

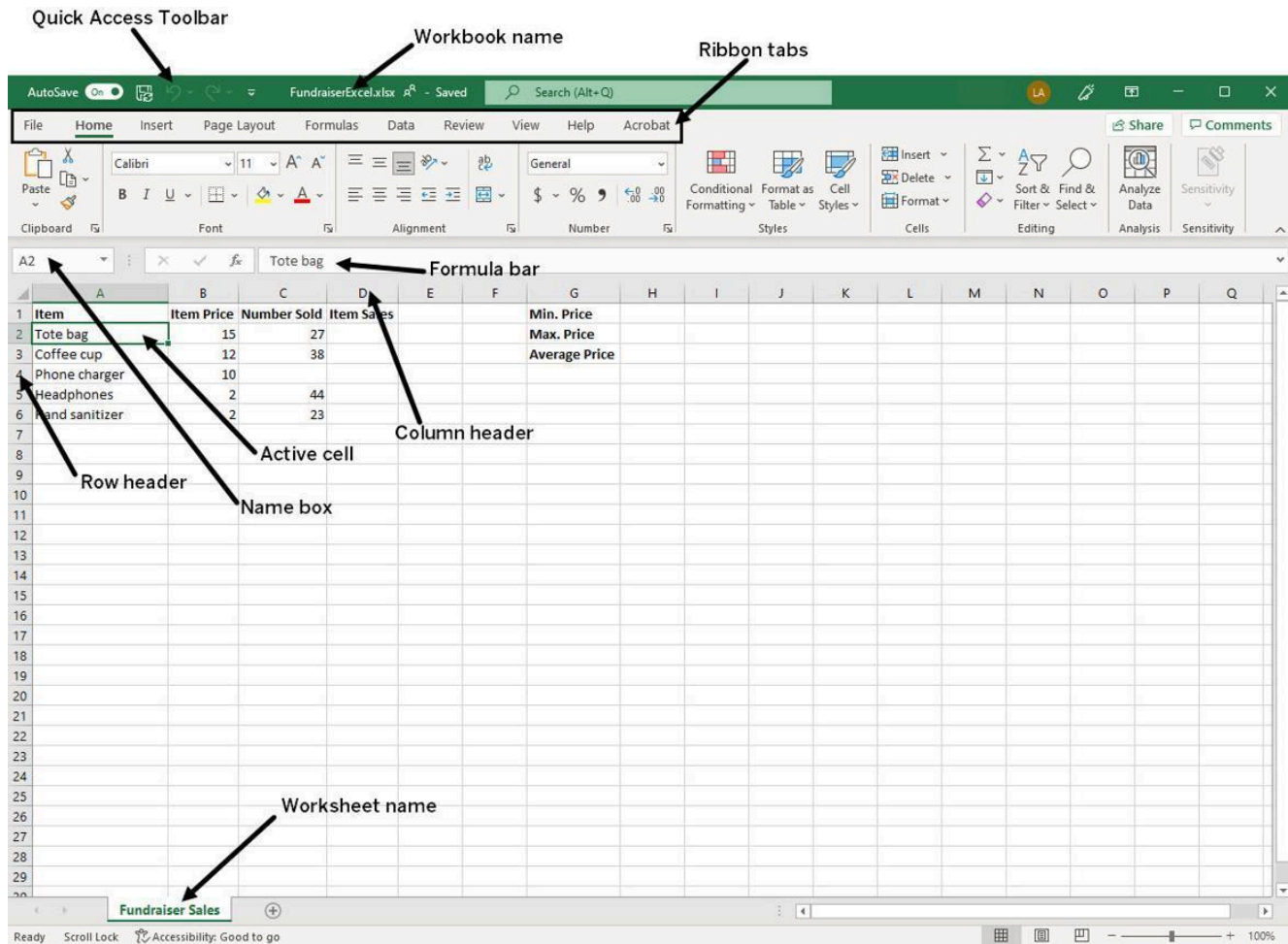
یہ نفسیات کے نوٹس میں نے خود آسان اور سادہ زبان میں تیار کیے ہیں۔ اگر ان سے کسی کو فائدہ ہو تو مجھے اپنی دعاؤں میں یاد رکھیے گا، اور گیارہ مرتبہ درودِ ابراہیمی بطور تحفہ ضرور پڑھ دیجیے گا۔

اللہ تعالیٰ ہم سب کو علمِ نافع عطا فرمائے، آمین۔

(محمد فہد شاہد (بی ایس سائیکولوجی-7 سمسٹر

CHAPTER 1: INTRODUCTION TO EXCEL

1. What is Excel?



	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							

Cell References in Excel

	A	B	C	D	E
1	Date	Product	Quantity(KG)	Rate Per KG	Total Amount
2	1/1/2019	Apple	1	25	=C2*D2
3	1/2/2019	Banana	4	40	160
4	1/3/2019	Apple	3	25	75
5	1/4/2019	Guava	8	50	400
6	1/5/2019	Apple	6	25	150
7	1/6/2019	Banana	5	40	200
8	1/7/2019	Cherry	5	60	300
9	1/8/2019	Guava	8	50	400
10	1/9/2019	Apple	3	25	75
11	1/10/2019	Banana	6	40	240

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✓ Simple Definition:

Excel is a **spreadsheet software** used to:

- Store data
- Perform calculations
- Analyze data

- Create charts/graphs

👉 Think Excel like a **digital notebook with automatic calculator**



2. Structure of Excel

♦ Workbook

- Complete Excel file
- Example: `Marks.xlsx`

♦ Worksheet

- Sheet inside workbook
- Like pages in notebook

♦ Rows & Columns

- Rows → Horizontal (1,2,3...)
- Columns → Vertical (A,B,C...)

♦ Cell

- Intersection of row & column
- Example: A1, B2

👉 **Memory Trick:**

👉 Cell = Column + Row (A1, B5)



3. Types of Data in Excel

Type	Example	Explanation
Label	Name	Text
Value	100	Numbers
Formula	=A1+B1	Calculation



4. Formulas in Excel

✅ **Definition:**

Formula = Calculation written in Excel

👉 Always start with =

Example:

=A1 + B1

⚙️ 5. Operators in Excel

♦ Arithmetic Operators

Operator Meaning

+	Add
-	Subtract
*	Multiply
/	Divide
^	Power

♦ Relational Operators

Operator Meaning

>	Greater
<	Less
=	Equal

🧠 6. Order of Precedence (VERY IMPORTANT)

👉 Excel follows order:

1. () Brackets
2. ^ Power
3.
 - /
4.
 - -

👉 Trick: **BODMAS**

Example:

=2+3*5 = 17 (not 25)

🎯 7. Precision vs Display

👉 Excel stores full value but shows rounded

Example:

Actual Display

0.125 0.13



8. Dates in Excel

- Excel stores date as numbers
- Used in calculations

Example:

=A2 - A1

👉 Gives number of days



9. Excel Practical (STEP BY STEP)

➤ Step 1: Open Excel

Start → Excel

➤ Step 2: Enter Data

Type in cells

➤ Step 3: Formula

Type:

=A1+B1

➤ Step 4: Save

Ctrl + S



10. Important Functions

Function	Use	Example
SUM	Add	=SUM(A1:A5)

Function	Use	Example
AVERAGE	Mean	=AVERAGE(A1:A5)
COUNT	Count numbers	=COUNT(A1:A5)



11. Exam Tips

- ✓ Always write formula with =
 - ✓ Learn shortcuts
 - ✓ Practice daily
 - ✓ Use brackets to avoid mistakes
-



MCQs (Chapter 1 – Detailed)

Q1. Excel is:

- A) Word processor
 - B) Spreadsheet software ✓
 - C) Browser
-

Q2. Intersection of row and column is:

- A) Table
 - B) Cell ✓
 - C) Sheet
-

Q3. Formula starts with:

- A) +
 - B) = ✓
 - C) *
-

Q4. Which is NOT operator?

- A) +
 - B) *
 - C) % (in basic Excel context) ✓
-

Q5. BODMAS means:

- A) Order of operations ☒
 - B) Formula type
 - C) Function
-

Q6. Workbook is:

- A) Page
 - B) File ☒
 - C) Cell
-

Q7. Row is:

- A) Vertical
 - B) Horizontal ☒
-

Q8. Column is:

- A) Horizontal
 - B) Vertical ☒
-

Q9. SUM function is used for:

- A) Multiply
 - B) Add ☒
-

Q10. Excel converts date into:

- A) Text
 - B) Number ☒
-



SHORT QUESTIONS (WITH ANSWERS)

Q1. What is Excel?

👉 Excel is a spreadsheet software used to store and analyze data.

Q2. What is a cell?

👉 A cell is the intersection of row and column.

Q3. What is formula?

👉 A formula is a calculation starting with =.

Q4. What is workbook?

👉 Excel file is called workbook.

Q5. What is worksheet?

👉 Sheet inside workbook.



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain Excel interface

👉 Excel interface includes:

- Ribbon
 - Formula bar
 - Rows & columns
 - Cells
-

Q2. Explain types of data

👉 Data types:

1. Label (text)
2. Value (numbers)
3. Formula (calculation)

Q3. Explain operators

👉 Operators perform calculations like +, -, *, /

PRACTICAL QUESTION (IMPORTANT)

👉 Create Excel sheet:

- Enter 5 numbers
 - Find sum and average
-

MEMORY TRICKS

- ✓ Cell = Column + Row
- ✓ Formula = must start with equal= sign
- ✓ BODMAS for order

CHAPTER 2: MEASURES OF CENTRAL TENDENCY

 What is Central Tendency?

Mean

The average value

How to find the Mean:

1. Add up all the numbers.
2. Divide the sum by the number of values.

E.g. The mean of 3,2,10,5 is

$$\frac{3+2+10+5}{4} = \frac{20}{4} = 5$$

Median

The middle number

How to find the Median:

1. Put the numbers from smallest to largest.
2. The number in the middle is the median. If there are two middle numbers, add them and divide by two.

Mode

The most frequent number

Special Cases:

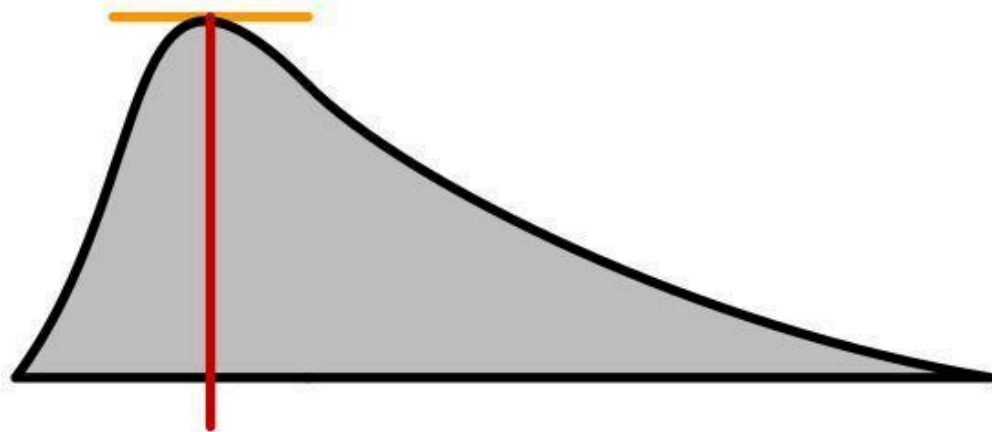
- **No Mode** if all the numbers occur the same amount of times.
- **More than one Mode** if more than one number is the most frequent.

