Covariance

Eg:

(x) Age (year)	Weight (kg) (y)
20	75
18	63
15	45
14	41
25	78

$X \uparrow \quad y \uparrow$

$X \downarrow \quad y \downarrow$

$\{ X \uparrow \quad y \downarrow \}$

$\{ X \downarrow \quad y \uparrow \}$

Covariance

① Quantify the relationship between x & y

Numerical value

Population

$$Cov(X,y) = \sum_{i=1}^{N} \frac{(x-\bar{x})(y-\bar{y})}{N}$$

Sample

Degree of freedom {Bessels correction}

$$Cov(X,y) = \sum_{i=1}^{n} \frac{(x-\bar{x})(y-\bar{y})}{n-1}$$

X Economic Growth (%)	Y NIFTY 50 Index (%)
2.1	8
2.5	12
4.0	14
3.6	10

Covariance

$$Cov(x,y) = \frac{\sum_{i=1}^{n}(x-\bar{x})(y-\bar{y})}{n-1}$$

+ve { X↑ Y↑ ; X↓ Y↓

-ve { X↑ Y↓ ; X↓ Y↑

X	y	$\bar{x}$	$\bar{y}$	$x-\bar{x}$	$y-\bar{y}$
2.1	8	3.1	11	−1	−3 ←
2.5	12	3.1	11	−0.6	1
4.0	14	3.1	11	0.9	3
3.6	10	3.1	11	0.5	−1

$$Cov(x,y) = \frac{(-1)(-3) + (-0.6)\times(1) + (0.9)\times(3) + (0.5)(-1)}{4-1}$$

$$= \frac{3 - 0.6 + 2.7 + 0.5}{3}$$

$$Cov(x,y) = \frac{4.6}{3} = 1.533$$ → +ve value

+1000 X −1000

Satisfying 2 conditions

① Economic Growth ↑ NIFTY 50 Index ↑ Growth

② Economic Growth ↓ NIFTY 50 Index ↓ Growth

{-1 to 1}

②