

# CORRELATION





# Correlation

## ■ key concepts:

Types of correlation

Methods of studying correlation

- a) Scatter diagram
- b) Karl pearson's coefficient of correlation
- c) Spearman's Rank correlation coefficient
- d) Method of least squares



# Correlation

- **Correlation:** The degree of relationship between the variables under consideration is measure through the correlation analysis.
- The measure of correlation called the correlation coefficient
- The degree of relationship is expressed by coefficient which range from correlation (  $-1 \leq r \leq +1$  )
- The direction of change is indicated by a sign.
- The correlation analysis enable us to have an idea about the degree & direction of the relationship between the two variables under study.



# Correlation

- Correlation is a statistical tool that helps to measure and analyze the degree of relationship between two variables.
- Correlation analysis deals with the association between two or more variables.



# Correlation & Causation

- Causation means cause & effect relation.
- Correlation denotes the interdependency among the variables for correlating two phenomenon, it is essential that the two phenomenon should have cause-effect relationship, & if such relationship does not exist then the two phenomenon can not be correlated.
- If two variables vary in such a way that movement in one are accompanied by movement in other, these variables are called cause and effect relationship.
- Causation always implies correlation but correlation does not necessarily implies causation.



# **Types of Correlation**

## **Type I**

```
graph TD; A[Correlation] --> B[Positive Correlation]; A --> C[Negative Correlation];
```

**Correlation**

**Positive Correlation**

**Negative Correlation**



# Types of Correlation Type I

- **Positive Correlation:** The correlation is said to be positive correlation if the values of two variables changing with same direction.  
Ex. Pub. Exp. & sales, Height & weight.
- **Negative Correlation:** The correlation is said to be negative correlation when the values of variables change with opposite direction.  
Ex. Price & qty. demanded.



# Direction of the Correlation

## ■ **Positive relationship** – Variables change in the same direction.

- As X is increasing, Y is increasing
- As X is decreasing, Y is decreasing

Indicated by  
sign; (+) or (-).

■ E.g., As height increases, so does weight.

## ■ **Negative relationship** – Variables change in opposite directions.

- As X is increasing, Y is decreasing
- As X is decreasing, Y is increasing

■ E.g., As TV time increases, grades decrease





# More examples

- **Positive relationships**

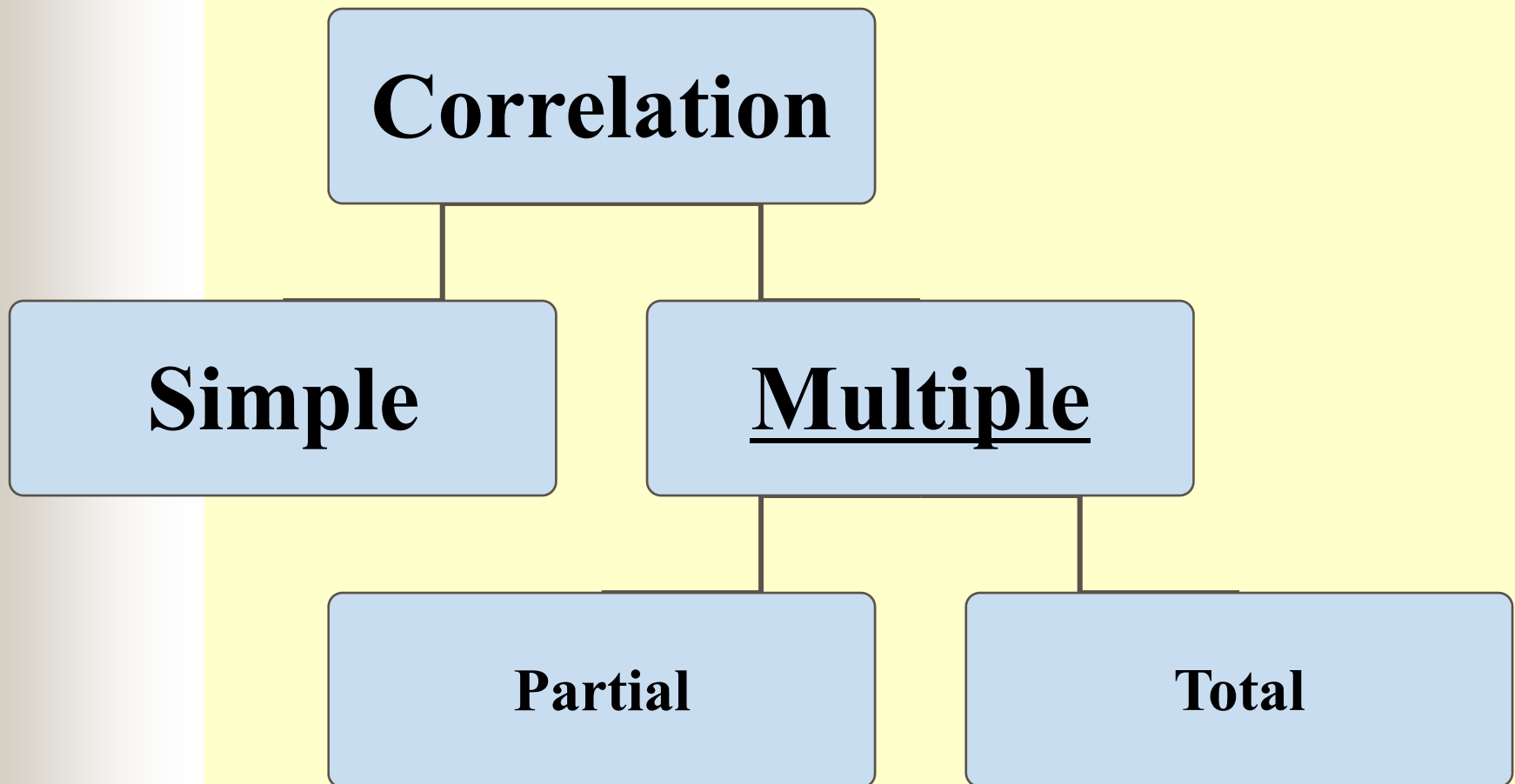
- water consumption and temperature.
- study time and grades.

