Basic Statistics

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INTRODUCTION

- **Statistics is the science of collecting, organizing, analyzing, and interpreting numerical data.**

- It helps us **understand patterns**, **make predictions**, and **support decisions** using data.

Two main types of statistics

Descriptive Statistics

01.

Inferential Statistics

02.

1.Descriptive Statistics:

- **Purpose:** To **summarize and describe** data.

- **What it does:** Organizes raw data into a meaningful form.

Examples of tools:

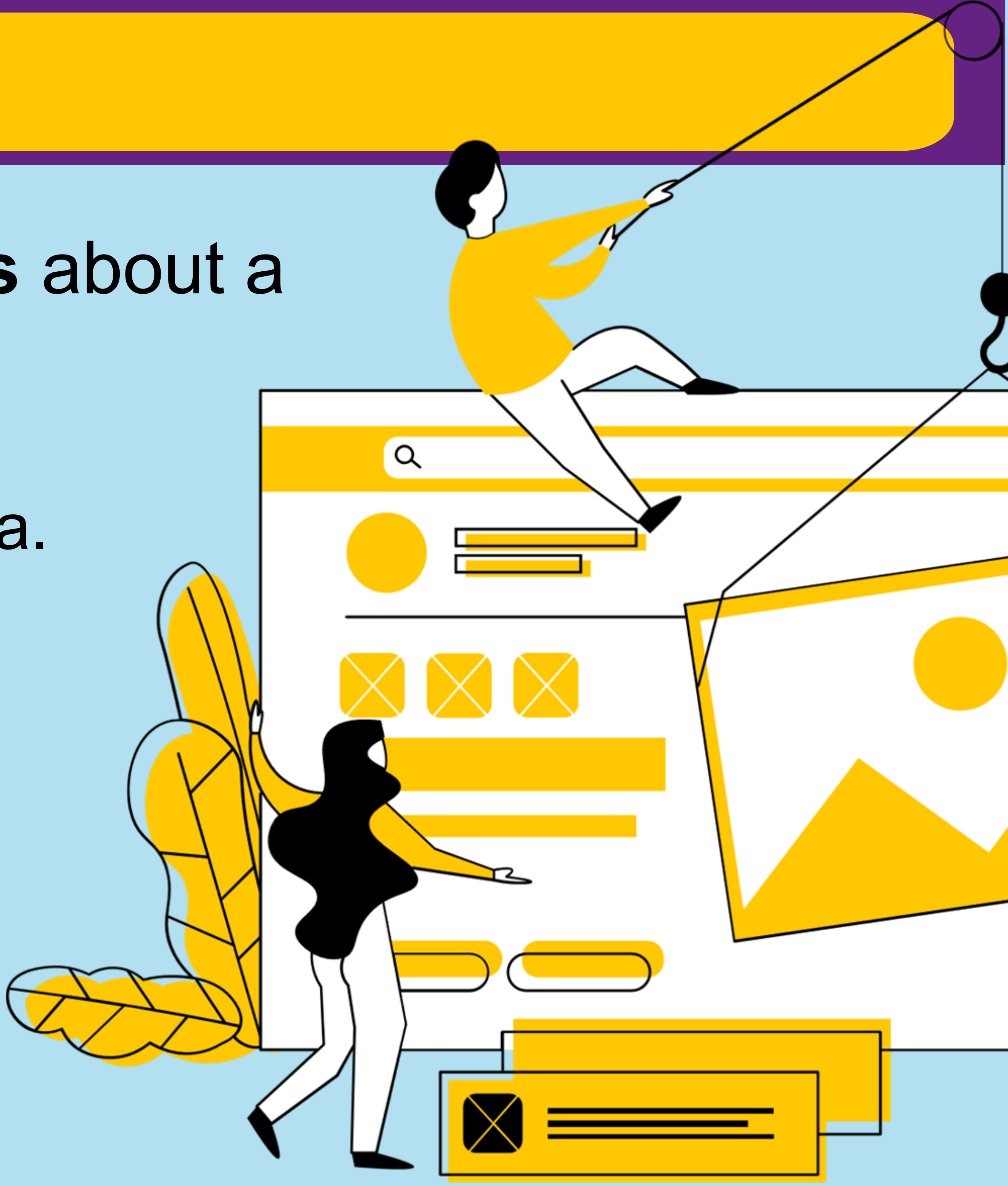
- Measures of central tendency (mean, median, mode)
- Measures of spread (range, variance, standard deviation)
- Tables, charts, and graphs

Weather Summaries: The average temperature in Basra during November.

2. Inferential Statistics

- **Purpose:** To **make predictions or draw conclusions** about a population based on a sample.

- **What it does:** Uses probability theory to generalize from data.