Range

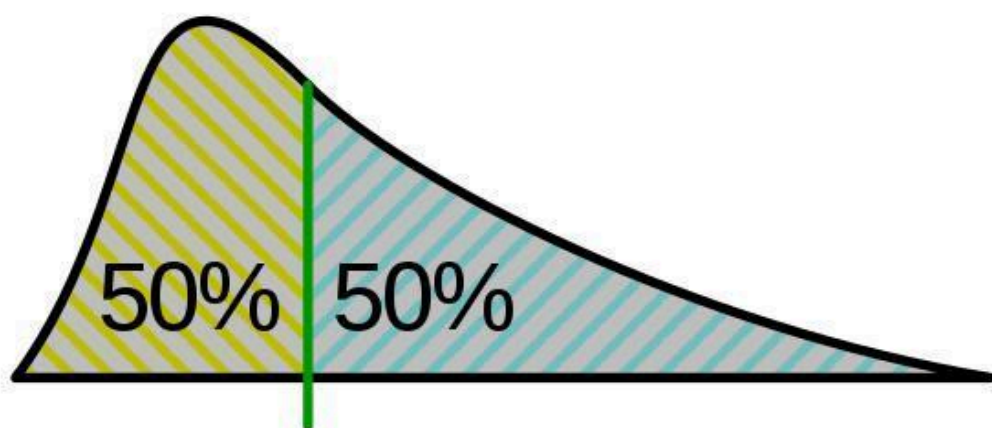
Difference between highest and lowest numbers

How to find the Range:

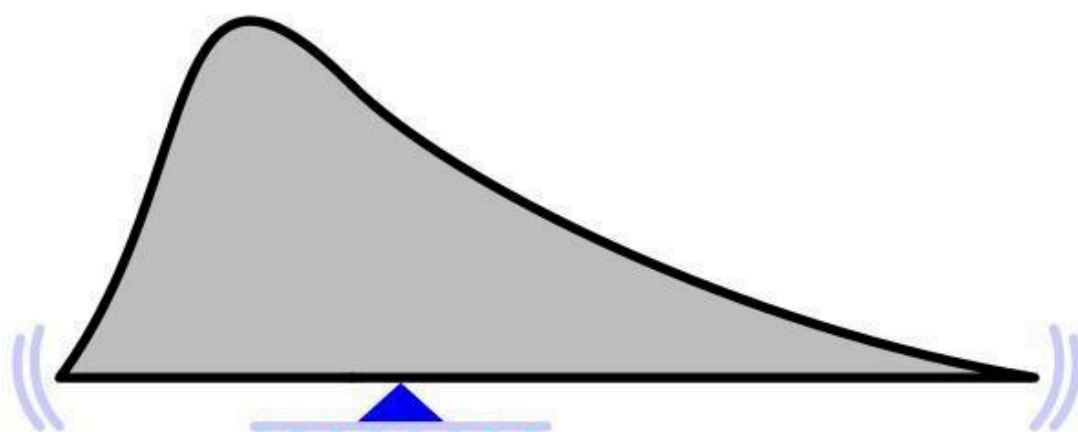
1. Put the numbers from smallest to largest.
2. Subtract the lowest value from the largest.



mode



median



mean

Example 17.

Find the median of the following set of numbers.

8 14 8 45 1 31 16 40 12 30 42 30 24

Solution.

Arrange the numbers from least to greatest. Find the middle term. In the case of an odd number of terms, find the middle term.

8 14 8 45 1 31 16 40 12 30 42 30 24

1 8 8 12 14 16 24 30 30 31 40 42 45



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✓ Simple Definition:

Central tendency means **center or average value of data**

👉 It tells:

“Data ka middle point kya hai?”

📌 Types of Central Tendency

1. Mean (Average)
2. Median (Middle value)
3. Mode (Most repeated value)

◆ 1. MEAN (AVERAGE)



Formula:

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



Simple Explanation:

👉 Add all values ÷ total numbers



Example:

Data: 2, 4, 6, 8

Step 1: Sum = 2+4+6+8 = 20

Step 2: n = 4

Mean = 20 ÷ 4 = 5



Important Point:

👉 Mean is affected by **outliers (extreme values)**

Example:

2, 3, 4, 100 → Mean becomes very large ❌



Mean in Excel

Steps:

1. Enter data in cells (A1:A5)
2. Click empty cell
3. Type:

=AVERAGE (A1 : A5)

◆ 2. MEDIAN

✓ Definition:

Median = **middle value after sorting data**



Steps:

Case 1: Odd numbers

Data: 1, 3, 5

👉 Median = 3

Case 2: Even numbers

Data: 1, 2, 3, 4

👉 Median = $(2+3)/2 = 2.5$



Important:

- ✓ Not affected by outliers
 - ✓ Best for skewed data
-



💻 Median in Excel

=MEDIAN (A1 : A5)

◆ 3. MODE

✓ Definition:

Mode = **most repeated value**



Example:

Data: 2, 3, 3, 5, 6

👉 Mode = 3

⚠ Important Points:

✓ Can be:

- No mode
 - One mode
 - More than one mode
-

👤💻 Mode in Excel

=MODE (A1 : A5)



COMPARISON TABLE

Measure	Meaning	Affected by Outliers
Mean	Average	Yes ✗
Median	Middle	No ✓
Mode	Most frequent	No ✓



EXAM TIPS (VERY IMPORTANT)

- ✓ If outliers → use Median
 - ✓ Normal data → use Mean
 - ✓ Repetition → use Mode
-



MEMORY TRICK

- 👉 Mean = Average
 - 👉 Median = Middle
 - 👉 Mode = Most
-



PRACTICAL NUMERICAL (VERY IMPORTANT)

Q: Find Mean, Median, Mode

Data: 5, 7, 8, 8, 10

Solution:

Mean:

$$\text{Sum} = 38$$

$$n = 5$$

$$\text{Mean} = 38/5 = 7.6$$

Median:

$$\text{Middle value} = 8$$

Mode:

$$\text{Most frequent} = 8$$



MCQs (LOTS – WITH ANSWERS)

Q1. Mean is:

- A) Middle
 - B) Average ☒
 - C) Frequency
-

Q2. Median is:

- A) Average
 - B) Middle value ☒
 - C) Maximum
-

Q3. Mode is:

- A) Least value
 - B) Most repeated value ☒
-

Q4. Which is affected by outliers?

- A) Mean ☒
 - B) Median
 - C) Mode
-

Q5. Median of 1,2,3,4 is:

- A) 2
 - B) 2.5 ☒
 - C) 3
-

Q6. Mode of 2,2,3,4 is:

- A) 2 ☒
 - B) 3
 - C) 4
-

Q7. Mean formula is:

- A) Sum/n ☒
 - B) Max-min
 - C) Frequency
-

Q8. Median requires:

- A) Sorting data ☒
 - B) Multiplying
 - C) Graph
-

Q9. If no value repeats:

- A) Mode exists
B) No mode 
-

Q10. Best for skewed data:

- A) Mean
B) Median 
-



SHORT QUESTIONS (WITH ANSWERS)

Q1. Define Mean

- 👉 Mean is sum of values divided by total numbers
-

Q2. Define Median

- 👉 Median is middle value of sorted data
-

Q3. Define Mode

- 👉 Mode is most repeated value
-

Q4. Which measure is not affected by extreme values?

- 👉 Median
-



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain Mean, Median, Mode

- 👉 Mean: Average value
👉 Median: Middle value
👉 Mode: Most frequent value
-

Q2. Compare Mean and Median

- 👉 Mean affected by outliers
 - 👉 Median not affected
-

Q3. Explain importance of central tendency

👉 Helps to:

- Summarize data
 - Understand distribution
 - Make decisions
-



EXCEL PRACTICAL QUESTION

👉 Enter data: 10, 20, 30, 40

Find:

- Mean
 - Median
 - Mode
-



FINAL QUICK REVISION

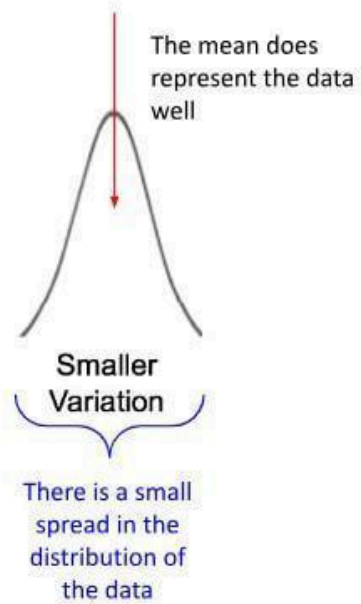
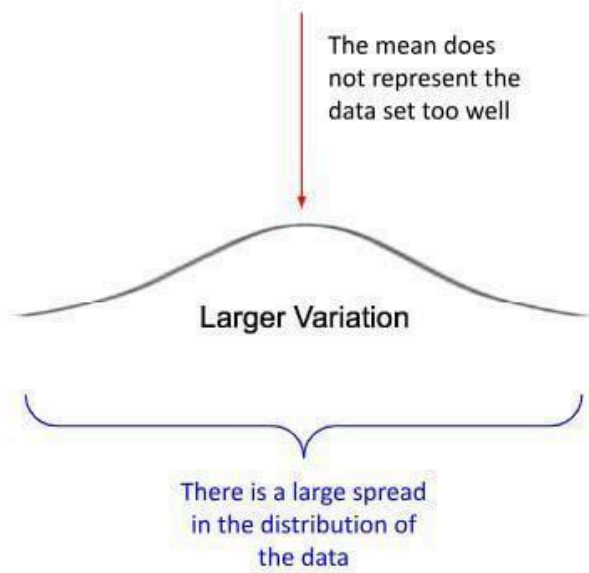
- ✓ Mean = $\text{Sum} \div n$
- ✓ Median = Middle
- ✓ Mode = Most frequent