- **Negative relationships:**

- alcohol consumption and driving ability.
- Price & quantity demanded

# Types of Correlation

## Type II





# Types of Correlation Type II

- **Simple correlation:** Under simple correlation problem there are only two variables are studied.
- **Multiple Correlation:** Under Multiple Correlation three or more than three variables are studied. Ex.  $Q_d = f(P, P_C, P_S, t, y)$
- **Partial correlation:** analysis recognizes more than two variables but considers only two variables keeping the other constant.
- **Total correlation:** is based on all the relevant variables, which is normally not feasible.

# **Types of Correlation**

## **Type III**

```
graph TD; A[Correlation] --> B[LINEAR]; A --> C[NON LINEAR]
```

**Correlation**

**LINEAR**

**NON LINEAR**



# Types of Correlation Type III

- **Linear correlation:** Correlation is said to be linear when the amount of change in one variable tends to bear a constant ratio to the amount of change in the other. The graph of the variables having a linear relationship will form a straight line.  
Ex  $X = 1, 2, 3, 4, 5, 6, 7, 8,$   
 $Y = 5, 7, 9, 11, 13, 15, 17, 19,$   
 $Y = 3 + 2x$
- **Non Linear correlation:** The correlation would be non linear if the amount of change in one variable does not bear a constant ratio to the amount of change in the other variable.





