* Measure of location :-

① mean
المتوسط الحسابي

* $\bar{x} = \frac{\sum x}{n}$

* oversensitive to extreme values.

* some properties

→ $y_i = c x_i$

↳ $\bar{y} = c\bar{x}$

→ $y_i = x_i + c$

↳ $\bar{y} = \bar{x} + c$

→ $y_i = x_i - c$

↳ $\bar{y} = \bar{x} - c$

(بمعنى آخر المتوسط الحسابي يتأثر بالعمليات الحسابية)

② median
(الوسيط)

Q_2

* أفضل مؤشر للـ Data (مهم)

Ex: 3, 4, 2, 5

* نرتب القيم

2, 3, 4, 5

* يوجد حالتين للحل

n زوجي

Ex: ~~2~~, 3, 4, ~~5~~

$\frac{3+4}{2} = 3.5$

الوسيط

n فردي

Ex: ~~2~~, ~~3~~, 4, ~~5~~, ~~6~~

الوسيط

③ mode
المنوال

العنصر الأكثر تكراراً

Ex :- 2, 3, 4, 5, 5, 6

mode :- 5

	عدد mode
unimodel →	1
Bimodel →	2
Trimodel →	3

* Measure of spread :-

① The Rang

* is very sensitive to extreme outliers.

* is the difference between the largest and smallest observation in a sample

② variance and standard Deviation

← التباين والإنحراف المعياري

$$s^2 = \frac{\sum (x - \bar{x})^2}{n-1}$$

$$s^2 = \frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}$$

② properties of variance and standard deviation:-

→ $y_i = x_i + c$ → $y_i = x_i - c$

$s_y^2 = s_x^2$ $s_y^2 = s_y^2$

← بمعنى آخر لا يتأثر بـ +, −

→ $y_i = c x_i$

$s_y^2 = c^2 s_x^2$

→ The variance can't be negative

③ Quantiles or percentiles:-

Q_1:- Lower quartile = 25%

Q_2:- median = 50%

Q_3:- upper quartile = 75%

* percentiles are less sensitive to outliers

$P_p = \frac{n * p}{100}$ n:- sample size, p:- percent

لاحظ البيانات مرتبة

$\frac{a}{b}$

Ex:- 2, 3, 4, 6

$n = 4$ $p = 35$ ⇒ تعطى بالسؤال

$P_p = \frac{4 * 35}{100} = 1.4^{th}$

$\approx 2^{th}$

بقرب القيمة لأقرب عدد صحيح

$= \underline{3}$

عدد صحيح

Ex:- 1, 2, 3, 4

$n = 4$ $p = 25\%$

$P_p = \frac{4 * 25}{100} = \underline{1^{th}}$

$\frac{1^{th} + 2^{th}}{2} = \frac{1+2}{2}$

$= \underline{1.5}$

* coefficient of Variation

$CV = \frac{S}{\bar{x}} * 100\%$

Outliers or Extreme Values

→ Inter-quartile Rang

$IQR = Q_3 - Q_1$

→ outlier from right

$Q_3 + 1.5(IQR)$

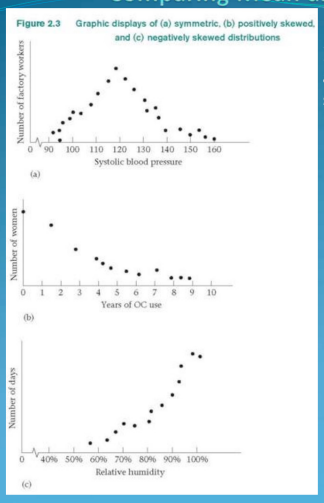
→ outlier from left

$Q_1 - 1.5(IQR)$

سُبْحَانَ اللَّهِ وَبِحَمْدِهِ
عَدَدَ خَلْقِهِ ، وَرِضَا نَفْسِهِ ،
وَزِنَةَ عَرْشِهِ ، وَمِدَادَ كَلِمَاتِهِ ..

Comparing Mean and Median

Figure 2.3 Graphic displays of (a) symmetric, (b) positively skewed, and (c) negatively skewed distributions

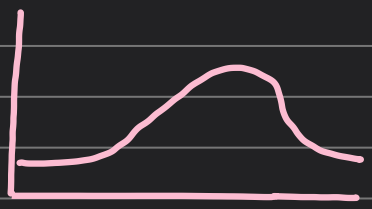


For symmetric distributions, arithmetic mean is approximately the same as the median

For positively skewed distributions, arithmetic mean tends to be larger than the median

For negatively skewed distributions, the arithmetic mean tends to be smaller than the median

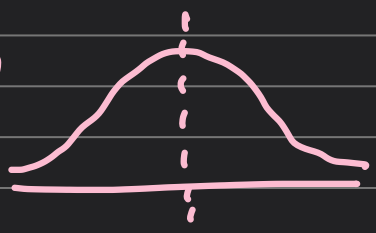
③



negatively skewed distribution

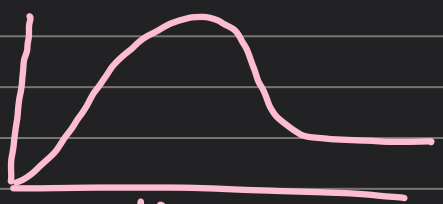
mode > Q_2 > $\bar{x}$

①



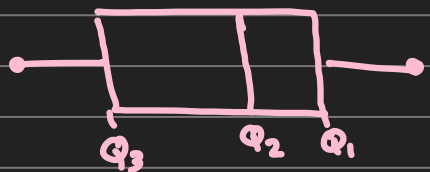
symmetric

②

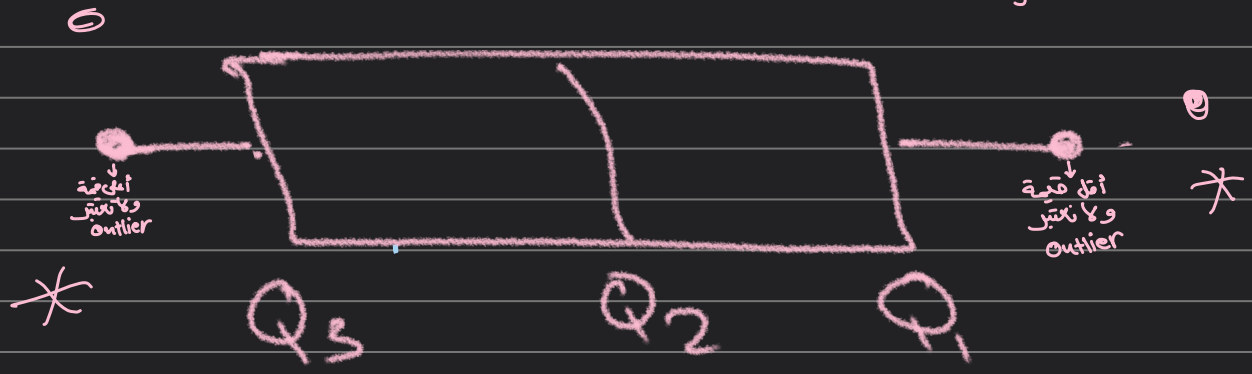


positively skewed distributions

mode < Q_2 < $\bar{x}$



Box plot

outlier •

extremely outlier *