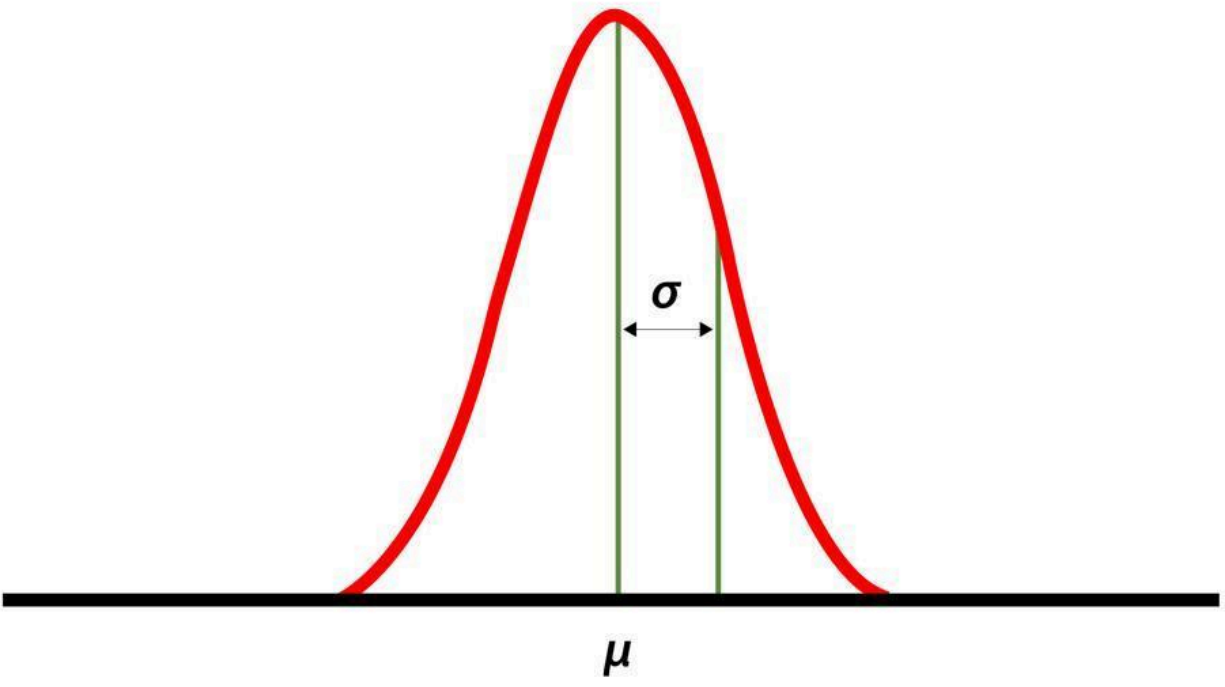
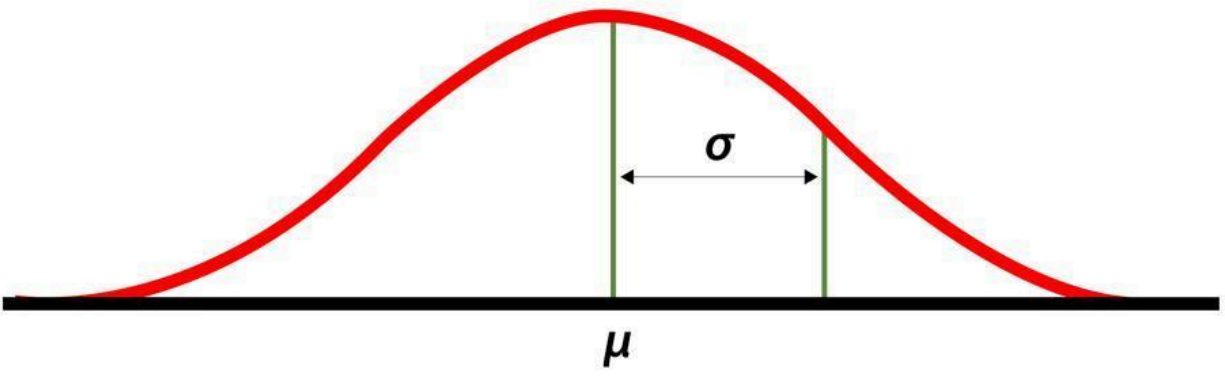


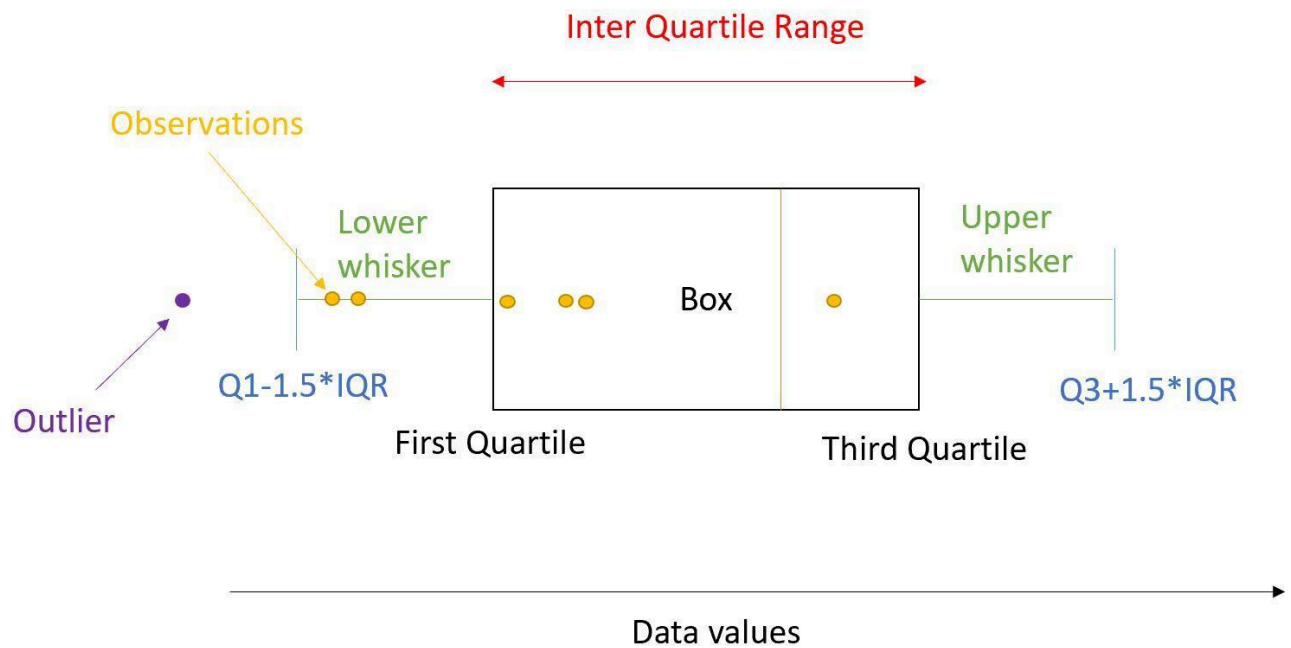
CHAPTER 3: MEASURES OF DISPERSION



What is Dispersion?







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✓ Simple Definition:

Dispersion means **how much data is spread out**

👉 It tells:

“Data ek jaga close hai ya phaila hua hai?”

📌 Why Dispersion is Important?

- ✓ Shows variability
- ✓ Helps compare datasets
- ✓ Used in decision making
- ✓ Important in exams



TYPES OF DISPERSION

1. Range
2. Variance
3. Standard Deviation
4. Interquartile Range (IQR)
5. Coefficient of Variation (CV)

◆ 1. RANGE



Formula:

$$\text{Range} = X_{\max} - X_{\min}$$



Explanation:

👉 Difference between highest and lowest value



Example:

Data: 2, 5, 8, 10

Max = 10

Min = 2

$$\text{Range} = 10 - 2 = 8$$



Disadvantages

- ✗ Uses only 2 values
 - ✗ Affected by outliers
-



Trick:

👉 “Range = Big – Small”

◆ 2. VARIANCE



Formula:

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

2.0

nnn

7.0

$$\bar{x} \approx -0.01, s^2 \approx 1.934$$

$$\bar{x} = -0.01, s^2 \approx 1.934$$



Explanation:

👉 Average of squared differences from mean



Example:

Data: 2, 4, 6

Mean = 4

Steps:

$$(2-4)^2 = 4$$

$$(4-4)^2 = 0$$

$$(6-4)^2 = 4$$

Sum = 8

$$\text{Variance} = 8/(3-1) = 4$$



Important:

✓ Square is used to remove negatives

◆ 3. STANDARD DEVIATION (MOST IMPORTANT)



Formula:

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



nnn



$\bar{x} \approx -0.01, s^2 \approx 1.934$
 $\bar{x} \approx -0.01, s^2 \approx 1.934$
 $\bar{x} \approx -0.01, s^2 \approx 1.934$



Explanation:

👉 Square root of variance

👉 Shows real spread in same unit



Example:

Variance = 4

SD = $\sqrt{4} = 2$



Interpretation:

SD Value	Meaning
Small	Data close
Large	Data spread



Trick:

👉 “SD = Spread Distance”



4. INTERQUARTILE RANGE (IQR)



Formula:

IQR = $Q_3 - Q_1$



Explanation:

👉 Middle 50% data



Example:

Data: 1,2,3,4,5,6,7

$Q1 = 2$

$Q3 = 6$

$IQR = 6 - 2 = 4$



Advantage:

✓ Not affected by outliers

◆ 5. COEFFICIENT OF VARIATION (CV)



Formula:

$$CV = \frac{s}{\bar{X}} \times 100 \quad CV = \frac{s}{\bar{X}} \times 100$$



Explanation:

👉 Shows variation in percentage



Example:

Mean = 50

SD = 5

$$CV = (5/50) \times 100 = 10\%$$



Use:

- ✓ Compare different datasets
-



EXCEL PRACTICAL (VERY IMPORTANT)

Step-by-Step:

➤ Enter Data in Column A

➤ Range:

=MAX (A1 : A10) - MIN (A1 : A10)

➤ Variance:

=VAR (A1 : A10)

➤ Standard Deviation:

=STDEV (A1 : A10)



EXAM TIPS

- ✓ SD is MOST important
 - ✓ Always show steps
 - ✓ Remember formulas
 - ✓ Practice numericals
-



MEMORY TRICKS

- ✓ Range = Max – Min
 - ✓ Variance = squared differences
 - ✓ SD = $\sqrt{\text{variance}}$
 - ✓ CV = percentage
-



SOLVED NUMERICAL (IMPORTANT)

Q: Find Range, Variance, SD

Data: 4, 6, 8

Step 1: Mean

$$= (4+6+8)/3 = 6$$

Step 2: Variance

$$(4-6)^2 = 4$$

$$(6-6)^2 = 0$$

$$(8-6)^2 = 4$$

$$\text{Sum} = 8$$

$$\text{Variance} = 8/2 = 4$$

Step 3: SD

$$\sqrt{4} = 2$$

Step 4: Range

$$8 - 4 = 4$$



MCQs (LOTS – EXAM LEVEL)

Q1. Range formula:

A) Max – Min ☒

B) Sum/n

C) Mean

Q2. SD is:

- A) Square
 - B) Square root of variance ☒
-

Q3. Variance uses:

- A) Squares ☒
 - B) Addition
-

Q4. Which is MOST important?

