Hand Calculation's of Percentiles & Boxplot

P. Pruthvi Vardhan.

1. What is Percentile ?

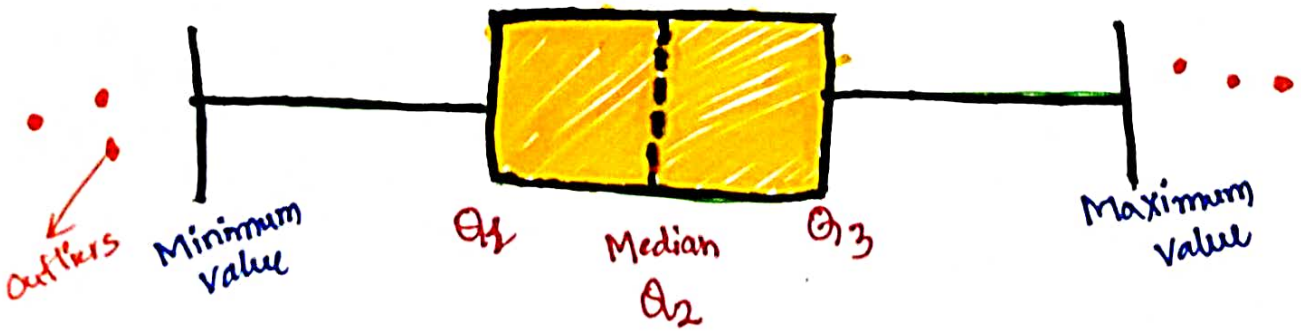
- it is "statistical measure that represents the percentage of observations in a dataset that fall below a particular value :

  Ex: The 75Th percentile is the value below, which 75% of observations in the dataset fall.

Formula :- $\frac{P}{100}(N+1)$

2. What is "Boxplot" ?

- it's also known as "whisker plot". its a graphical representation of a dataset that shows distribution of data.
- Summary of data, including minimum and Maximum value
- The First quartile (Q_1), the median (Q_2) and third quartile (Q_3)



⇒ Percentile Formula = $\boxed{PL = \frac{P}{100}(n+1)}$

∴ PL = Desired percentile Value Location

P = Percentile Rank [Expressed as Percentage]

N = Total no. of observations in Dataset.

* Example :-

Que: Find 75th percentile Score from below Data

78, 82, 84, 88, 91, 93, 94, 96, 98, 99
1 2 3 4 5 6 7 8 9 10

Step: 1 : Sort The Data into "Ascending Order".

78, 82, 84, 88, 91, 93, 94, 96, 98, 99
1 2 3 4 5.6 7 8 9 10

5.6th

Percentile Formula : $\boxed{PL = \frac{P}{100}(n+1)} \Rightarrow \frac{75}{100}(10+1)$

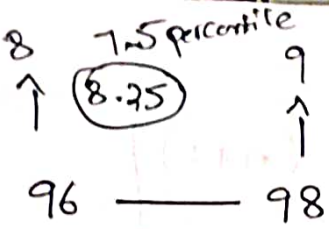
∴ We need 75th Percentile

n = no of points

$= \frac{75}{100}(11) \Rightarrow \frac{3}{4} \times 11$

$= \frac{33}{4} \Rightarrow 8.25$

96 — 98



$96 + 0.25(98 - 96)$

$96 + 0.25(2) \rightarrow (96 + 0.5)$

$= 96.5$

75^{Th} Percentile $\Rightarrow$ **96.5**

for 50^{th} percentile :- $PL = \frac{P}{100}[n+1]$

$PL = \frac{50}{100}(10+1]$

$= \frac{1}{2}[11] \Rightarrow 5.5$

91 —— 93 $\Rightarrow$ $91 + 0.5(93-91)$

5 (5.5) 6 $= 91 + 0.5(2)$

50 percentile $\Rightarrow 91 + 1$

$\Rightarrow 92$

****

Now, we have To **Create Boxplot** with Example.

We Have

↳ 6 , 213 , 241, 260 , 281 , 290 , 314 , 321 , 350 , 1500

1 2 3 4 5 . 6 7 8 9 10

"10" Datapoints

50th percentile

$$PL = \frac{P}{100}(n+1)$$

So, we Want to Quartile of Second,

Firstly, $Q_2 = \frac{P}{100}(n+1) = \frac{50}{100}(10+1) \Rightarrow \frac{50}{100}(11)$

$= \frac{1}{2}(11) \Rightarrow 5.5$

Distance 50th $\Rightarrow$ 281 — 290

$\Rightarrow$ 281 + 0.5 (290 - 281)

$\Rightarrow$ 281 + 0.5 (9)

$\Rightarrow$ 281 + 4.5

50th percentile $\Rightarrow$ **285.5** Q_2

Q_1 ⇒ First Quartile ⇒ 0.25 / 25th percentile.

