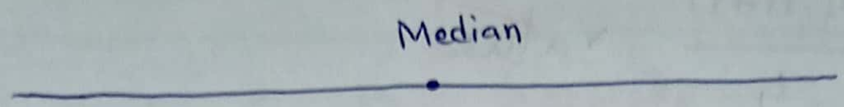
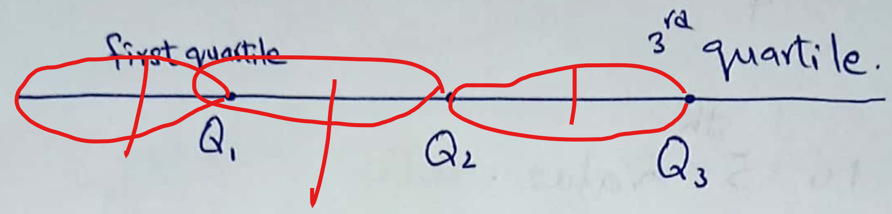
Quartiles





$\boxed{\text{3 points = 4 equal parts.}}$

$\Rightarrow$ Rules same as Median.

~~Step~~ **Question:** 43, 12, 8, 15, 6, 13, 27, 5, 31, 9, 17, 21, 38

find all quartiles.

Sol:- **Step I:** Ascending order.

5, 6, 8, 9, 12, 13, 15, 17, 21, 27, 31, 38, 43
$\hookrightarrow n = 13.$

Step II: $Q_1 = \boxed{\left(\frac{n+1}{4}\right)^{th} \text{ value}}$

$= \left(\frac{13+1}{4}\right)^{th} \text{ value} = 3.5^{th} \text{ value}$

Step III: $Q_1 = 8 + 0.5(9-8)$

$= 8 + 0.5 = 8.5$

$$Q_3 = \boxed{\frac{3(n+1)}{4}^{th} \text{ value}}$$

$$= \frac{3\times(13+1)}{4}^{th} \text{ value}$$

$$= 10.5^{th} \text{ value.}$$

$$\therefore Q_3 = 27 + 0.5(31-27)$$

$$= 27 + 0.5 \times 4$$

$$= 27 + 2$$

$$= 29.$$

13, 29, 6, 11, 17, 2, 22, 17, 28, 9

$Q_1 =$ $D_4 =$ $P_{43} =$

$Q_3 =$ $D_9 =$ $P_{72} =$

Deciles.

9 points $\longrightarrow$ 10 equal parts.

D_1 D_2 D_3 D_4 D_5 D_6 D_7 D_8 D_9.

$$D_1 = \boxed{\left(\frac{n+1}{10}\right)^{th} \text{ value}}$$

$$= \left(\frac{13+1}{10}\right)^{th} \text{ value} = 1.4^{th} \text{ value}.$$

$$\therefore D_1 = 5 + 0.4(6-5)$$

$$= 5 + 0.4 \times 1$$

$$= 5.4$$

$$D_7 = \boxed{7\left(\frac{n+1}{10}\right)^{th} \text{ value}}$$

$$= \left(\frac{7 \times 14}{10}\right)^{th} \text{ value} = 9.8^{th} \text{ value}.$$