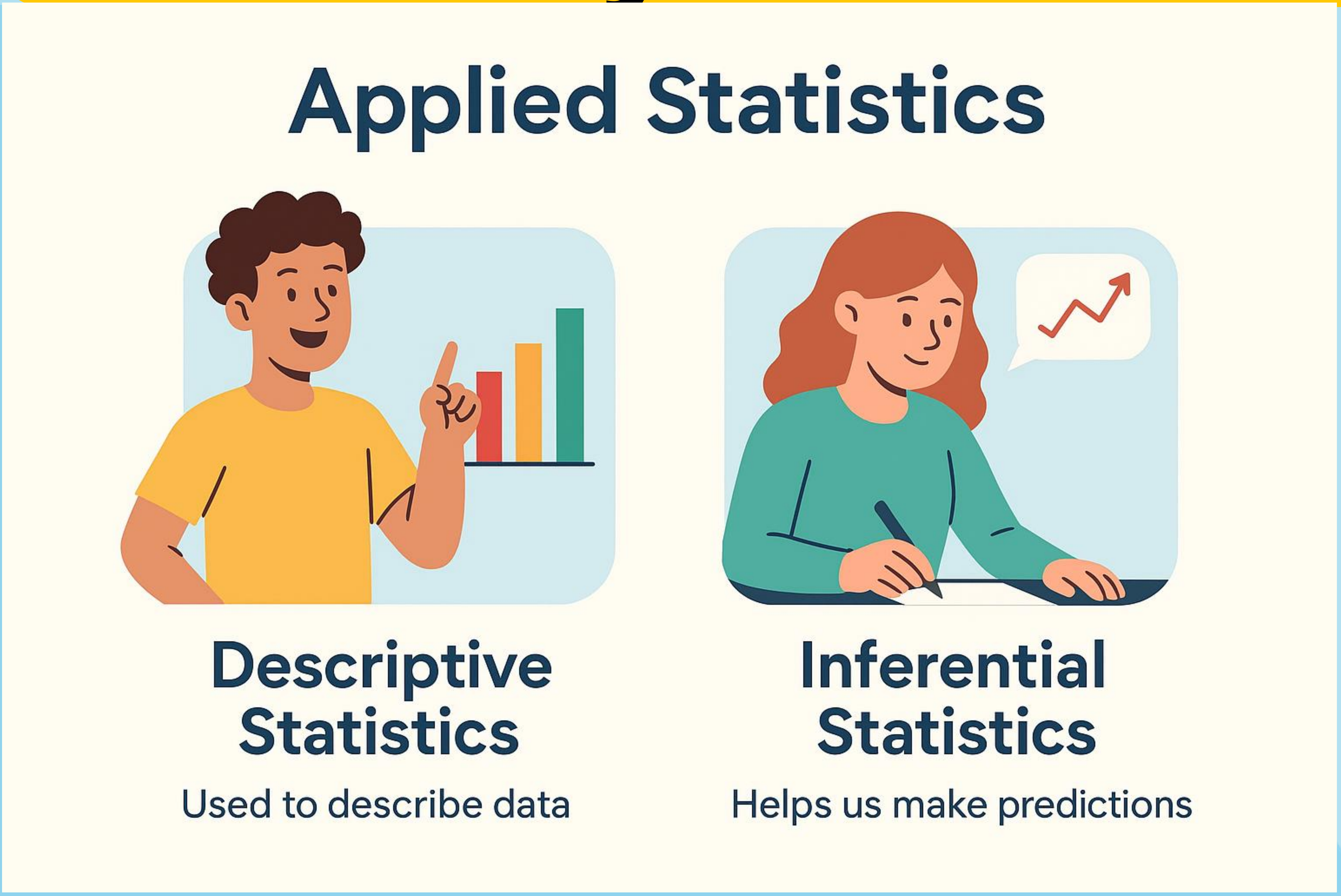


Examples of tools:

📊 *Hypothesis Testing* → document + calculator
- 📈 *Confidence Intervals* → bell curve with interval line
- 🔹 *Regression Analysis* → scatter plot with best-fit line
- 📦 *ANOVA* → three boxplots side by side

Educational Research: Predicting student performance based on a sample of class .

Summery


Applied Statistics
Descriptive Statistics
Used to describe data
Inferential Statistics
Helps us make predictions

نشاط

النشاط الجماعي (10 دقائق)

1. "When you read a report saying that *the average height of students in our university is 170 cm*, what kind of statistics is that?