$$P.L = \frac{P}{100}(n+1) = \frac{25}{100}(10+1) = \frac{25}{100}(11)$$

$$= \frac{1}{4}(11) = \frac{11}{4} \Rightarrow 2.75$$

213 — 241

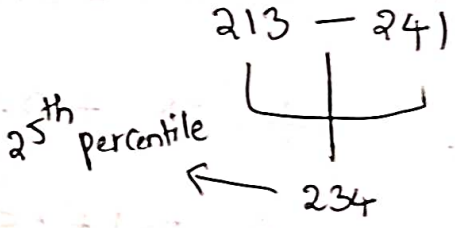
25th percentile (2.75)

$$213 + 0.75(241 - 213)$$

$$= 213 + 0.75(28)$$

$$= 213 + 21$$

$Q_1 = 234$



Q_3 ⇒ Third Quartile ⇒ 0.75 / 75th percentile

$$PL = \frac{P}{100}(n+1) = \frac{75}{100}(10+1) \Rightarrow \frac{75}{100}(11)$$

$$= \frac{3}{4}(11) = \frac{33}{4} \Rightarrow 8.25$$

321 —— 350

75th percentile

$321 + 0.25\,(350 - 321)$

$= 321 + 0.25\,(291)$

$= 321 + 7.25$

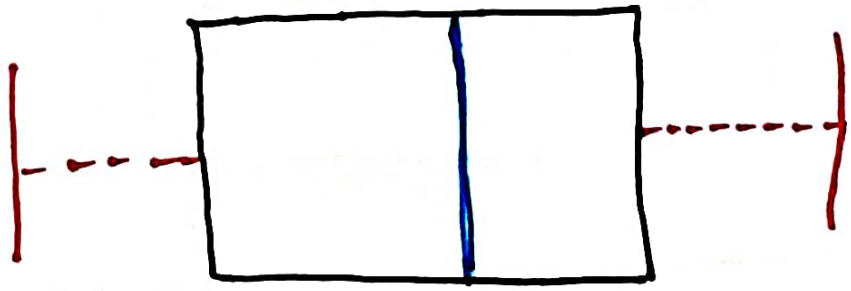
$Q_3 = \boxed{328.75}$

321 — 350

328.75 [75th percentile]

6, 213, 241, 260, 281, 290, 314, 321, 350, 1500

1 2 3 4 5 6 7 8 9 10



For Finding "Minimum and Maximum" Values.

⇒ Minimum ⇒ $Q_1 - 1.5\,[IQR)$

⇒ Maximum ⇒ $Q_3 + 1.5\,[IQR)$

Here IQR value is Max-min

328 - 234

⇒ 94 [IQR]

Minimum Value : $Q_1 - 1.5\,[IQR]$

$= 234 - 1.5\,[94]$

$= 234 - 141$

$= 93$

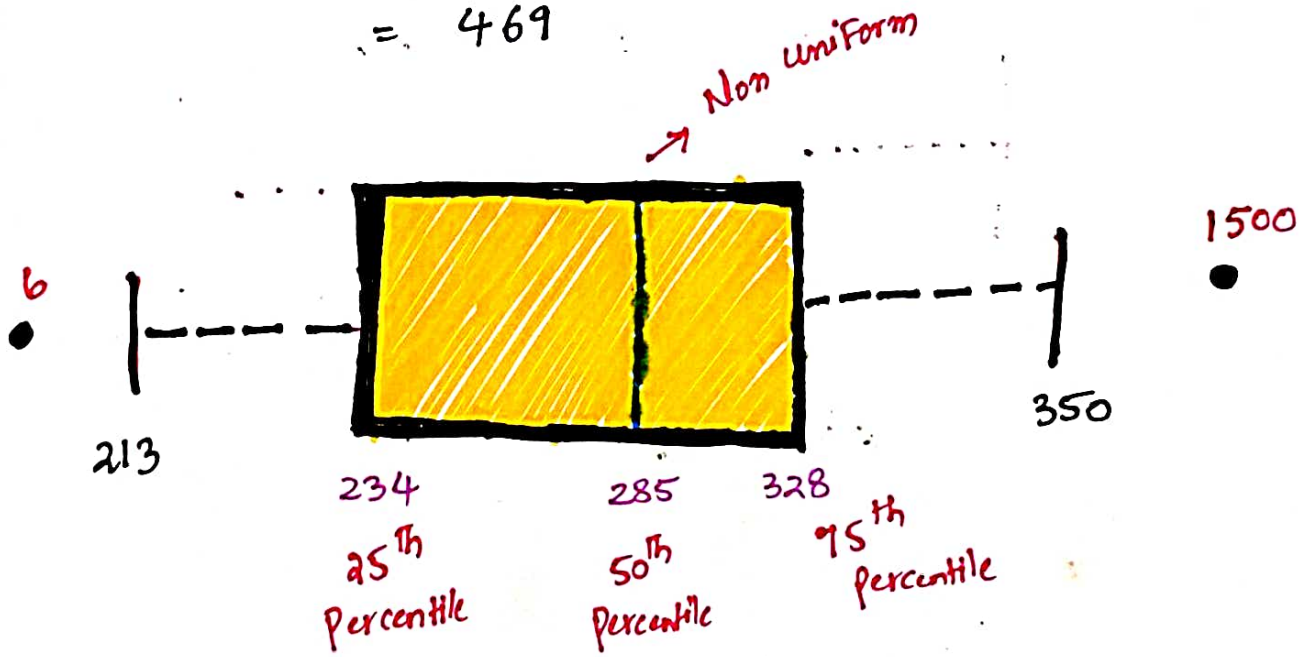
- Minimum Value = 93

Maximum Value : $Q_3 + 1.5\,[IQR]$

$= 328 + 1.5\,[94]$

$= 328 + 141$

$= 469$



14/06/23