$$\therefore D_7 = 21 + 0.8(27-21)$$

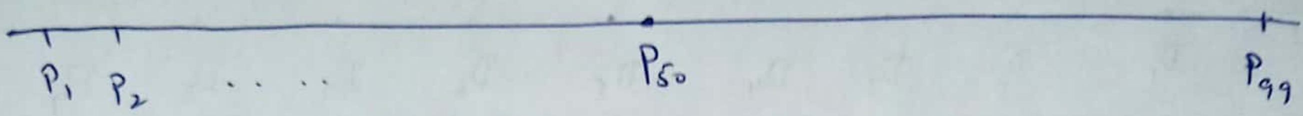
$$= 21 + 0.8 \times 6$$

$$= 21 + 4.8$$

$$= 25.8.$$

Percentiles

$\boxed{99 \text{ points} = 100 \text{ equal parts}}$



$$P_{57} = \boxed{\frac{57(n+1)}{100}^{th} \text{ value}}$$

$$= \left(\frac{57 \times 14}{100}\right)^{th} \text{ value}$$

$$= 7.98^{th} \text{ value.}$$

$$\therefore P_{57} = 15 + 0.98\,(17 - 15)$$

$$= 15 + 0.98 \times 2$$

$$= 16.96.$$

Step I: Ascending order

2, 6, 9, 11, 13, 17, 17, 22, 28, 29

$n = 10.$

Step II: $Q_1 = \left(\frac{n+1}{4}\right)^{th}$ value

$= \left(\frac{11}{4}\right)^{th}$ value

$= 2.75^{th}$ value

Step III:

$\therefore Q_1 = 6 + 0.75(9-6)$

$= 6 + 0.75(3)$

$= 6 + 2.25 = 8.25$

Now

~~Step III~~:

$Q_3 = \left[\frac{3(n+1)}{4}\right]^{th}$ value.

$= \left(3 \times \frac{11}{4}\right)^{th}$ value $= 8.25^{th}$ value.

$\therefore Q_3 = 22 + 0.25(28-22)$

$= 22 + 0.25 \times 6$

$= 22 + 1.5$

$= 23.5$

$$D_4 = \boxed{\frac{4(n+1)}{10}^{th} \text{ value}}$$

$$= \left(\frac{4 \times 11}{10}\right)^{th} \text{value} = 4.4^{th} \text{ value.}$$

$$\therefore D_4 = 11 + 0.4(13-11)$$

$$= 11 + 0.4 \times 2 \quad = 11.8.$$

. — .

$$D_9 = \boxed{\frac{9(n+1)}{10}^{th} \text{ value}} = 9.9^{th} \text{ value}$$

$$= 28 + 0.9(29-28) = 28 + 0.9 = 28.9$$

. — .

$$P_{43} = \boxed{\frac{43(n+1)}{100}^{th} \text{ value}} = 4.73^{rd} \text{ value}$$

$$= 11 + 0.73(13-11) = 11 + 0.73 \times 2 = 12.46.$$

. — .

$$P_{72} = \boxed{\frac{72(n+1)}{100}^{th} \text{ value}} = 7.92^{th} \text{ value}$$

$$= 17 + 0.92(22-17) = 21.6.$$

Box & Whisker Plot

Definition:-

A box and whisker plot or boxplot is a diagram based on the five-number summary of a data set.

* **Five-number Summary:-**

The five-number summary of a data set consists of the five numbers determined by computing the minimum, Q_1, $\tilde{X}$, Q_3, maximum of the data set.

NOTE 1:- To find the exact outlier.

NOTE 2:- A visual representation of the distribution of the data.

Q-1:- Draw a box plot for the data set:

3, 7, 8, 5, 12, 14, 21, 13, 18

Sol:- Arranged data:

3, 5, 7, 8, 12, 13, 14, 18, 21

$\therefore$ Minimum = $\boxed{3}$

Maximum = $\boxed{21}$

$$\boxed{\text{Median}} = \tilde{X} = \boxed{12}$$

For Q_1 ;

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

$$= \left(\frac{9+1}{4}\right)^{th} \text{ value}$$

$$= 2.5^{th} \text{ value}$$

$$\therefore \boxed{Q_1} = 5 + 0.5(7-5)$$

$$= 5 + 1$$

$$= \boxed{6}$$

For Q_3 ;