A. "If we use that data to *predict* the average height of all university students in Iraq, what kind of statistics ?

توزيع الطلبة إلى مجموعتين:

Group A: gathers examples of descriptive statistics from real life

Group B: gathers examples of inferential statistics

Frequency Distribution

- Organizing Raw Data for Better Insights

FREQUENCY DISTRIBUTION

RAW DATA

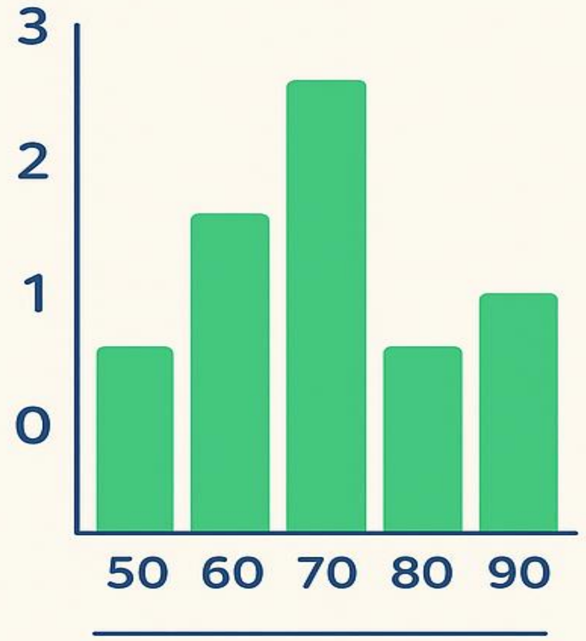
50 60 70 60 80
90 70 60 70

CLASSES

50–59	1
60–69	3
70–79	3
80–89	1
90–100	2

FREQUENCY DISTRIBUTION

CLASS	FREQUENCY
50–59	1
60–69	3
70–79	3
80–89	1
90–100	2



Cumulative Frequency

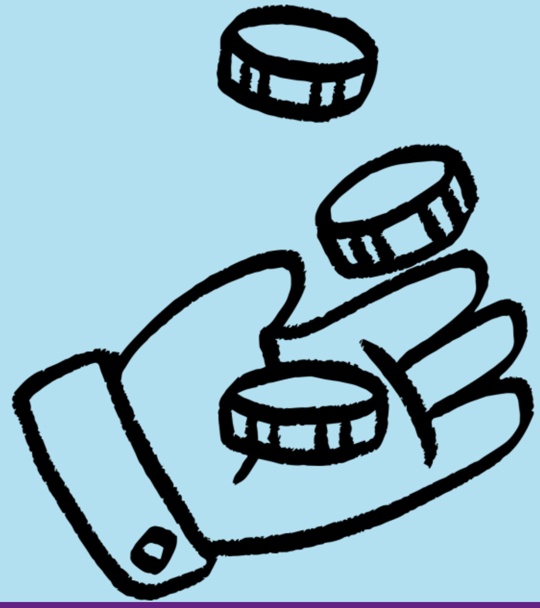
➢ **Cumulative frequency is the running total of the frequencies from the beginning up to that class.**

- **It helps us answer questions like: "How many students scored less than 90?"**

📊 Example Dataset

Score Range	Frequency	Cumulative Frequency
0–49	3	3
50–69	5	8
70–79	7	15
80–89	4	19
90–100	6	25

👉 So, **less than 90** → cumulative frequency = **19 students**.



Calss work Activity :

Students classify the fields as *Active* or *Inactive* and create a **frequency table**.

- **Use Excel:**

create a **frequency table:**

A. Histogram

B. Bar Chart

Iraq's Major Oil Fields – Sample Data

No.	Oil Field	Region	Status	Daily Production *(thousand barrels)*
1	Rumaila	South	Active	1,300
2	West Qurna 1	South	Active	800
3	Majnoon	South	Active	250
4	Kirkuk	North	Active	400
5	Qayyarah	North	Active	30
6	East Baghdad	Central	Inactive	0
7	Akkaz	West	Inactive	0
8	Al-Ahdab	Central	Active	140
9	Nasiriyah	South	Active	90
10	Hamrin	North	Inactive	0

Activity 2 :

Activity 3 :

A class interval table is given:

Class Interval	Frequency (f)
0–10	5
10–20	7
20–30	8
30–40	10

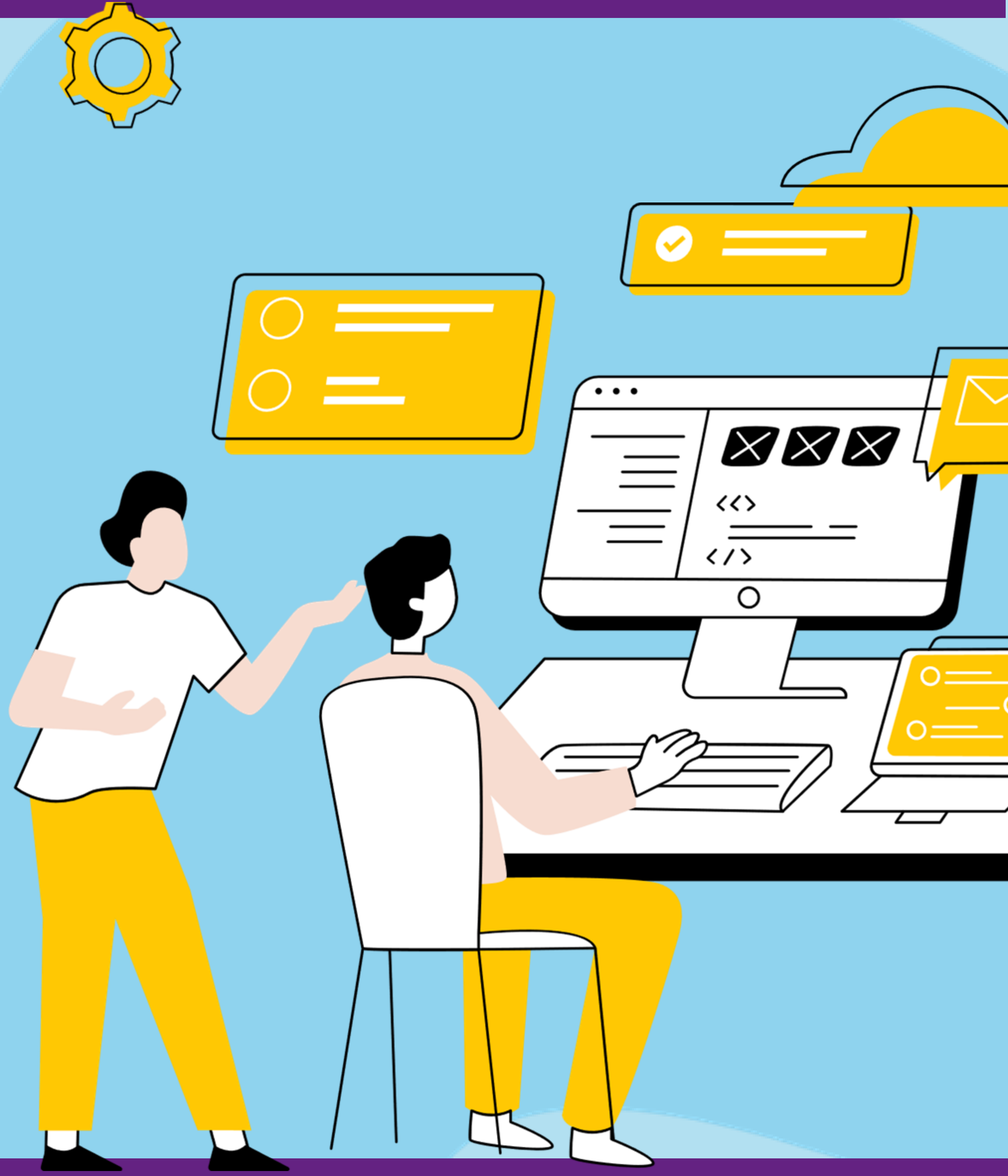
What is the **cumulative frequency (cf)** for the class 20–30?

- A) 8
- B) 12
- C) 20

H.W on Goggle Classroom

Basic Statistics

Part 2



Do you hear about Mean?