- A) Range
 - B) SD ☒
-

Q5. IQR formula:

- A) $Q3 - Q1$ ☒
 - B) $Q1 - Q3$
-

Q6. CV is:

- A) Ratio
 - B) Percentage ☒
-

Q7. Small SD means:

- A) Spread
 - B) Close data ☒
-

Q8. Range depends on:

- A) All values
 - B) Only max & min ☒
-

Q9. Variance removes:

A) Negatives using square 

Q10. SD unit is:

A) Same as data 



SHORT QUESTIONS (WITH ANSWERS)

Q1. Define Range

 Difference between max and min

Q2. Define Variance

 Average squared deviation

Q3. Define SD

 Square root of variance

Q4. Define IQR

 Difference between Q3 and Q1

Q5. Define CV

 Ratio of SD to mean in %



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain measures of dispersion

 Includes:

- Range
 - Variance
 - SD
 - IQR
 - CV
-

Q2. Compare Range and SD

- 👉 Range: simple, less accurate
 - 👉 SD: accurate, uses all values
-

Q3. Explain importance of SD

👉 Helps:

- Understand spread
 - Compare data
 - Decision making
-



PRACTICAL QUESTION

👉 Enter data in Excel

Find:

- Range
 - Variance
 - SD
-



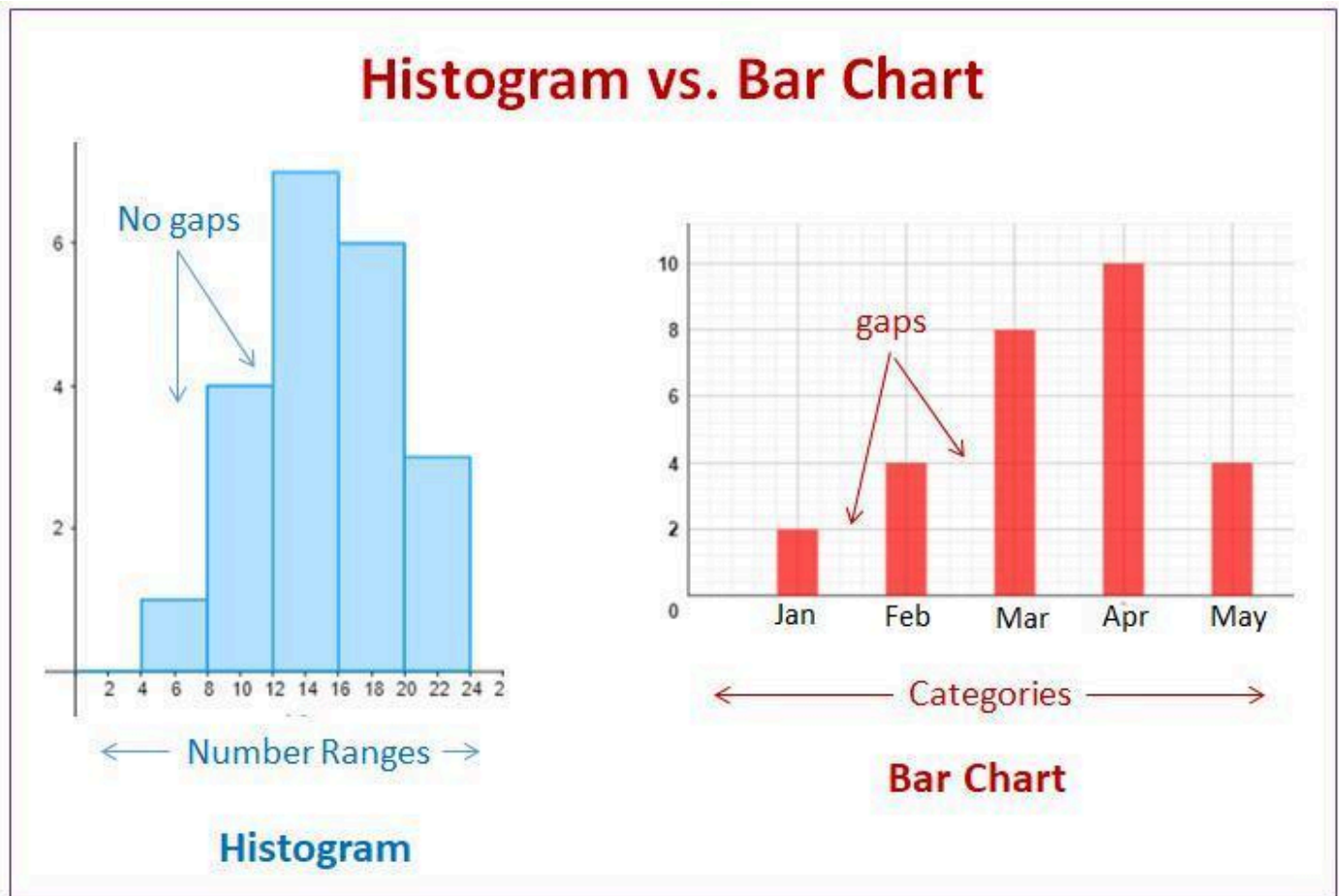
FINAL REVISION

- ✓ Range = Max – Min
- ✓ Variance = squared difference
- ✓ SD = $\sqrt{\text{variance}}$
- ✓ IQR = Q3 – Q1
- ✓ CV = % variation

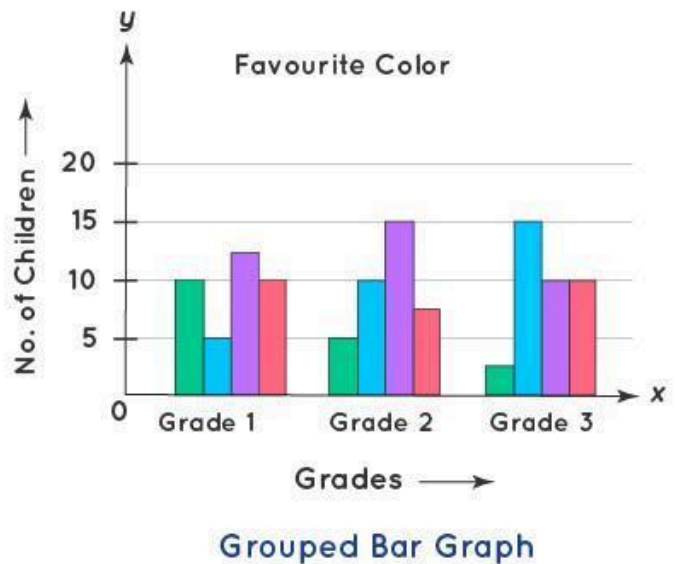
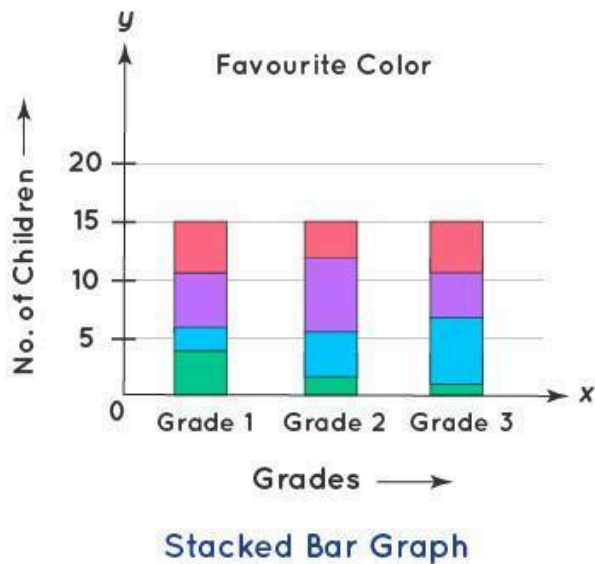
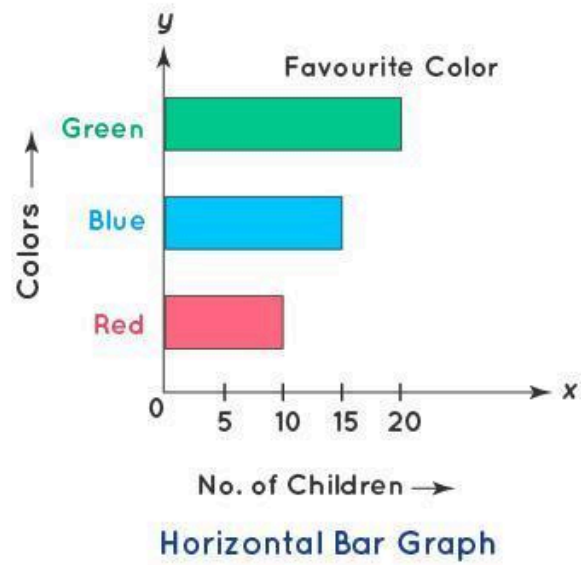
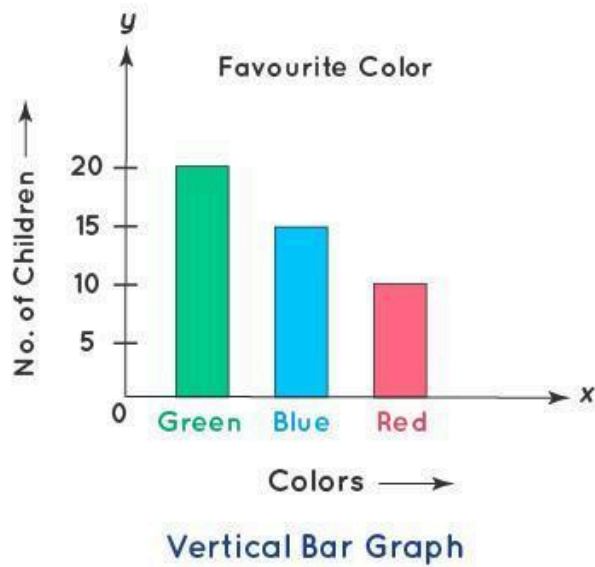
CHAPTER 4: GRAPHS & DATA PRESENTATION

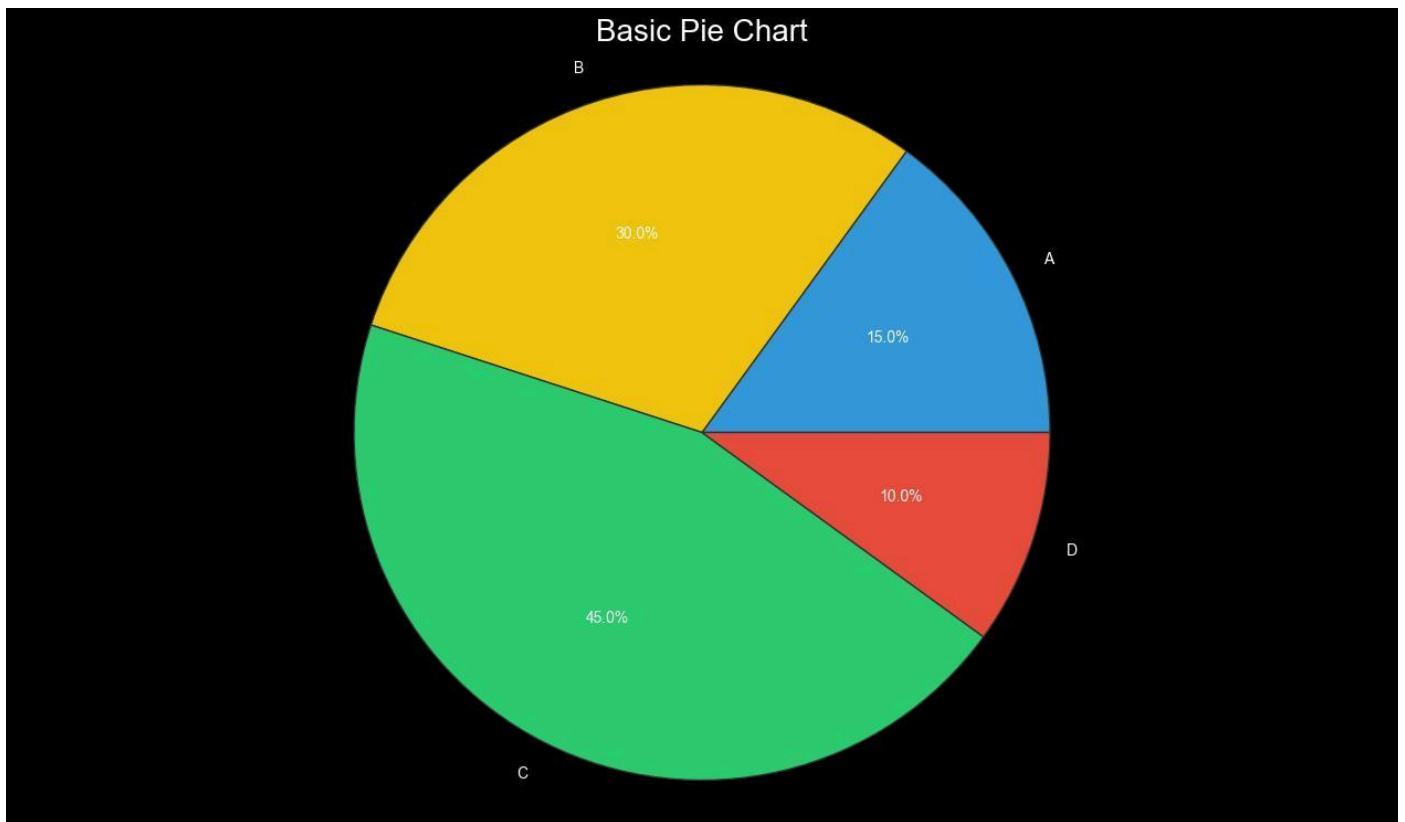


Why Graphs are Important?