# Methods of Studying Correlation

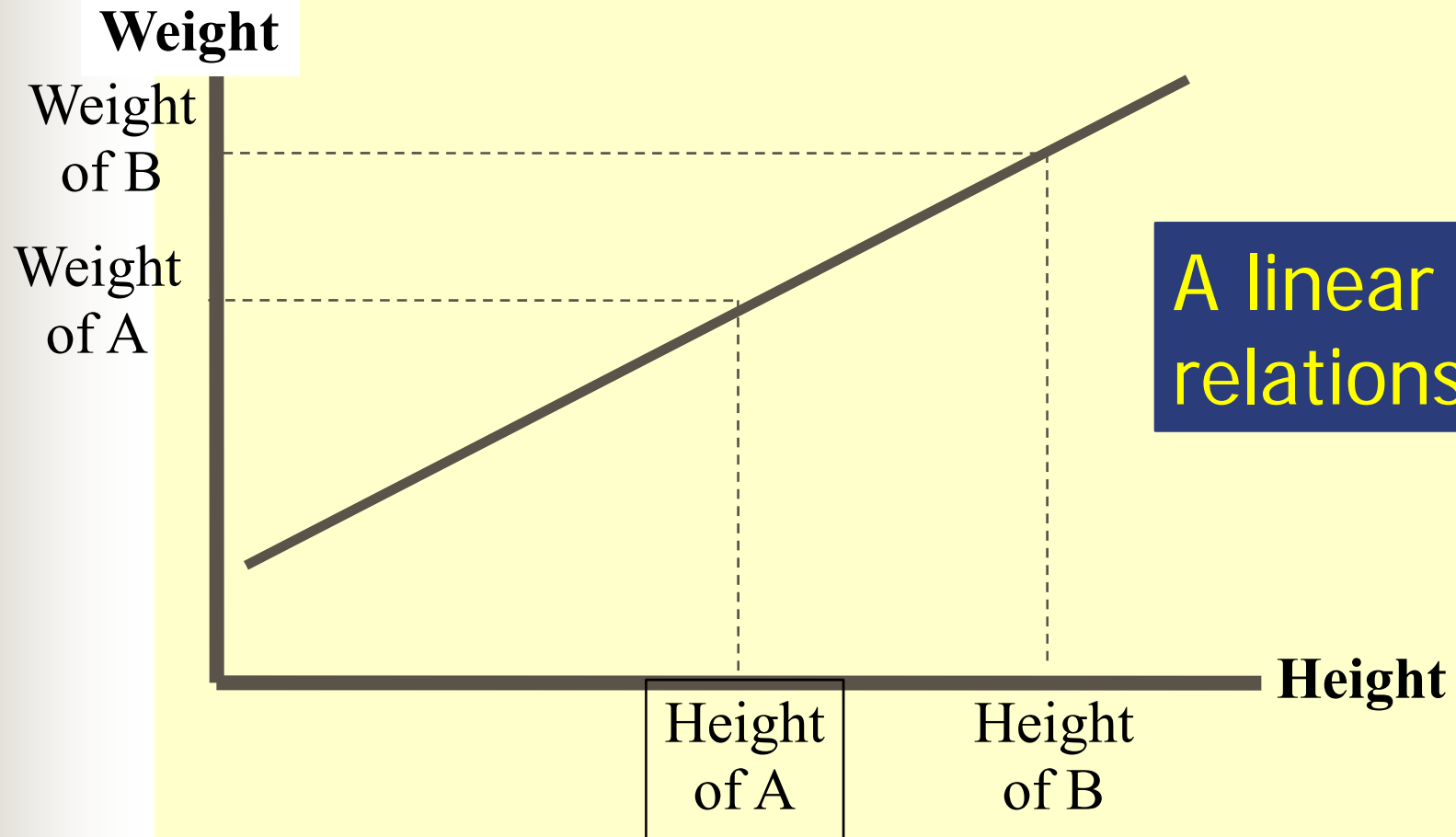
- Scatter Diagram Method
- Graphic Method
- Karl Pearson's Coefficient of Correlation
- Method of Least Squares