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

$$= \left(\frac{3 \times 10}{4}\right)^{th} \text{ value}$$

$$= 7.5^{th} \text{ value}$$

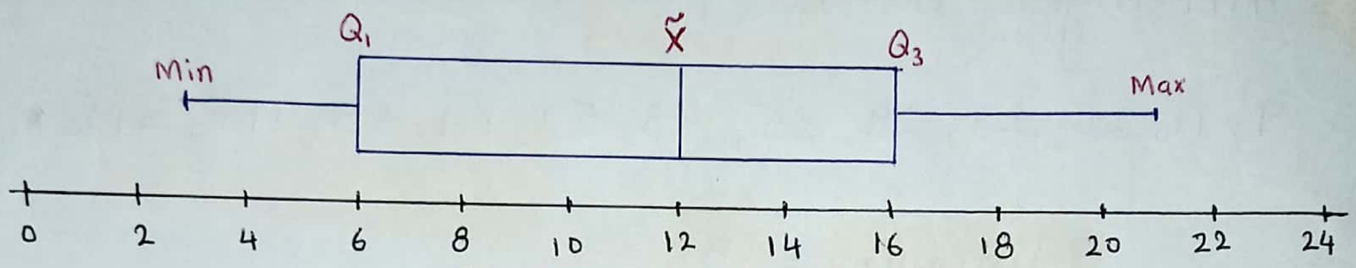
$$\therefore \boxed{Q_3} = 14 + 0.5(18-14)$$

$$= 14 + 2$$

$$= \boxed{16}$$

Thus, we had the five-number summary:

Min: 3 , Q_1: 6 , Median: 12 , Q_3: 16 and Max: 21



Box & Whisker plot

NOTE 3:- To find exact outlier in data, find lower and upper limits as:

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$$\text{Lower Limit} = Q_1 - 1.5\,(Q_3 - Q_1)$$

and

$$\text{Upper Limit} = Q_3 + 1.5\,(Q_3 - Q_1)$$

* Any data values outside these limits are referred to as outliers.

*

Q- Draw a box plot for the following data set and indicate outlier/s, if any:

3, 11, 115, 29, 63, 52, 43, 61, 27, 20, 212, 9, 35

sol:- Arranged data:

3, 9, 11, 20, 27, 29, 35, 43, 52, 61, 63, 115, 212

Minimum = $\boxed{3}$

Maximum = $\boxed{212}$.

Median = $\boxed{35}$

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{value} = \left(\frac{14}{4}\right)^{th} \text{value} = 3.5^{th} \text{value}$$

$$\Rightarrow Q_1 = 11 + 0.5(20 - 11)$$

$$= \boxed{15.5}$$

$$Q_3 = \left(\frac{3(n+1)}{4}\right)^{th} \text{value} = 10.5^{th} \text{value}$$

$$= 61 + 0.5(63 - 61)$$

$$= \boxed{62}.$$

Lower limit $= Q_1 - 1.5(Q_3 - Q_1)$

$= 15.5 - 1.5(62 - 15.5)$

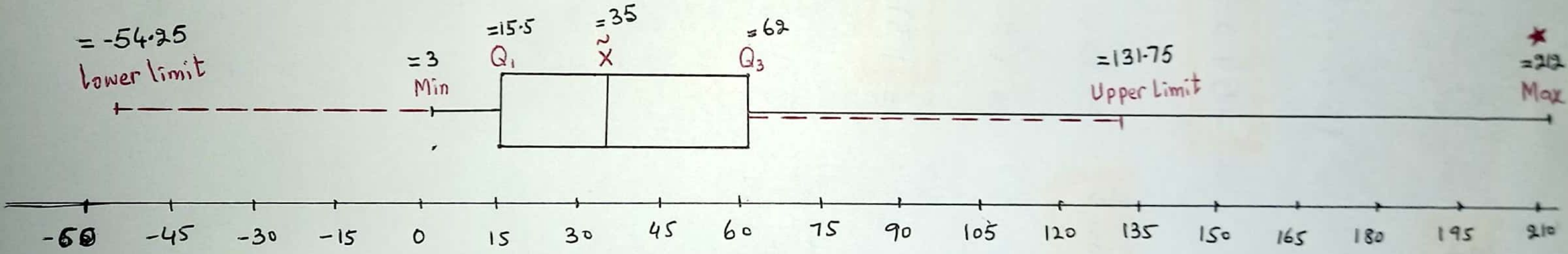
$= \boxed{-54.25}$

Upper limit $= Q_3 + 1.5(Q_3 - Q_1)$

$= 62 + 1.5(62 - 15.5)$

$= \boxed{131.75}$

P.T.O



Therefore there is only one outlier in given data set,
i.e; 212.