107\right)*(375-300)}{18}$$

$$Q_3 = 300 + \frac{(112.5-107)*(375-300)}{18}$$

$$Q_3 = 300 + \frac{(5.5)*(75)}{18} = 300 + 22.91 = 322.91$$

Q5. The following table gives frequency distribution of age of teachers.

- i. Calculate Median age
- ii. Find the limits within which middle 50% teachers have their ages.
- iii. Find the number of teachers in the age group 38 - 58

Age	No. of teachers	l.c.f.
20 -25	21	21
25 - 30	19	40

30 - 35	50	90
35 - 40	40	130
40 - 45	16	146
45 - 50	20	166
50 - 55	10	176
55 - 60	10	186
60 - 65	4	190
65 - 70	10	200

Median Class is the class containing $\frac{N}{2}$ th = $\frac{200}{2}$ th = 100th observation ie 35-40

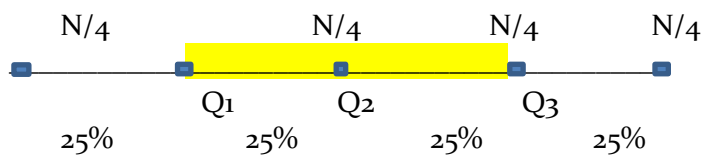
$$Q_2 = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

$$= 35 + \frac{\left(\frac{200}{2} - 90\right) * (40 - 35)}{40}$$

$$Q_2 = 35 + \frac{(100 - 90) * (5)}{40}$$

$$Q_2 = 35 + \frac{(10) * (5)}{40} = 35 + 1.25 = 36.25$$

Middle 50% means Q_1 to Q_3



Q_1 Class is the class containing $\frac{N}{4}$ th = $\frac{200}{4}$ = 50th observation ie 30-35

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 30 + \frac{\left(\frac{200}{4} - 40\right) * (35 - 30)}{50}$$

$$Q_1 = 30 + \frac{(50-40)*(5)}{50}$$

$$Q_1 = 30 + \frac{(10)*(5)}{50} = 30 + 1 = 31$$

Q3. Class is the class containing $\frac{3N}{4}$ th = $\frac{3(200)}{4}$ th = 150th observation ie 45-50

$$Q_3 = l_1 + \frac{\left(\frac{3N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 45 + \frac{\left(\frac{3(200)}{4} - 146\right) * (50 - 45)}{20}$$

$$Q_3 = 45 + \frac{(150 - 146) * (5)}{20}$$

$$Q_3 = 45 + \frac{(4) * (5)}{20} = 45 + 1 = 46$$

The limits within which middle 50% observations lie is 31 to 46 years

To find the number of teachers in the age group 38 - 58

$$= \text{freq}(38-40) + \text{freq}(40-45) + \text{freq}(45-50) + \text{freq}(50-55) + \text{freq}(55-58)$$

$$= \frac{40}{5} \times 2 + 16 + 20 + 10 + \frac{10}{5} \times 3$$

$$= 16 + 16 + 20 + 10 + 6$$

$$= 68$$

Q6. Calculate first and third quartile for the following.

Ht in cms	No. of Children	Intervals	Frequency
Below 100	17	Below 100	17
Below 110	35	100 - 110	35 - 17 = 18
Below 120	55	110 - 120	55 - 35 = 20
Below 130	85	120 - 130	85 - 55 = 30
Below 140	105	130 - 140	105 - 85 = 20
Below 150	120	140 - 150	120 - 105 = 15

Q₁ Class is the class containing $\frac{N}{4}$ th = $\frac{120}{4}$ = 30th observation ie 100-110

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 100 + \frac{\left(\frac{120}{4} - 17\right) * (110 - 100)}{18}$$

$$Q_1 = 100 + \frac{(30 - 17) * (10)}{18}$$

$$Q_1 = 100 + \frac{(13) * (10)}{18} = 100 + 7.22 = 107.22$$

Q₃. Class is the class containing $\frac{3N}{4}$ th = $\frac{3(120)}{4}$ th = 90th observation ie 130-140

$$Q_3 = l_1 + \frac{\left(\frac{3N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 130 + \frac{\left(\frac{3(120)}{4} - 85\right) * (140 - 130)}{20}$$

$$Q_3 = 130 + \frac{(90 - 85) * (10)}{20}$$

$$Q_3 = 130 + \frac{(5) * (10)}{20} = 130 + 2.5 = 132.5$$

Q7. Calculate first and third quartile for the following.