# Scatter Diagram Method

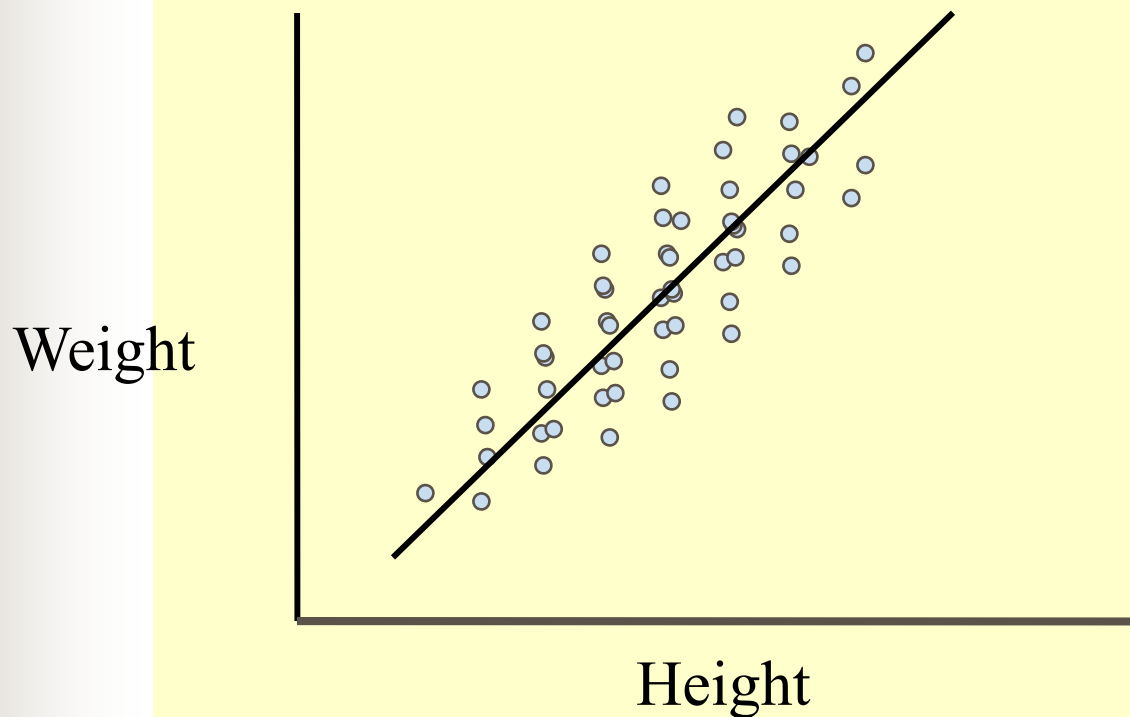
- Scatter Diagram is a graph of observed plotted points where each point represents the values of  $X$  &  $Y$  as a coordinate. It portrays the relationship between these two variables graphically.

