

MSRUAS
Assignment-1

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question 1.

Number of specimens of a new aluminium-lithium alloy
 $N=15$. The given compressive strengths in psi.

$\therefore 105, 221, 183, 153, 174, 181, 158, 208, 194, 133$
 $, 165, 171, 158, 190, 135$

(a) * Average of compressive strengths :

$$\text{Mean : } \bar{x} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{N}$$

$$\bar{x} = \frac{\sum_{i=1}^N x_i}{N}$$

$$\bar{x} = \frac{105 + 221 + 183 + 153 + 174 + 181 + 158 + 208 + 194 + 133 + 165 + 171 + 158 + 190 + 135}{15}$$

$$= \frac{2529}{15} = 168.6$$

\therefore The average of the compressive strengths
 $= 168.6 \text{ (psi)}$

* Standard deviation

$$\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N}} \Rightarrow \sqrt{\text{variance}}$$

$$\sigma = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{N}}$$

Standard deviation is a measure of how close the numbers are to the mean.

	x^i	$x^i - \bar{x}$	$(x^i - \bar{x})^2$
1	105	-63.6	4044.96
2	221	52.4	2745.76
3	183	14.4	207.36
4	153	-15.6	243.36
5	174	5.4	29.16
6	181	12.4	153.76
7	158	-10.6	112.36
8	208	39.4	1552.36
9	194	25.4	645.16
10	133	-35.6	1267.36
11	165	-3.6	12.96
12	171	2.4	5.76
13	158	-10.6	112.36
14	190	21.4	457.96
15	135	-33.6	1128.96
Total	2529	0	12719.6

$$\text{Variance} = \frac{(105 - 168.6)^2 + (221 - 168.6)^2 + (183 - 168.6)^2 + \dots + (190 - 168.6)^2 + (135 - 168.6)^2}{15}$$

$$= \frac{4044.96 + 2745.76 + 207.36 + 243.36 + 29.16 + 153.76 + 112.36 + 1552.36 + 645.16 + 1267.36 + 12.96 + 5.76 + 112.36 + 457.96 + 1128.96}{15}$$

$$= \frac{12719.6}{15}$$

$$\text{Variance} = \frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N} = \frac{12719.6}{15} = 847.973$$

$$\text{Standard deviation} = \sqrt{\text{variance}} = \sqrt{847.973}$$

$$= 29.11998$$

(6) Quartiles: A quartile is a type of quantile which divides the number of data points into four more or less equal parts or quarters.

\therefore , Quartiles divide data into 4 equal parts.

There are 3 quartiles = Q_1 = Lower quartile

Q_2 = Median

Q_3 = Upper quartile.

1. ~~Arr~~ Arrange the data in ascending order.

2. $Q_i = \left[\frac{i(N+1)}{4} \right]^{th}$ value

$$Q_1 = \left[\frac{1(15+1)}{4} \right]^{th} = \frac{16}{4} = 4^{th} \text{ value} = 153$$

$$Q_2 = \left[\frac{2(15+1)}{4} \right]^{th} = \frac{2(16)}{4} = 8^{th} \text{ value} = 171$$

$$Q_3 = \left[\frac{3(15+1)}{4} \right]^{th} = 3\left(\frac{16}{4}\right) = 12^{th} \text{ value} = 190$$

The given data in ascending order:-

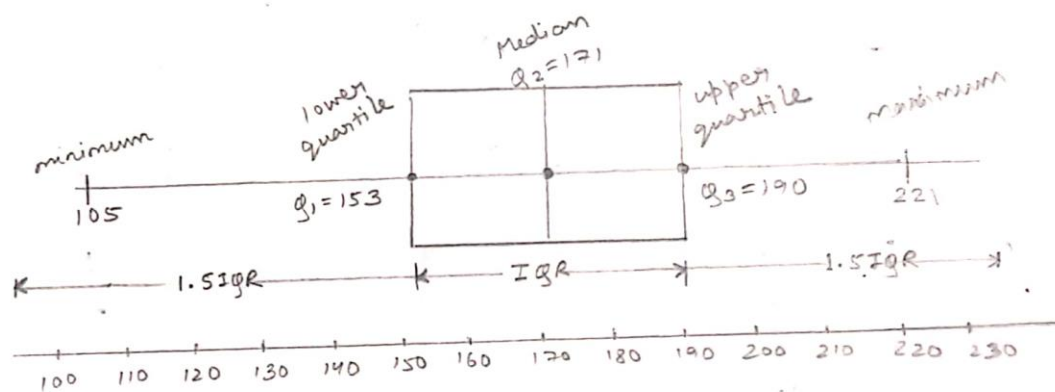
105, 133, 135, $\overset{Q_1}{(153)}$, 158, 165, $\overset{Q_2}{(171)}$, 174, 181, 183,
 $\overset{Q_3}{(190)}$, 194, 208, 221

Lower quartile, $Q_1 = 153$

Median $Q_2 = 171$

Upper quartile $Q_3 = 190$

Box and Whisker plot



from the data the quartiles we got -

$$Q_1 = 153, \quad Q_2 = 171, \quad Q_3 = 190$$

$$\begin{aligned} \text{Interquartile Range } IQR &= Q_3 - Q_1 \\ &= 190 - 153 \\ &= 37 \end{aligned}$$

lower inner fence

$$\begin{aligned} &= Q_1 - 1.5 IQR \\ &= 153 - 1.5(37) \\ &= 153 - 55.5 \\ &= 97.5 \end{aligned}$$

upper inner fence

$$\begin{aligned} &= Q_3 + 1.5 IQR \\ &= 190 + (1.5)(37) \\ &= 190 + 55.5 \\ &= 245.5 \end{aligned}$$

Outliers will be any points below $Q_1 - 1.5 IQR$ or above $Q_3 + 1.5 IQR$

here, there are no points which satisfy the above condition. \therefore It has no outliers.

\therefore , there are no values > 245.5 and < 97.5 , there are no outliers.

Extreme values:

lower outer fence

$$\begin{aligned} &= Q_1 - 3IQR \\ &= 153 - 3(37) \\ &= 153 - 111 \\ &= 42. \end{aligned}$$

upper outer fence

$$\begin{aligned} &= Q_3 + 3IQR \\ &= 190 + 3(37) \\ &= 190 + 111 \\ &= 301 \end{aligned}$$

Since there are no values > 301 and < 42 , there are no extreme values.