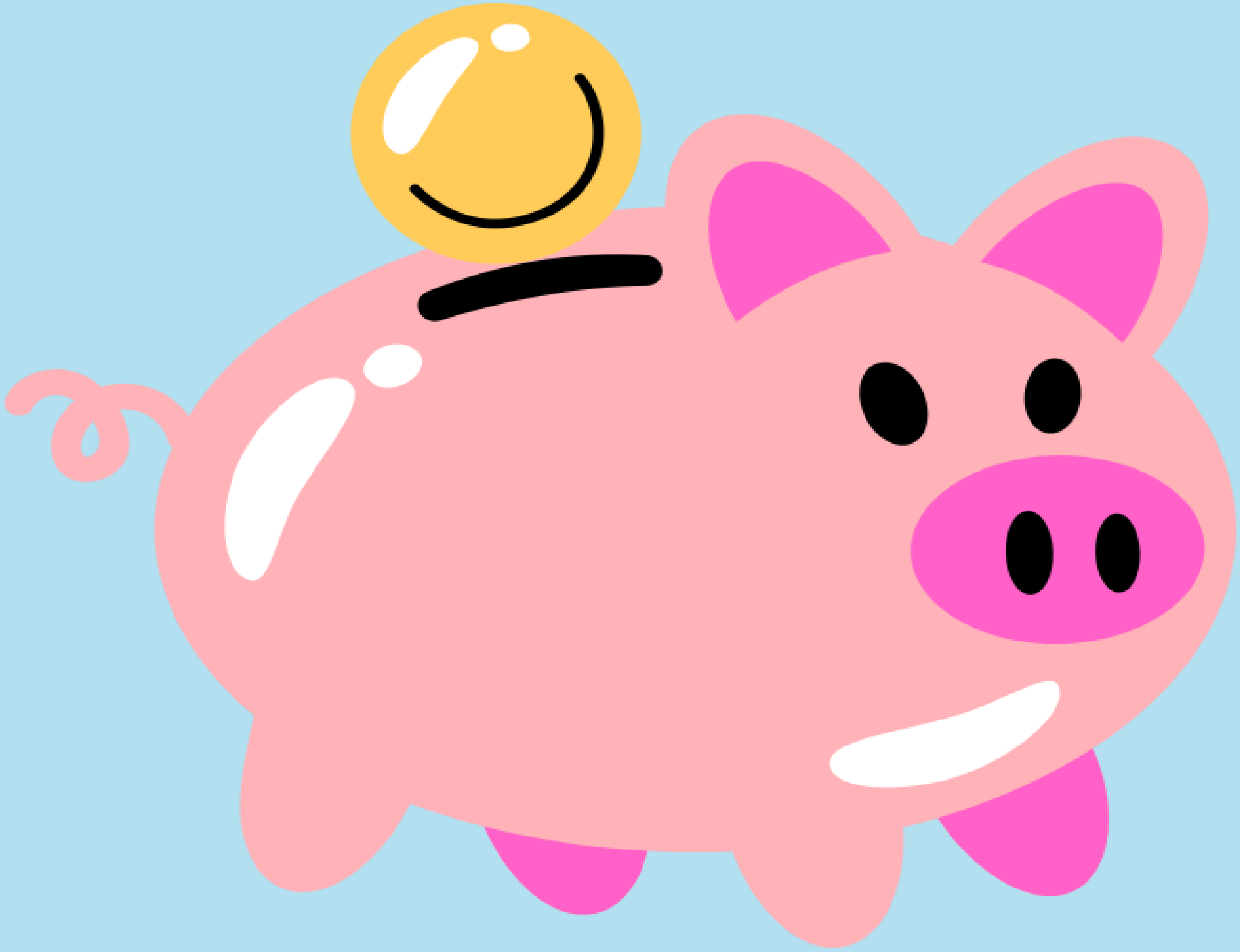
Mean (μ)

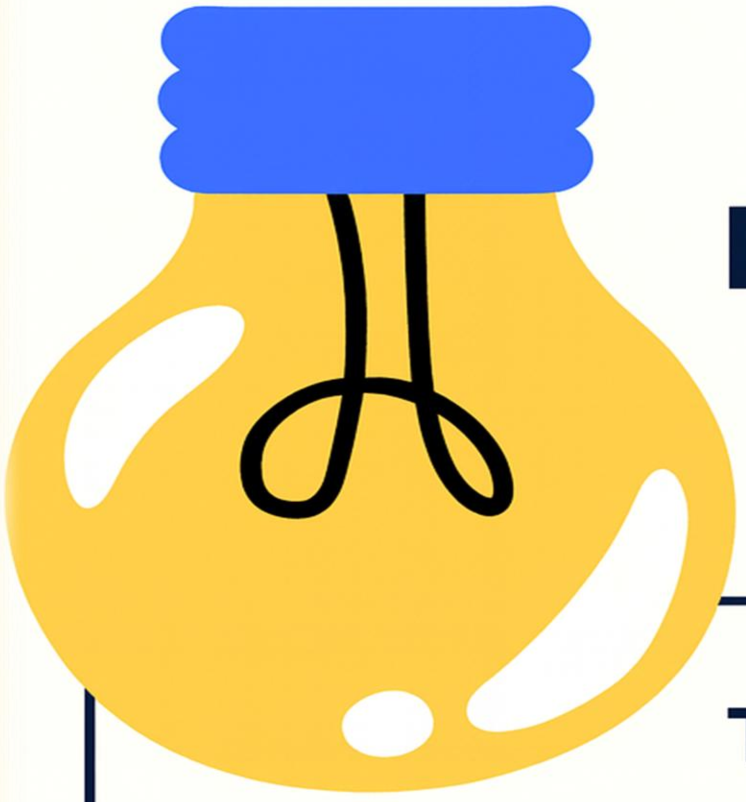
1. Introduction

The arithmetic mean, often called the ***average***, is one of the most commonly used measures of central tendency in statistics. It provides a single value that summarizes or represents an entire dataset

The mean is used to describe the general tendency of data, representing a “typical” or “central” value. In engineering and industrial fields, it helps identify average production rates, performance levels, or operational efficiency.