# A perfect positive correlation



# High Degree of positive correlation

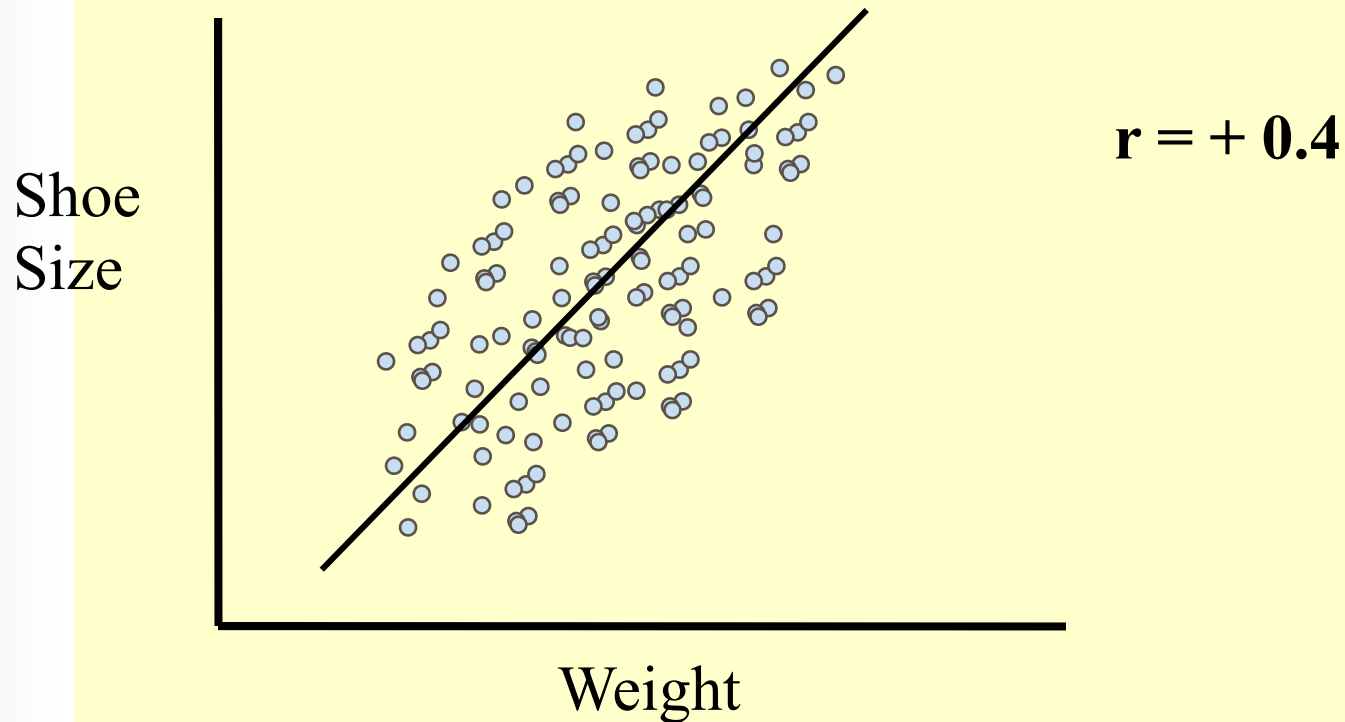
- Positive relationship



$$r = +.80$$

# Degree of correlation

## ■ Moderate Positive Correlation

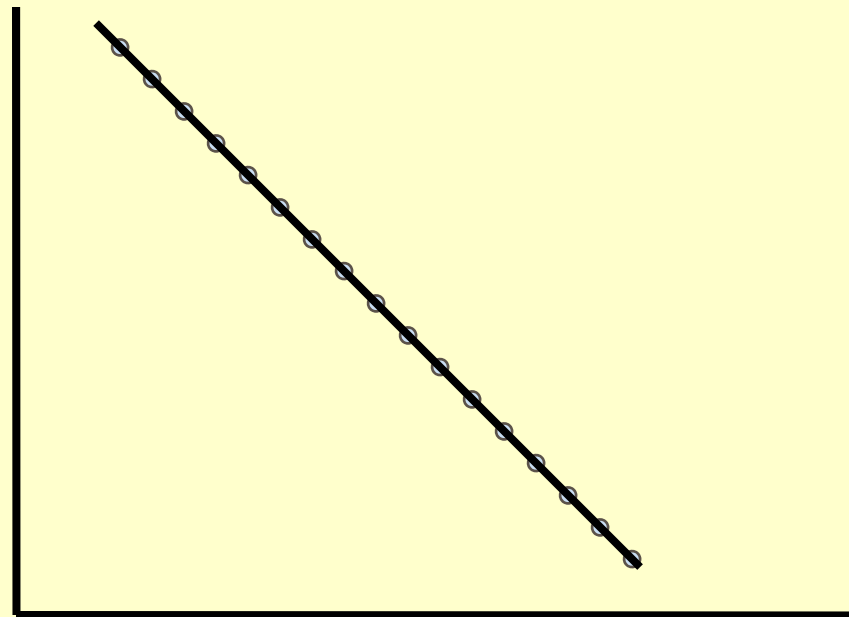




# Degree of correlation

## ■ Perfect Negative Correlation

TV  
watching  
per  
week



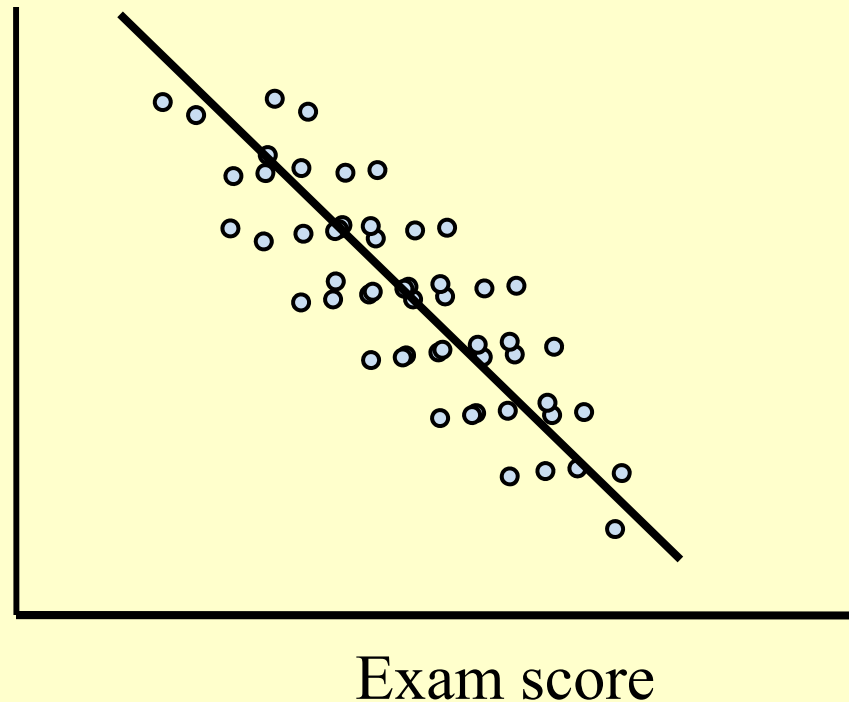
Exam score

$$r = -1.0$$

# Degree of correlation

## ■ Moderate Negative Correlation

TV  
watching  
per  
week

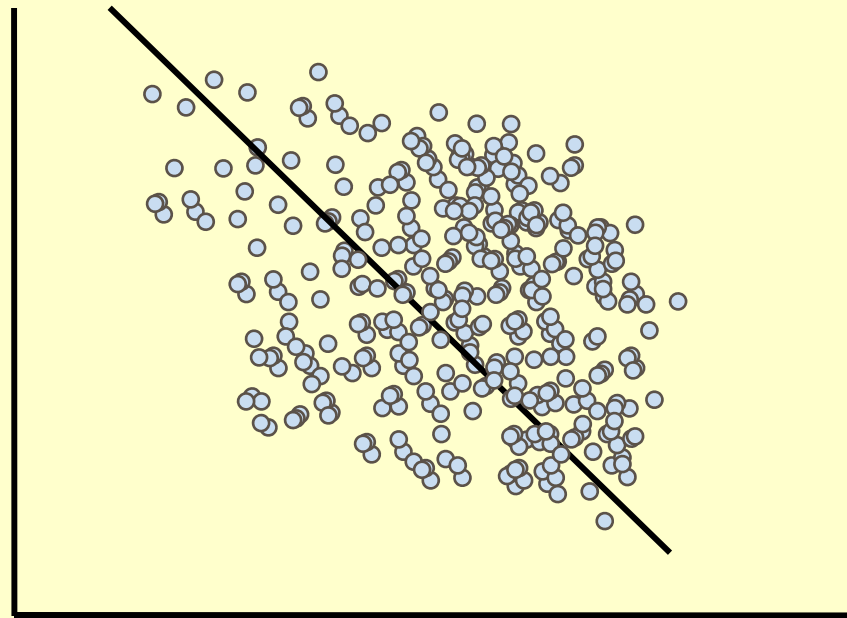


$$r = -.80$$

