

# Statistics, lecture 6:

e.g) If  $Q_2 = 40$ , then find  $P$

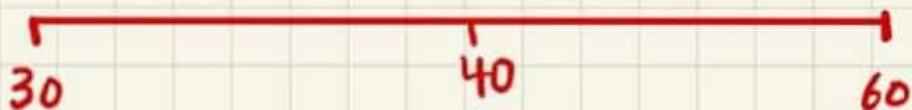
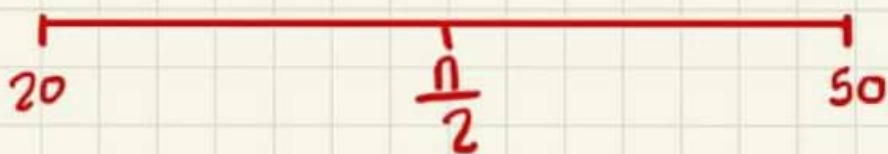
|     |                 |                  |                  |                  |                  |        |
|-----|-----------------|------------------|------------------|------------------|------------------|--------|
| I   | $0 \leq X < 10$ | $10 \leq X < 30$ | $30 \leq X < 60$ | $60 \leq X < 80$ | $80 \leq X < 90$ | Sum    |
| P   | 5               | 15               | 30               | P                | 2                | $52+P$ |
| c.f | 5               | $20 \frac{n}{2}$ | 50               | $50+P$           | $52+P$           |        |
| URB | 10              | $30 \ 40$        | 60               | 80               | 90               |        |

$$\text{sol) } \frac{\frac{n}{2} - 20}{50 - 20} = \frac{40 - 30}{60 - 30}$$

$$\frac{n}{2} - 20 = 10$$

$$\frac{n}{2} = 30$$

$$n = 60$$



I

e.g) Find the percentage of observation that are less than 6.

|      |     |     |      |      |
|------|-----|-----|------|------|
| I    | 3-5 | 6-8 | 9-11 | Sum  |
| f    | 4   | 2   | 4    | 10   |
| c.f. | 4   | 6   | 10   |      |
| URB  | 5.5 | 6   | 8.5  | 11.5 |

Sol)

$$\frac{x-4}{6-4} = \frac{6-5.5}{8.5-5.5}$$

$$\frac{x-4}{2} = \frac{0.5}{3}$$

$$x = 4.3\bar{3}$$

$$\frac{4.3\bar{3}}{10} \times 100\% = 43.3\%$$

### \* Coding (Linear Transformation)

If  $Y = aX + b$  then,

i)  $\bar{Y} = a\bar{X} + b$

ii) Mode of  $Y = a \cdot (\text{Mode of } X) + b$

iii)  $Q_2$  of  $Y = a \cdot (Q_2 \text{ of } X) + b$

iv)  $Q_1$  of  $Y = a \cdot (Q_1 \text{ of } X) + b, a > 0$   
 $= a \cdot (Q_3 \text{ of } X) + b, a < 0$

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v)  $Q_3$  of  $Y = a \cdot (Q_3 \text{ of } X) + b, a > 0$   
 $= a \cdot (Q_1 \text{ of } X) + b, a < 0$

vii)  $P_k$  of  $Y = a \cdot (P_k \text{ of } X) + b, a > 0$   
 $= a \cdot (P_{100-k} \text{ of } X) + b, a < 0$

viii) Range of  $Y = |a| \cdot (\text{Range of } X)$   
 ix)  $S_y = |a| \cdot S_x$   
 x)  $S_y^2 = a^2 \cdot S_x^2$

eg) If  $Y = 2 - 3X$  and

$$\bar{X} = 10$$

$$Q_2 = 9$$

$$Q_1 = 5$$

$$Q_3 = 12$$

$$P_{20} = 3$$

$$P_{80} = 15$$

$$S_x^2 = 3$$

Find the previous quantities for  $Y$ .

Sol)

$$\bar{Y} = 2 - 3 \cdot \bar{X} = 2 - 3 \cdot 10 = -28$$

$$Q_2 \text{ of } Y = 2 - 3 \cdot (Q_2 \text{ of } X) = -25$$

$$Q_1 \text{ of } Y = 2 - 3 \cdot (Q_3 \text{ of } X) = -34$$

$$Q_3 \text{ of } Y = 2 - 3 \cdot (Q_1 \text{ of } X) = -13$$

$$P_{20} \text{ of } Y = 2 - 3 \cdot (P_{80} \text{ of } X) = -43$$

$$P_{80} \text{ of } Y = 2 - 3 \cdot (P_{20} \text{ of } X) = -7$$

$$S_y^2 = a^2 S_x^2 = (-3)^2 \cdot 3 = 27$$

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e.g) If the mean mark of a group of students is 15 and the variance is 2. The teacher decided to decrease each mark by 10% and then add 2 marks to each transcript. Find the new mean and new variance.