Mean (μ)





Definition

The arithmetic mean is defined as:

$$\text{Mean} = \frac{\text{Sum of all values}}{\text{Number of values}}$$

$$\bar{X} = \frac{\sum X_i}{n}$$

Example : Salaries (in $1000s)

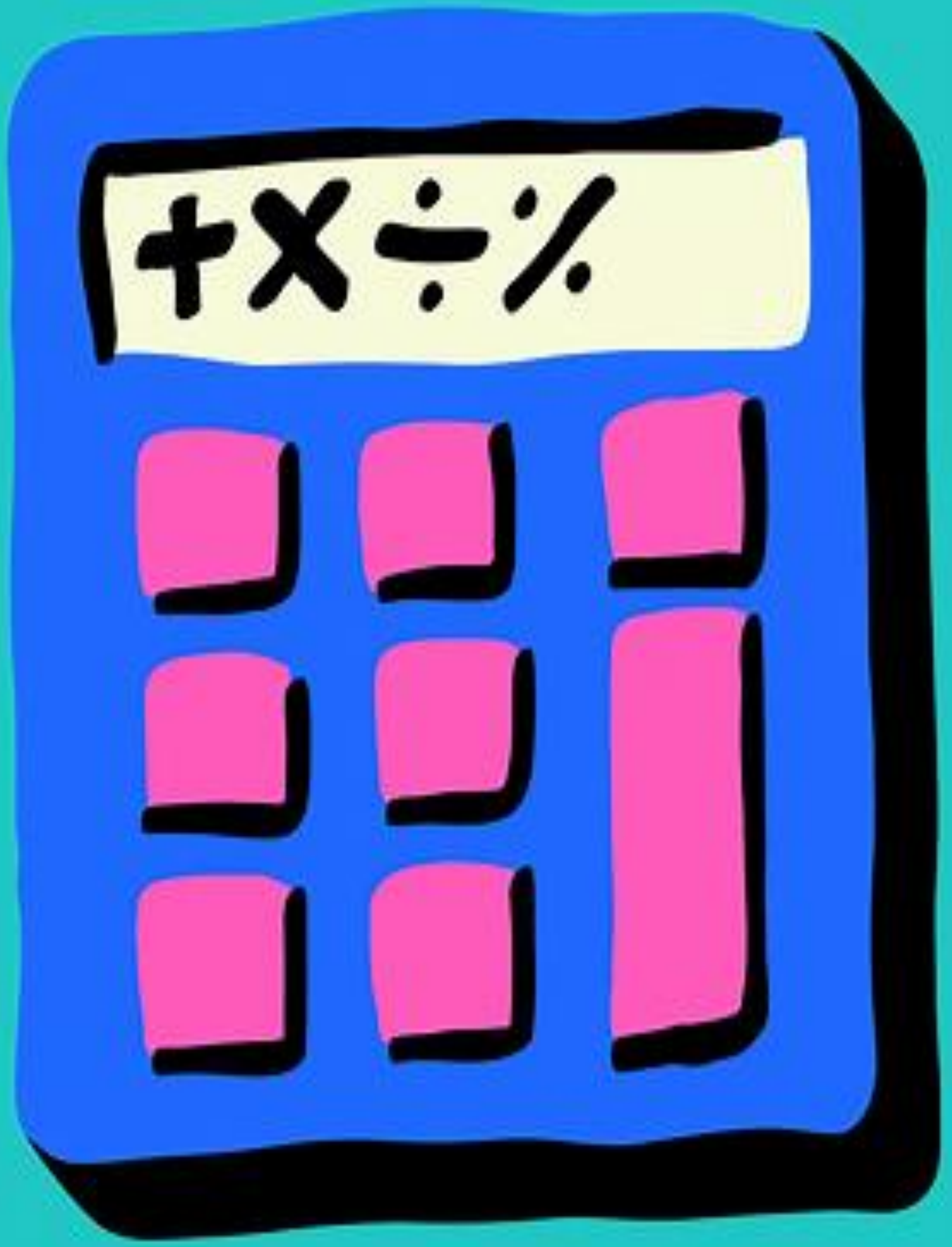
Problem: Find the mean of salaries: 2, 3, 4, 5, 6

Solution:

$$\bar{X} = \frac{2 + 3 + 4 + 5 + 6}{5} = \frac{20}{5} = 4$$

Answer: The mean salary = **4 (thousand dollars)**

Do you hear about SD?



INTRODUCTION

- The **standard deviation** is a key statistical measure that tells you how spread out the values in a dataset are. It quantifies the amount of variation or dispersion from the mean (average).