Types of Bar Graph





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✓ Simple Idea:

Graphs help us:

- Understand data quickly
- Make decisions
- Compare values

👉 Instead of reading numbers, we **see the data visually**



TYPES OF DATA PRESENTATION

1. Frequency Distribution (Table)
2. Histogram
3. Bar Chart
4. Pie Chart
5. Cumulative Graph (Ogive)

◆ 1. FREQUENCY DISTRIBUTION



Definition:

Table showing how many times values occur



Steps to Make Table

Example Data:

12, 15, 18, 22, 25, 27, 30

Step 1: Find Range

$$30 - 12 = 18$$

Step 2: Choose classes

Example: 10–20, 20–30

Step 3: Count frequency

Class **Frequency**

10–20 3

20–30 4



Important Rules

- ✓ Classes should not overlap
 - ✓ Use 5–15 classes
 - ✓ Equal width
-

◆ 2. HISTOGRAM



Definition:

Graph using **bars (no gaps)** for continuous data



Key Features:

- ✓ No space between bars
 - ✓ X-axis = class intervals
 - ✓ Y-axis = frequency
-

Example Understanding:

- Height of bar = frequency
 - More height → more data
-

Trick:

👉 Histogram = “No Gap Graph”

◆ **3. BAR CHART**

Definition:

Graph using bars for **categorical data**

Features:

- ✓ Bars have **gaps**
 - ✓ Used for categories
-

Example:

Color Number

Red 10

Blue 5

Trick:

👉 Bar chart = “Categories + Gap”

◆ 4. PIE CHART



Definition:

Circle divided into parts



Features:

- ✓ Shows percentage
 - ✓ Total = 100%
-



Example:

Category	%
A	40%
B	60%



Trick:

- 👉 Pie = “Parts of whole”
-

◆ 5. OGIVE (CUMULATIVE GRAPH)



Definition:

Graph of cumulative frequency



Use:

- ✓ Find median
 - ✓ Analyze distribution
-



EXCEL PRACTICAL (VERY IMPORTANT)



Create Chart in Excel

Steps:

1. Enter data
 2. Select data
 3. Click **Insert** tab
 4. Choose chart:
 - Bar
 - Pie
 - Histogram
-



Histogram in Excel

Insert → Charts → Histogram



Pie Chart

Insert → Pie Chart



Bar Chart

Insert → Bar Chart



EXAM TIPS

- ✓ Histogram = no gaps
 - ✓ Bar chart = gaps
 - ✓ Pie chart = percentage
 - ✓ Practice drawing
-



MEMORY TRICKS

- ✓ Histogram → “No Gap”
 - ✓ Bar → “Gap”
 - ✓ Pie → “100%”
-



SOLVED EXAMPLE

Data: 5, 10, 15, 20

👉 Bar chart:

- X-axis = values
 - Y-axis = frequency
-



MCQs (LOTS – EXAM LEVEL)

Q1. Histogram has:

- A) Gaps
 - B) No gaps ✓
-

Q2. Bar chart is used for:

- A) Continuous data
 - B) Categorical data ✓
-

Q3. Pie chart shows:

- A) Frequency
 - B) Percentage ✓
-

Q4. Total of pie chart:

- A) 50%
- B) 100% ✓

Q5. Frequency distribution is:

- A) Graph
- B) Table ☒

Q6. Histogram uses:

- A) Categories
- B) Continuous data ☒

Q7. Ogive is:

- A) Bar chart
- B) Cumulative graph ☒

Q8. Bars in histogram:

- A) Touch each other ☒
- B) Separate

Q9. Bar chart bars:

- A) Touch
- B) Have gaps ☒

Q10. Graph helps:

- A) Confuse
 - B) Understand data ☒
-



SHORT QUESTIONS (WITH ANSWERS)

Q1. What is histogram?

👉 Graph with no gaps for continuous data

Q2. What is bar chart?

👉 Graph with gaps for categories

Q3. What is pie chart?

👉 Circle showing percentages

Q4. What is frequency distribution?

👉 Table of frequencies



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain histogram, bar chart, pie chart

👉 Histogram → continuous

👉 Bar → categorical

👉 Pie → percentage

Q2. Difference between histogram and bar chart

👉 Histogram → no gaps

👉 Bar → gaps

Q3. Importance of graphs

👉 Helps:

- Understand data
 - Compare values
 - Make decisions
-



PRACTICAL QUESTIONS

👉 Draw:

- Histogram
 - Bar chart
 - Pie chart
-



FINAL REVISION

- ✓ Histogram = No gap
- ✓ Bar = Gap
- ✓ Pie = Percentage
- ✓ Ogive = Cumulative

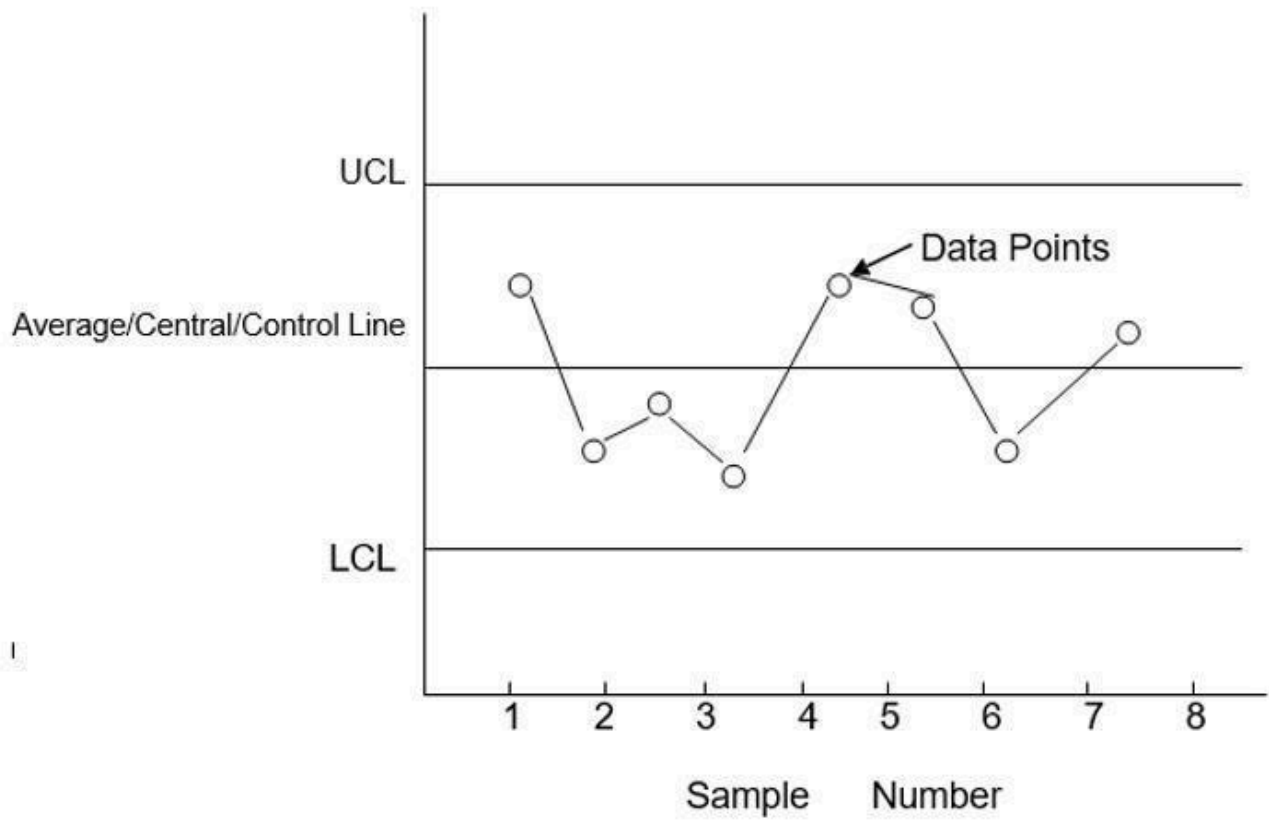


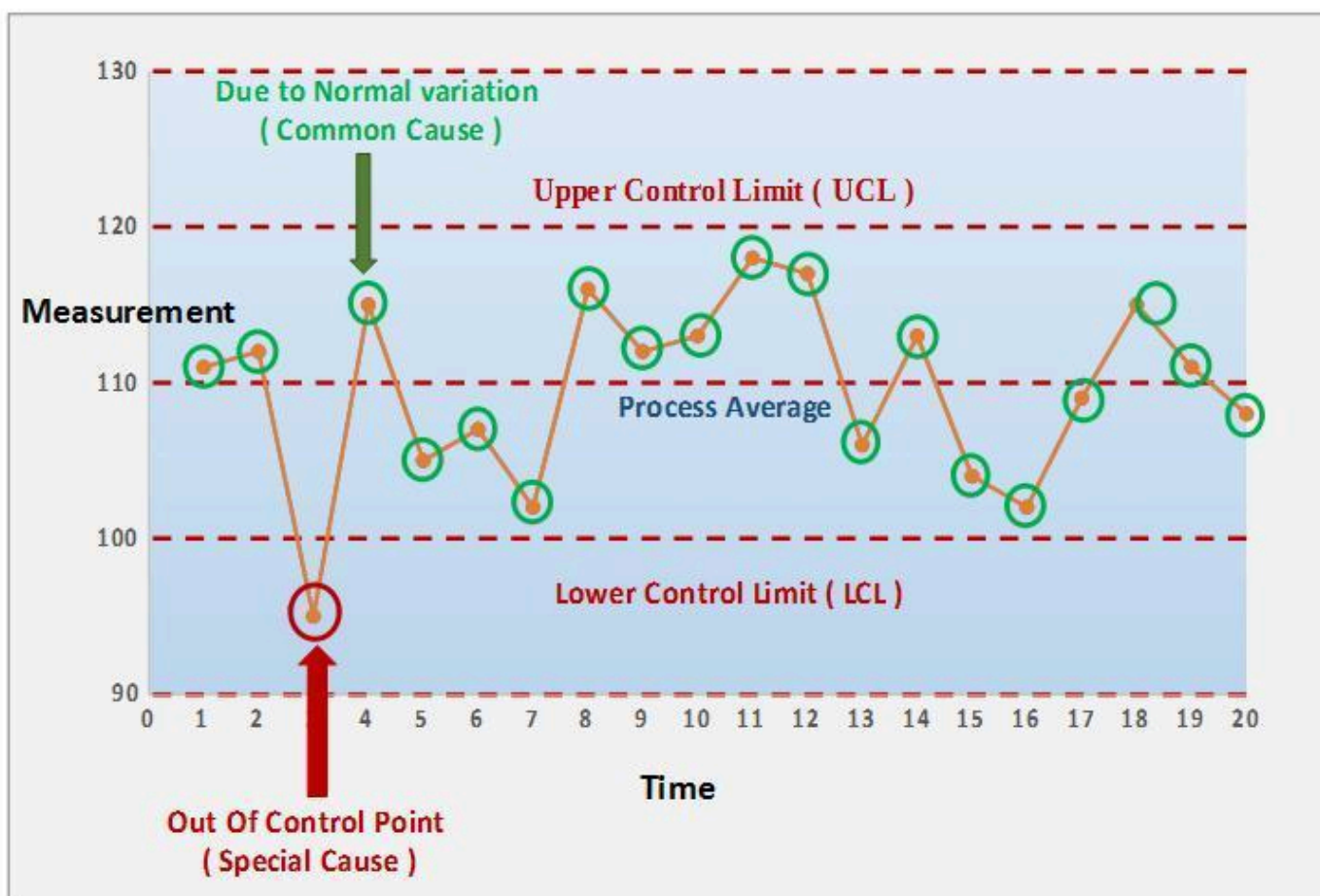
CHAPTER 5: CONTROL CHARTS



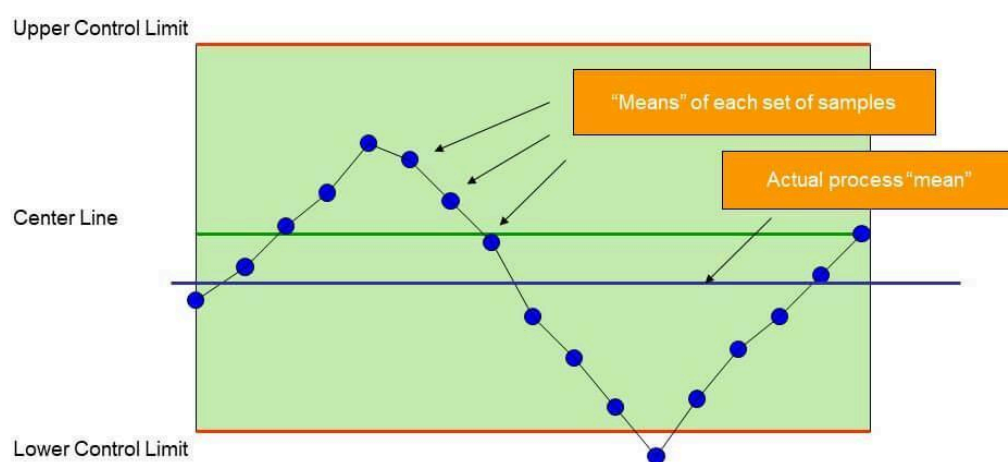
What is a Control Chart?

OUTLINE OF CONTROL CHART





X bar Control Chart



✓ Simple Definition:

A control chart is a **graph used to monitor a process over time**

👉 It helps answer:

“Process stable hai ya problem hai?”

📌 What is SPC (Statistical Process Control)?

👉 SPC means:

Using statistics to **control and improve quality**

- ✓ Used in factories
 - ✓ Used in production systems
-



BASIC COMPONENTS OF CONTROL CHART

◆ 1. CL (Center Line)

👉 Average (Mean) of data

◆ 2. UCL (Upper Control Limit)

◆ 3. LCL (Lower Control Limit)



FORMULA (VERY IMPORTANT)

$$UCL = \bar{X} + 3\sigma$$

$$LCL = \bar{X} - 3\sigma$$

✓ Explanation:

- UCL = maximum limit
 - LCL = minimum limit
 - CL = average
-

KEY IDEA

- ✓ If points are **inside limits** → process is OK 
 - ✓ If points are **outside limits** → problem exists 
-



TYPES OF CONTROL CHARTS

♦ 1. X-bar Chart

 Used for averages

♦ 2. R Chart

 Used for range

♦ 3. p Chart

 Used for proportion/defects

♦ 4. c Chart

 Used for count of defects



EXAMPLE (VERY IMPORTANT)

Data mean = 50
Standard deviation = 5

Step 1: UCL

$$= 50 + 3(5) = 65$$

Step 2: LCL

$$= 50 - 3(5) = 35$$

👉 So:

- UCL = 65
 - CL = 50
 - LCL = 35
-



INTERPRETATION

Situation	Meaning
Inside limits	Process stable ✓
Outside limits	Problem ✗



IMPORTANT RULES

- ✓ One point outside → out of control
 - ✓ Many points near limit → warning
 - ✓ Random pattern → normal
-



EXCEL PRACTICAL

Steps:

1. Enter data
 2. Calculate Mean
 3. Calculate SD
 4. Compute UCL & LCL
 5. Insert line chart
-

Formulas in Excel:

=AVERAGE (A1:A10)

=STDEV (A1:A10)

=Mean + 3*SD

=Mean - 3*SD



EXAM TIPS

- ✓ Always write formulas
 - ✓ Draw diagram
 - ✓ Explain CL, UCL, LCL clearly
 - ✓ Give interpretation
-



MEMORY TRICK



“3 Sigma Rule”

- ✓ $UCL = +3\sigma$
 - ✓ $LCL = -3\sigma$
-



SOLVED QUESTION

Q: Mean = 100, SD = 10

UCL:

$$100 + 3(10) = 130$$

LCL:

$$100 - 3(10) = 70$$



MCQs (EXAM LEVEL)

Q1. Control chart is used for:

- A) Decoration
 - B) Monitoring process ☒
-

Q2. CL represents:

- A) Maximum
 - B) Average ☒
-

Q3. UCL formula:

- A) $\text{Mean} + 3\sigma$ ☒
-

Q4. LCL formula:

- A) $\text{Mean} - 3\sigma$ ☒
-

Q5. If point outside limit:

- A) OK
 - B) Problem ☒
-

Q6. SPC stands for:

- A) Statistical Process Control ☒
-

Q7. X-bar chart shows:

- A) Average ☒
-

Q8. R chart shows:

- A) Range ☒
-

Q9. p chart shows:

A) Proportion 

Q10. Sigma means:

A) Mean

B) Standard deviation 



SHORT QUESTIONS (WITH ANSWERS)

Q1. What is control chart?

 Graph to monitor process

Q2. What is CL?

 Mean of data

Q3. What is UCL?

 Upper limit

Q4. What is LCL?

 Lower limit

Q5. What is SPC?

 Statistical Process Control



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain control chart

👉 Control chart shows process performance using:

- CL
 - UCL
 - LCL
-

Q2. Explain types of control charts

👉 Types:

- X-bar
 - R
 - p
 - c
-

Q3. Explain importance of control charts

👉 Helps:

- Detect problems
 - Maintain quality
 - Improve process
-



PRACTICAL QUESTION

👉 Given data:

Find:

- Mean
 - SD
 - UCL
 - LCL
-



FINAL REVISION

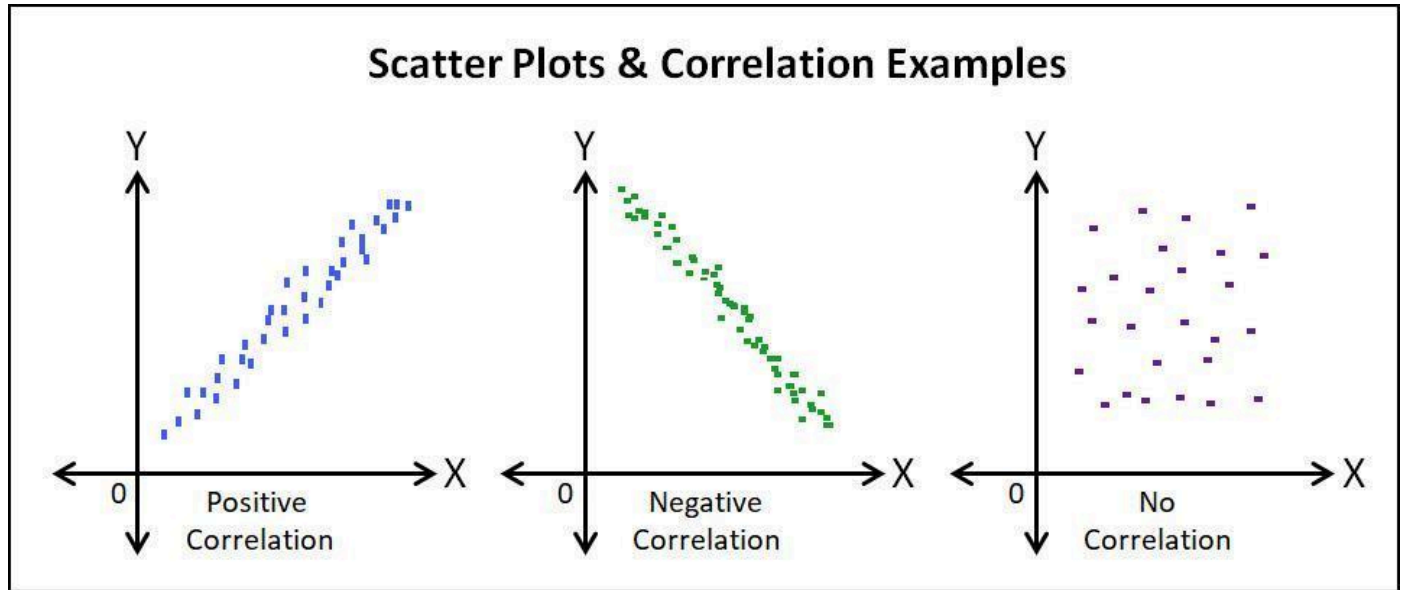
- ✓ CL = Mean
- ✓ UCL = Mean + 3σ

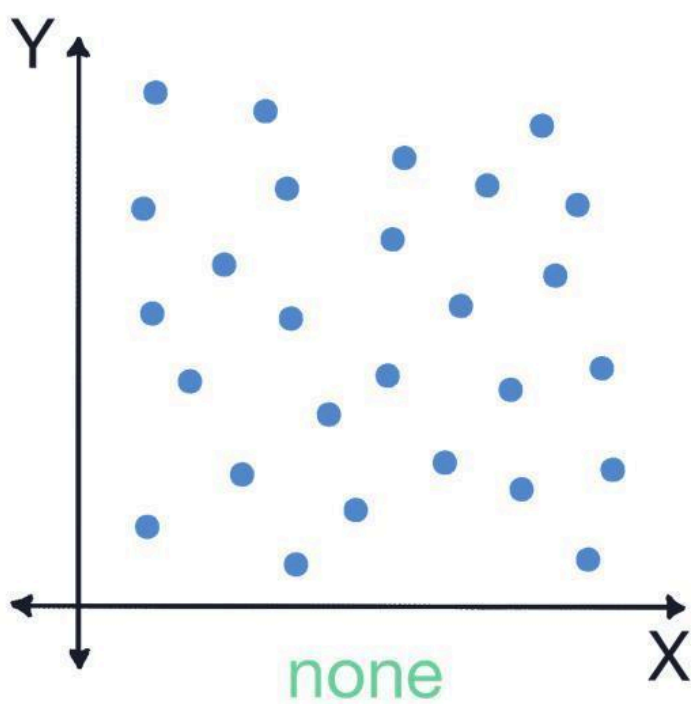
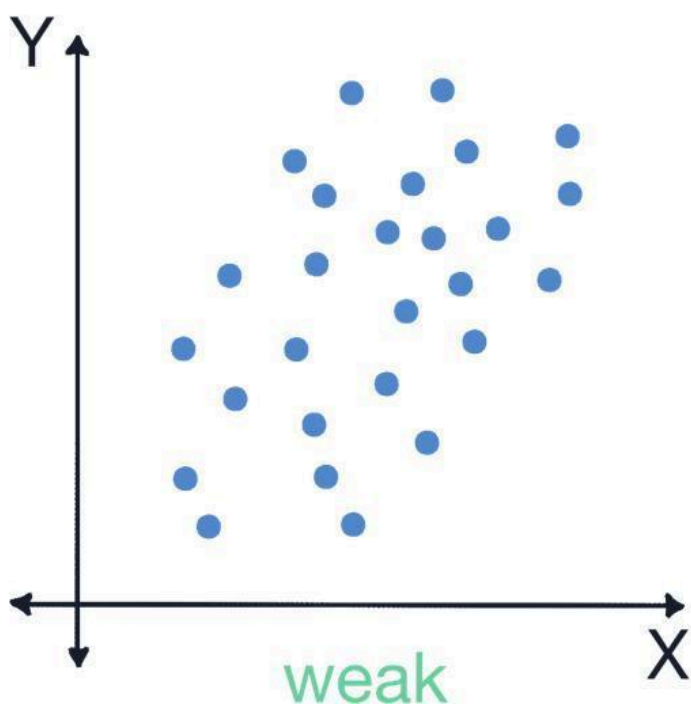
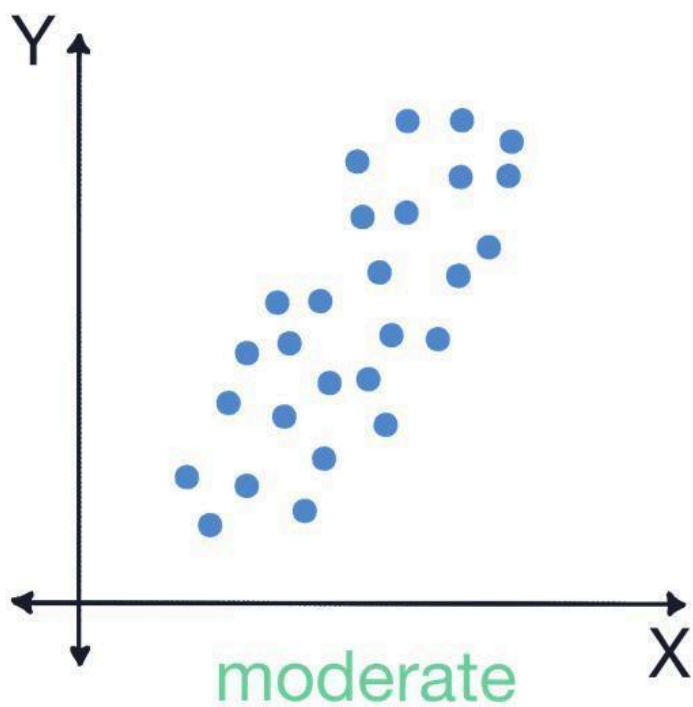
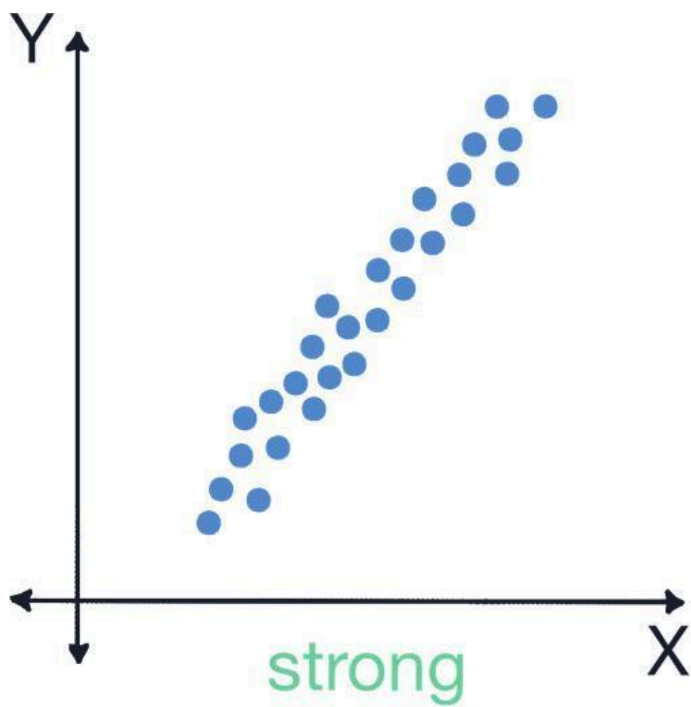
- ✓ $LCL = \text{Mean} - 3\sigma$
- ✓ Inside = OK
- ✓ Outside = Problem

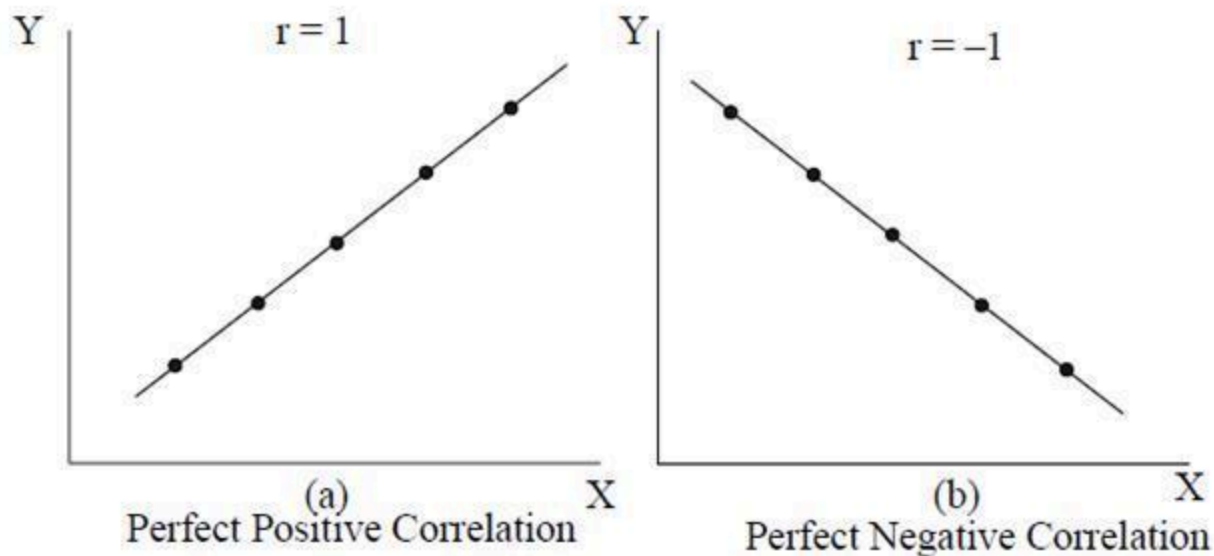
CHAPTER 6: CORRELATION & REGRESSION



What is Correlation?







5

✓ Simple Definition:

Correlation shows **relationship between two variables**

👉 It answers:

“Ek cheez badhe to doosri kya karti hai?”

📌 Types of Correlation

♦ 1. Positive Correlation

👉 Both increase together

Example:

- Study $\uparrow \rightarrow$ Marks $\uparrow$
-

♦ 2. Negative Correlation

👉 One increases, other decreases

Example:

- Price $\uparrow \rightarrow$ Demand $\downarrow$
-

♦ 3. Zero Correlation

👉 No relation



Correlation Coefficient (r)

Range:

$$-1 \leq r \leq +1$$

Value	Meaning
+1	Perfect positive
0	No relation
-1	Perfect negative



Interpretation

- ✓ r close to +1 $\rightarrow$ strong positive
 - ✓ r close to 0 $\rightarrow$ weak
 - ✓ r close to -1 $\rightarrow$ strong negative
-



SCATTER DIAGRAM

👉 Graph of points

- ✓ Shows relationship visually
-

♦ REGRESSION



Definition:

Regression predicts value of one variable using another



Regression Equation:

$$y = b_0 + b_1x$$

b_0

1.0

b_1

1.0



Terms:

Term	Meaning
y	Dependent variable
x	Independent variable
b_0	Intercept
b_1	Slope



Simple Meaning:

👉 “If x changes, what will y be?”



EXAMPLE

If:

$$b_0 = 2$$

$$b_1 = 3$$

Equation:

$$y = 2 + 3x$$

If x = 4:

$$y = 2 + 12 = 14$$



DIFFERENCE: CORRELATION vs REGRESSION

Correlation	Regression
Measures relationship	Predicts value
r value	Equation



EXCEL PRACTICAL (VERY IMPORTANT)



Correlation in Excel

=CORREL (A1:A10, B1:B10)



Regression in Excel

Steps:

1. Go to **Data tab**
 2. Click **Data Analysis**
 3. Select **Regression**
 4. Input X and Y range
 5. Click OK
-



Output:

- ✓ Coefficients
 - ✓ R value
 - ✓ Equation
-



EXAM TIPS

- ✓ Always write range of r
 - ✓ Draw scatter diagram
 - ✓ Explain positive/negative clearly
 - ✓ Practice regression equation
-



MEMORY TRICKS

✓ Correlation = Relationship

✓ Regression = Prediction

👉 “r tells strength, equation tells future”



SOLVED NUMERICAL

Given:

$$x = 2, y = 8$$

Equation:

$$y = 2 + 3x$$

Solution:

$$y = 2 + 3(2)$$

$$y = 2 + 6 = 8$$



MCQs (EXAM LEVEL)

Q1. Correlation shows:

A) Prediction

B) Relationship ✓

Q2. Range of r:

A) 0 to 1

B) -1 to +1 ✓

Q3. $r = 1$ means:

A) Weak

B) Perfect positive ✓

Q4. $r = 0$ means:

A) No relation ☒

Q5. Regression is used for:

A) Prediction ☒

Q6. Equation is:

A) $y = b_0 + b_1x$ ☒

Q7. Positive correlation:

A) Opposite
B) Same direction ☒

Q8. Negative correlation:

A) Same
B) Opposite ☒

Q9. Scatter diagram shows:

A) Table
B) Relationship visually ☒

Q10. b_1 is:

A) Intercept
B) Slope ☒



SHORT QUESTIONS (WITH ANSWERS)

Q1. Define correlation

👉 Relationship between variables

Q2. Define regression

👉 Prediction of variable

Q3. What is r?

👉 Correlation coefficient

Q4. What is scatter diagram?