# Degree of correlation

## ■ Weak negative Correlation

Shoe  
Size

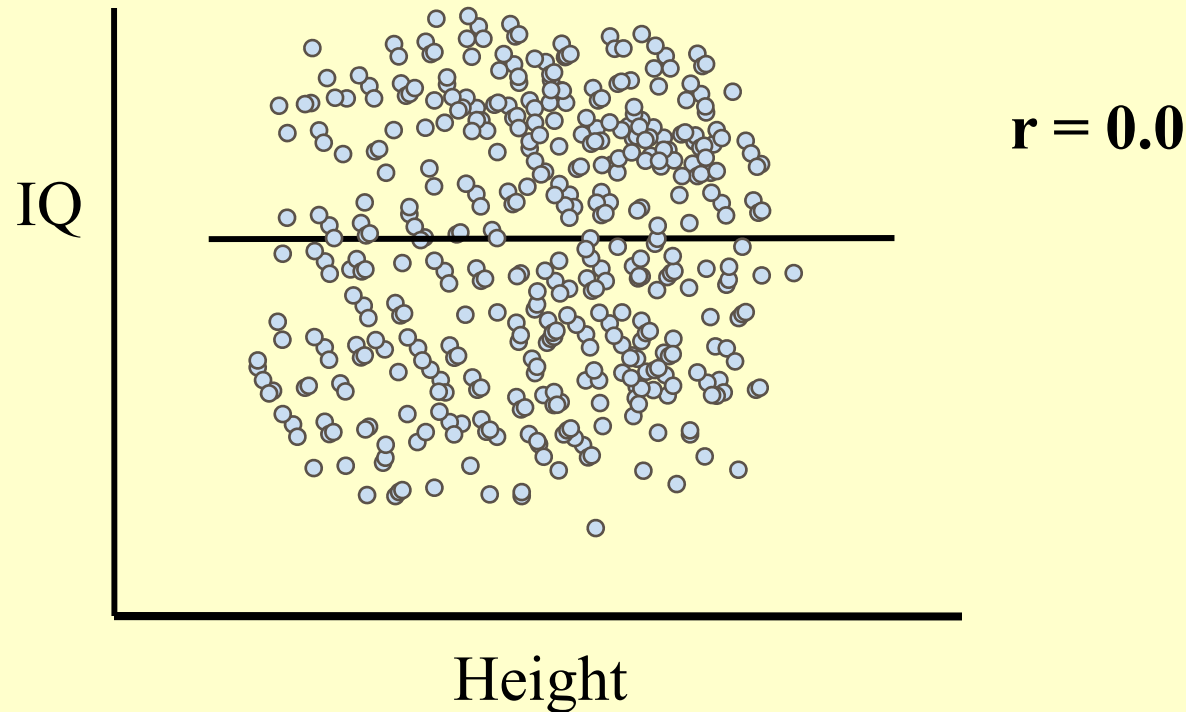


$$r = -0.2$$

Weight

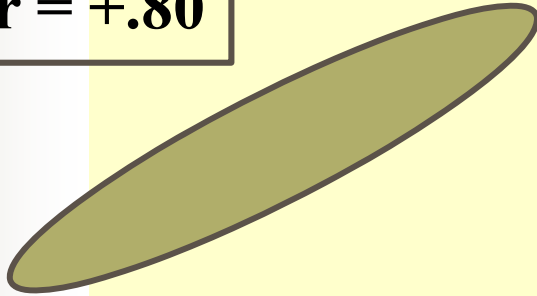
# Degree of correlation

- No Correlation (horizontal line)

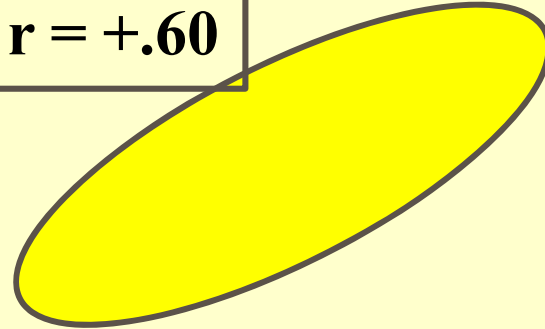


# Degree of correlation (r)

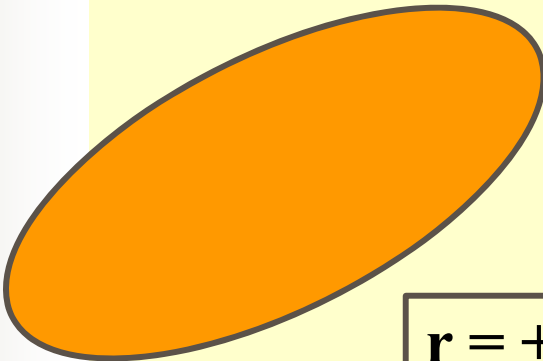
$r = +.80$



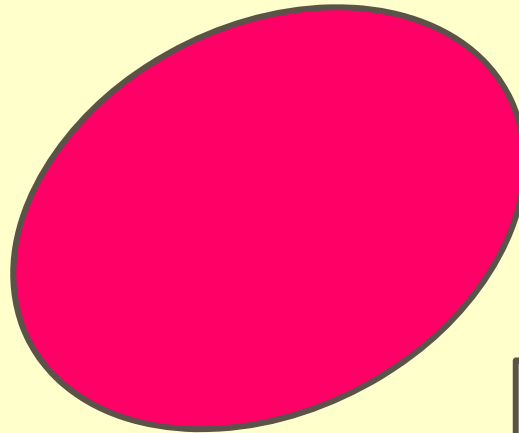
$r = +.60$



$r = +.40$



$r = +.20$





## 2) Direction of the Relationship

- **Positive relationship** – Variables change in the same direction.

- As X is increasing, Y is increasing
- As X is decreasing, Y is decreasing

Indicated by  
sign; (+) or (-).

- E.g., As height increases, so does weight.

- **Negative relationship** – Variables change in opposite directions.

- As X is increasing, Y is decreasing
- As X is decreasing, Y is increasing

- E.g., As TV time increases, grades decrease



# Advantages of Scatter Diagram

- Simple & Non Mathematical method
- Not influenced by the size of extreme item
- First step in investigating the relationship between two variables

# Disadvantage of scatter diagram



Can not adopt the an exact degree of correlation