Two main types of standard deviation

for a population

01.

for a sample

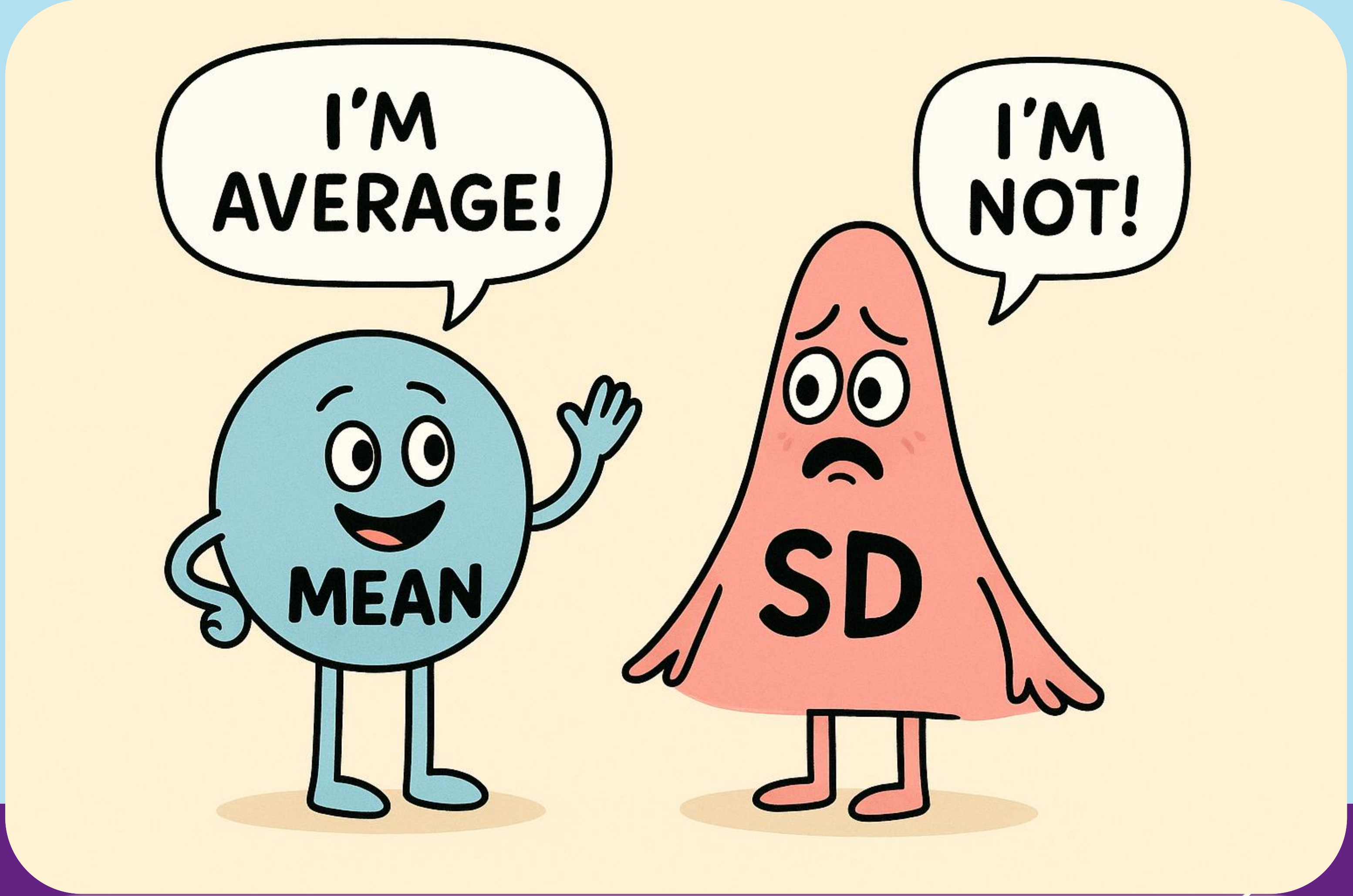
02.

Definition

Standard Deviation is a **measure of dispersion** in a dataset.

➢ It tells us how far the values spread out from the **mean (average)**.

- A **small SD** means the data points are close to the mean.
- A **large SD** means the data points are more spread out



Applications of Standard Deviation

- **Education**:

 To measure variation in student scores (e.g., how consistent exam results are).

- **Manufacturing**:

To check consistency in product quality (low SD means stable production).

1. Standard deviation for a population

:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

σ: standard deviation
N: number of data points
x_i :each individual data point
μ: mean of the dataset

2. Standard deviation for a sample

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

$\bar{x}$: sample mean

s: sample standard deviation

n: sample size

Example :

Dataset: Values: 4, 5, 8, 10

Steps 1

Mean:

$$\bar{X} = \frac{4+5+8+10}{4} = \frac{27}{4} = 6.75$$

Steps 2

Deviations from mean (Variance) :

4 − 6.75: -2.75
5 − 6.75: -1.75
8 − 6.75: 1.25
10 − 6.75: 3.25

Example :

Steps 3

Squared deviations:

$$(-2.75)^2 = 7.5625$$
$$(-1.75)^2 = 3.0625$$
$$(1.25)^2 = 1.5625$$
$$(3.25)^2 = 10.5625$$