$$\begin{aligned} \text{sol) } Y &= 0.90X + 2 \\ \bar{Y} &= 0.90 \times 15 + 2 \\ &= 15.5 \end{aligned}$$

$$\begin{aligned} S_y^2 &= a^2 \times S_x^2 \\ &= (0.90)^2 \cdot 2 \\ &= 1.62 \end{aligned}$$

e.g) If  $Y = aX + b$   
 $\bar{X} = 10, \bar{Y} = 5$   
 $S_x = 3, S_y = 1$   
 Find a and b.

$$\begin{aligned} \text{sol) } \bar{Y} &= a \cdot \bar{X} + b \\ 5 &= 10 \times a + b \quad \text{--- ①} \end{aligned}$$

$$\begin{aligned} S_y &= |a| \times S_x \\ 1 &= |a| \times 3 \\ a &= \pm \frac{1}{3} \end{aligned}$$

$$\begin{aligned} a &\rightarrow \frac{1}{3} \\ 5 &= 10 \times \frac{1}{3} + b \Rightarrow b = \frac{5}{3} \\ &\downarrow \\ Y &= \frac{1}{3}X + \frac{5}{3} \end{aligned}$$

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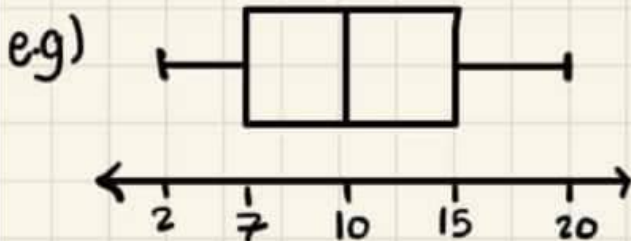
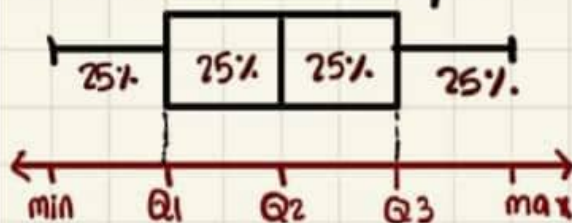
$$a = -\frac{1}{3} \rightarrow 5 = 10 \times \frac{1}{3} + b$$

$$b = \frac{25}{3}$$

$$Y = -\frac{1}{3}X + \frac{25}{3}$$

### \* Graphical Representation

□ Box and whiskers plot:



The above are the marks of 40 students, find:

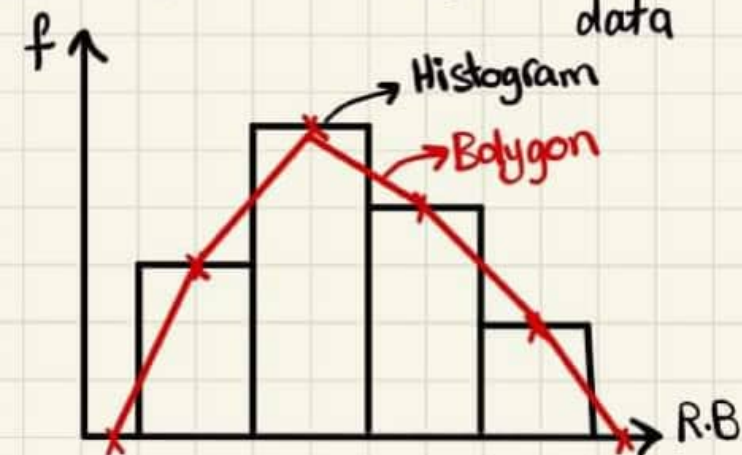
- i) The median :  $Q_2 = 10$
- ii) The Range :  $20 - 2 = 18$
- iii) The IQR :  $Q_3 - Q_1 = 8$
- iv) The no. of students that achieved more than 15 :  $\frac{1}{4} \times 40 = 10$
- v) An estimation for the mean:

|     |     |      |       |       |     |
|-----|-----|------|-------|-------|-----|
| I   | 2-7 | 7-10 | 10-15 | 15-20 | Sum |
| f   | 10  | 10   | 10    | 10    | 40  |
| X   | 4.5 | 8.5  | 12.5  | 17.5  |     |
| f.X | 45  | 85   | 125   | 175   |     |