Daily wages More than	No. of workers	Intervals	Frequency	LCF
10	200	10 -15	200 - 188 =12	12
15	188	15 - 20	188 - 160 = 28	40
20	160	20 -25	160 - 124 = 36	76
25	124	25 - 30	124 - 74 = 50	126
30	74	30 - 35	74 - 49 = 25	151
35	49	35 - 40	49 - 31 = 18	169
40	31	40 - 45	31 - 15 = 16	185

45	15	45 - 50	15 - 5 = 10	195
50	5	50 & above	5	200

Q₁ Class is the class containing $\frac{N}{4}$ th = $\frac{200}{4}$ = 50th observation ie 20- 25

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right) * (l_2 - l_1)}{f}$$

$$= 20 + \frac{\left(\frac{200}{4} - 40\right) * (25 - 20)}{36}$$

$$Q_1 = 20 + \frac{(50 - 40) * (25 - 20)}{36}$$

$$Q_1 = 20 + \frac{(10) * (5)}{36} = 20 + 1.38 = 21.38$$

Q₃. Class is the class containing $\frac{3N}{4}$ th = $\frac{3(200)}{4}$ th = 150th observation ie 30-35

$$Q_3 = l_1 + \frac{\left(\frac{3N}{4} - cf\right) * (l_2 - l_1)}{f}$$

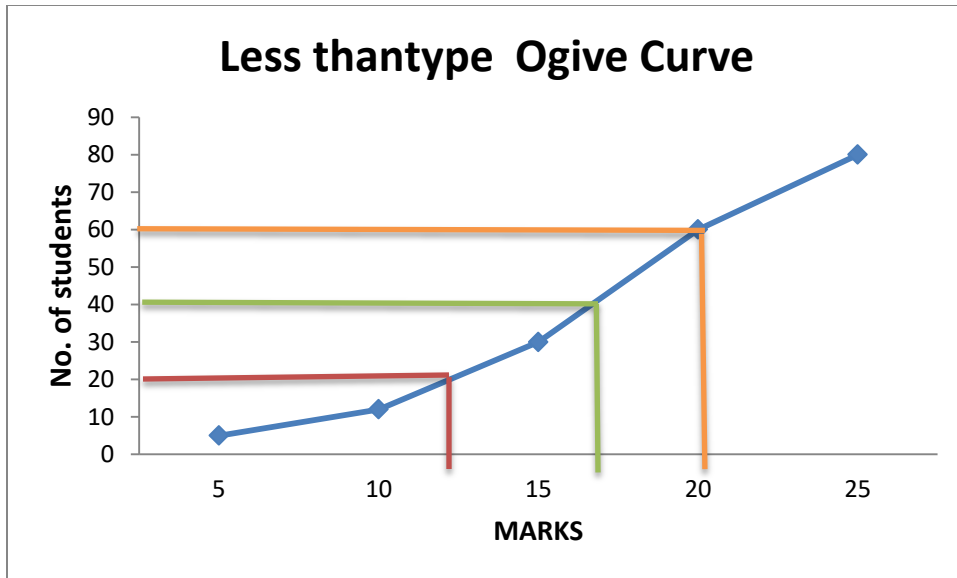
$$= 30 + \frac{\left(\frac{3(200)}{4} - 126\right) * (35 - 30)}{25}$$

$$Q_3 = 30 + \frac{(150 - 126) * (5)}{25}$$

$$Q_3 = 30 + \frac{(24) * (5)}{25} = 30 + 4.8 = 34.8$$

Locating Quartiles graphically

Marks	No. of students	lcf
0 - 5	5	5
5 - 10	7	12
10 - 15	18	30
15 - 20	30	60
20 - 25	20	80



$Q_1 = \text{Value of } \frac{N}{4} \text{ th observation} = 12.5$

$Q_2 = \text{Value of } \frac{N}{2} \text{ th observation} = 17$

$Q_3 = \text{Value of } \frac{3N}{4} \text{ th observation} = 20$