Sum: $\mathbf{7.5625 + 3.0625 + 1.5625 + 10.5625 = 22.75}$

Steps 4

Population variance and SD:

$$\boldsymbol{\sigma^2 = \frac{22.75}{4} = 5.6875}$$
$$\boldsymbol{\sigma = \sqrt{5.6875} \approx 2.385}$$

Sample variance and SD (if this is a sample):

$$\boldsymbol{s^2 = \frac{22.75}{4-1} = \frac{22.75}{3} \approx 7.5833}$$

$$\boldsymbol{s = \sqrt{7.5833} \approx 2.753}$$

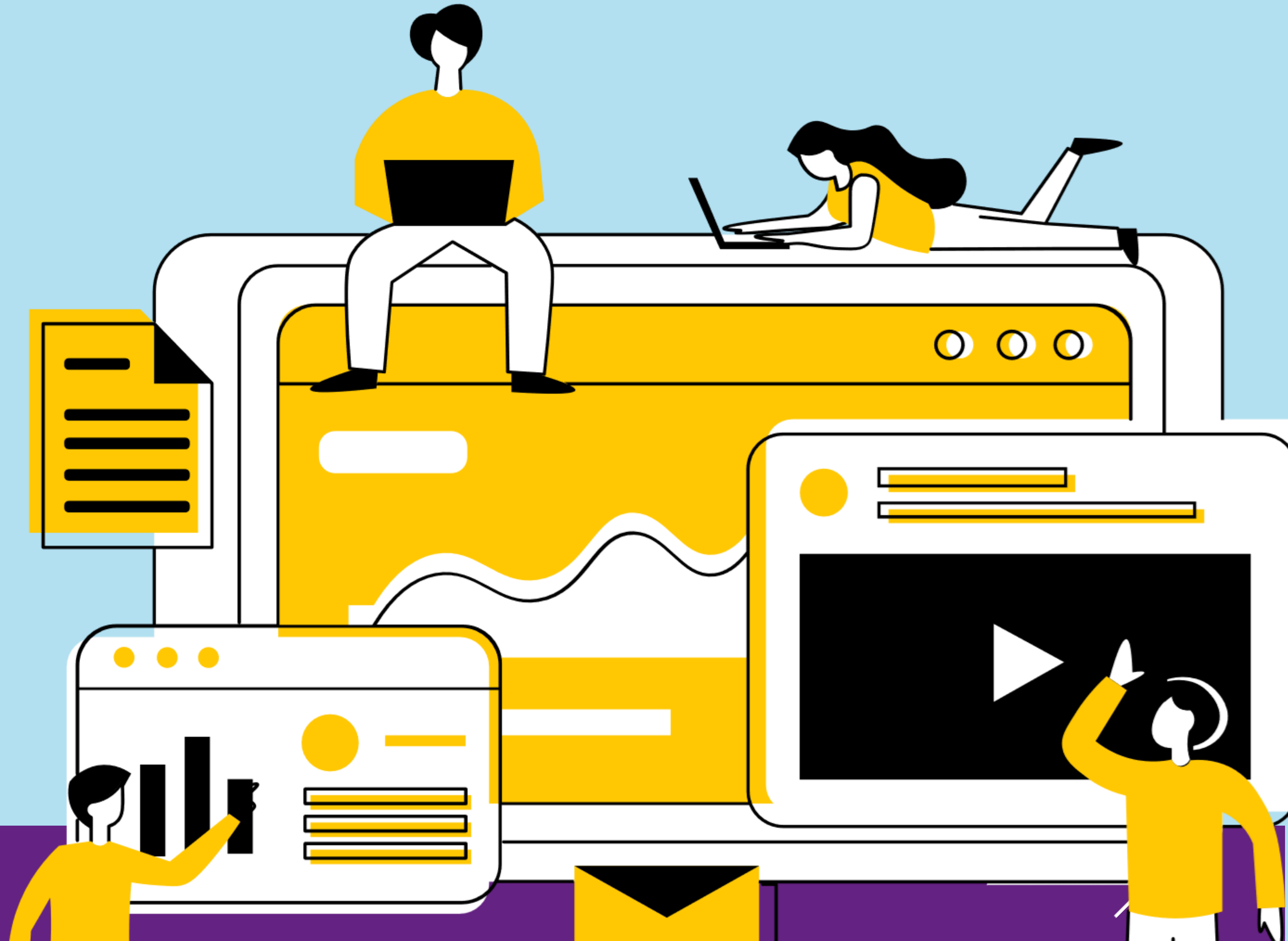
Activity Together Groups

An oil field produces the following barrels per day (BPD) over 7 days:

[10,200 | 10,500 | 10,300 | 10,400 | 10,700 | 10,600 | 10,300]

What is the SD :

- **for Population**
- **for a sample**



Class Work Activity

H.W

https://classroom.google.com/c/ODE1MTc5MzkxMzQ2/a/ODIyNTQ5MzY3NTE1/details

Thank You for listing