$$\bar{X} = \frac{430}{40} = 10.75$$

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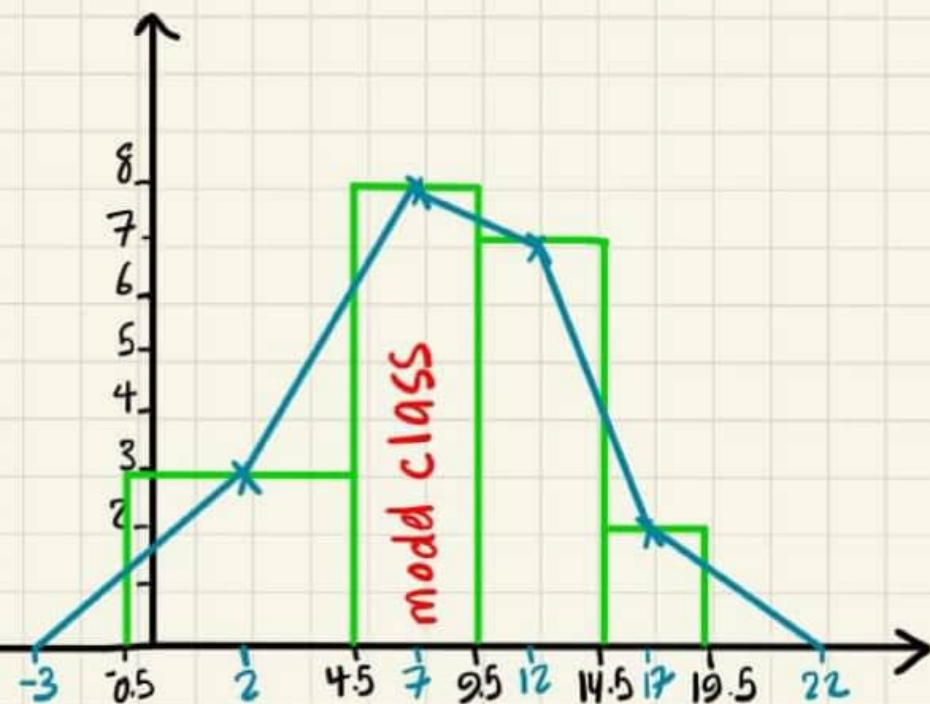
## 2] Histogram and Polygon: for continuous data



g) Draw a Histogram and a polygon:

-0.5    4.5    9.5    14.5    19.5

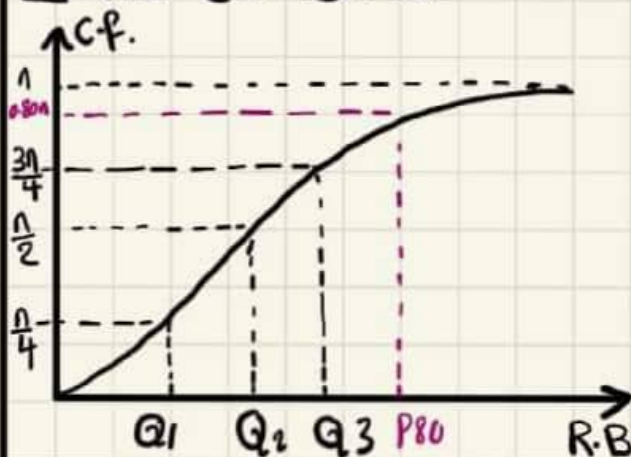
|   |     |     |       |       |
|---|-----|-----|-------|-------|
| I | 0-4 | 5-9 | 10-14 | 15-19 |
| f | 3   | 8   | 7     | 2     |



ملاحظة: يمكن يطينا الرسمة ويطلب كوكا جدول  
وكتيب

6

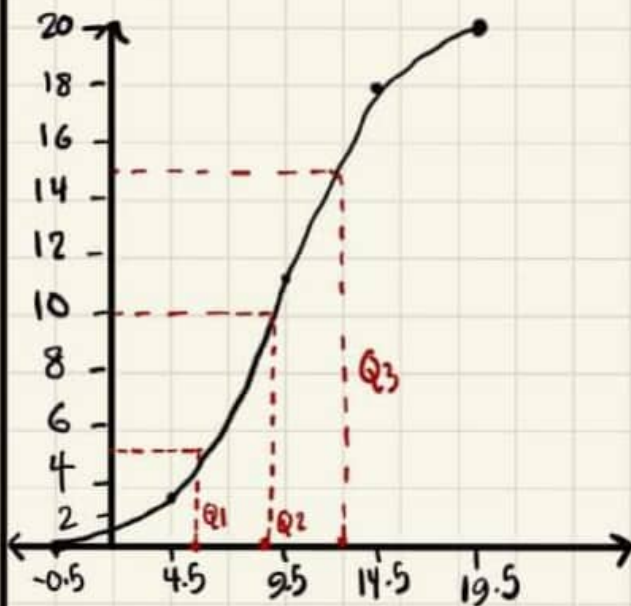
## 3] The c.f curve



g) Draw a c.f. curve:

-0.5    4.5    9.5    14.5    19.5

|     |     |     |       |       |
|-----|-----|-----|-------|-------|
| I   | 0-4 | 5-9 | 10-14 | 15-19 |
| f   | 3   | 8   | 7     | 2     |
| c.f | 3   | 11  | 18    | 20    |
| URB | 4.5 | 9.5 | 14.5  | 19.5  |



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