👉 Graph showing relationship



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain correlation

👉 Types:

- Positive
 - Negative
 - Zero
-

Q2. Explain regression

👉 Equation:

$$y = b_0 + b_1x$$

Used for prediction

Q3. Difference between correlation & regression

- 👉 Correlation → relationship
 - 👉 Regression → prediction
-

PRACTICAL QUESTION

👉 Given X and Y data:

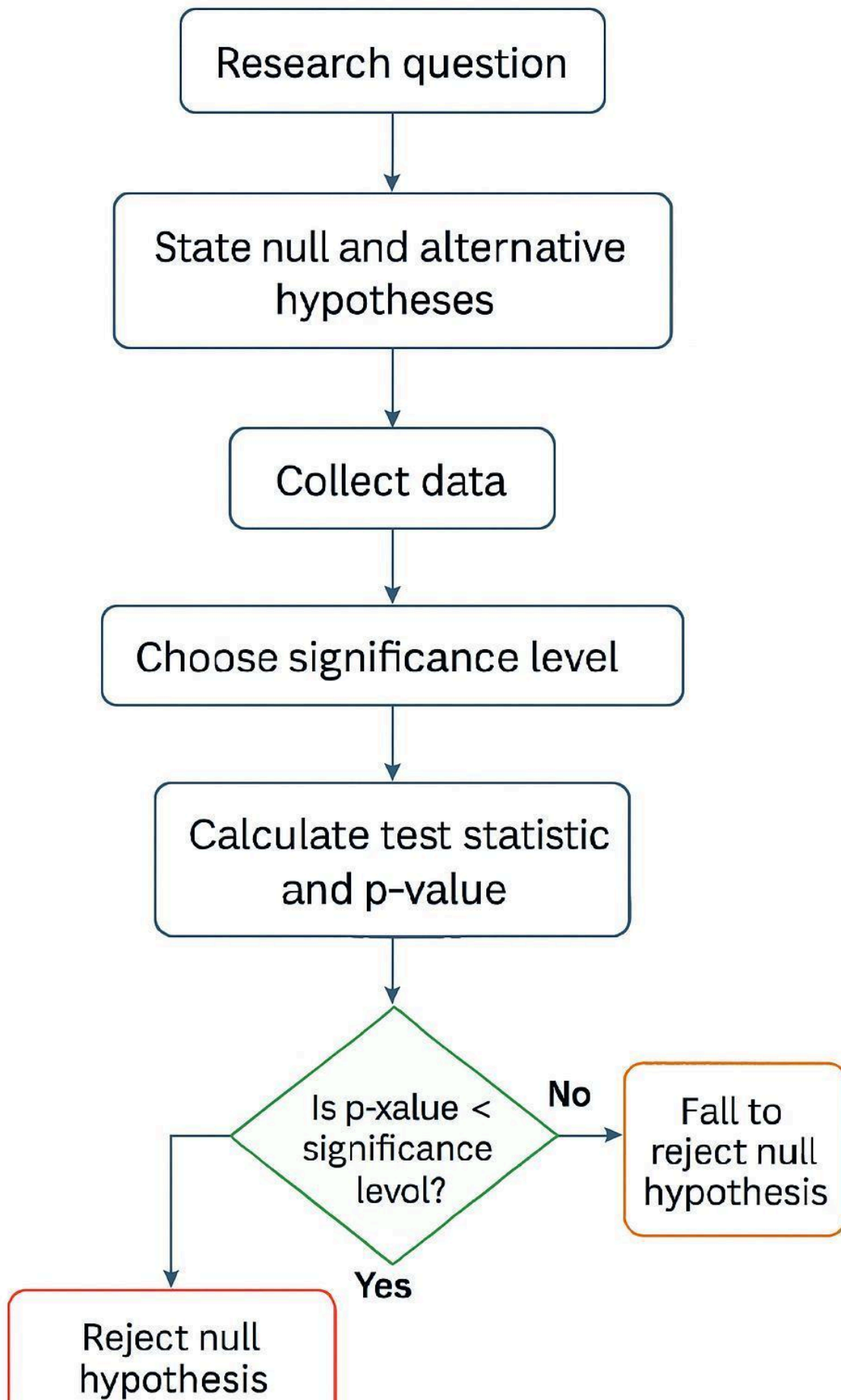
- Find correlation
 - Find regression
-

FINAL REVISION

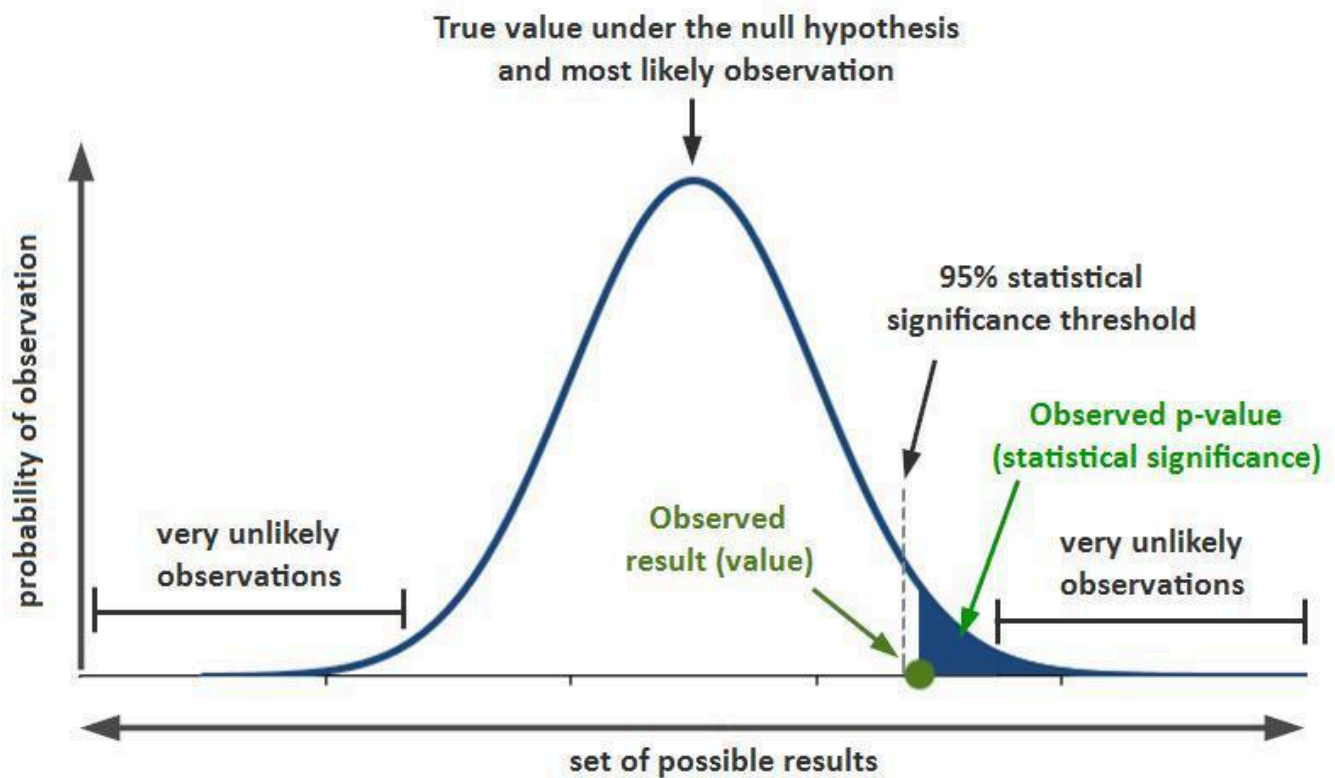
- ✓ r range = -1 to +1
 - ✓ Positive = same direction
 - ✓ Negative = opposite
 - ✓ Regression = prediction
 - ✓ Equation = $y = b_0 + b_1x$
-
-

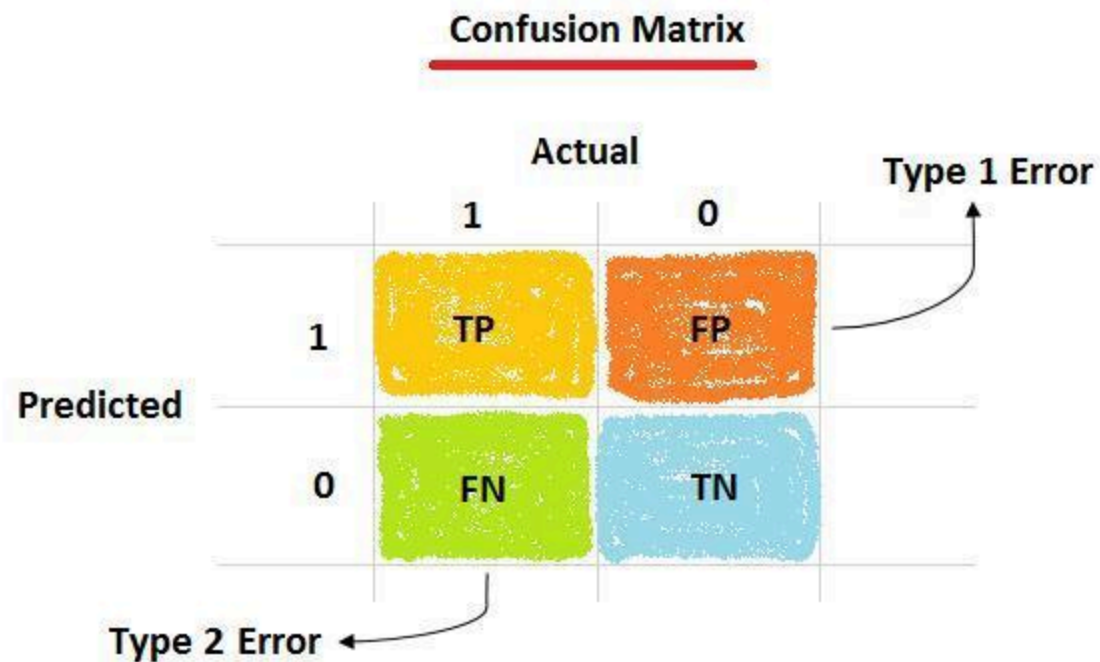
CHAPTER 7: HYPOTHESIS TESTING

 What is Hypothesis Testing?



Probability & Statistical Significance Explained





6

✓ Simple Definition:

Hypothesis testing is a method to **make decisions using data**

👉 It answers:

“Claim sahi hai ya galat?”



BASIC TERMS (VERY IMPORTANT)

◆ 1. Null Hypothesis (H_0)

👉 Default statement (no change / no effect)

Example:

H_0 : Mean = 50

◆ 2. Alternative Hypothesis (H_1)

👉 Opposite of H_0

Example:

H_1 : Mean $\neq 50$

🎯 Simple Understanding:

👉 H_0 = “Nothing special”

👉 H_1 = “Something is happening”



TYPES OF TESTS

◆ 1. One-Tailed Test

👉 Direction matters

Example:

- Mean > 50
-

◆ 2. Two-Tailed Test

👉 Any difference

Example:

- Mean $\neq 50$
-



SIGNIFICANCE LEVEL (α)

👉 Probability of error

Common values:

- 0.05
 - 0.01
-



p-VALUE (VERY IMPORTANT)



Definition:

p-value = probability of getting result



Decision Rule:

- ✓ $p \leq 0.05 \rightarrow \text{Reject } H_0$ ✗
 - ✓ $p > 0.05 \rightarrow \text{Accept } H_0$ ✓
-



Trick:

👉 “Small p = Reject H_0 ”



ERRORS IN HYPOTHESIS TESTING

◆ Type I Error

👉 Reject true H_0

◆ Type II Error

👉 Accept false H_0



Table:

Decision	Reality	Error
Reject H_0	True	Type I ✗
Accept H_0	False	Type II ✗



STEPS OF HYPOTHESIS TESTING

Step 1:

State H_0 and H_1

Step 2:

Choose significance level (α)

Step 3:

Calculate test statistic

Step 4:

Find p-value

Step 5:

Make decision



EXAMPLE (VERY IMPORTANT)

Given:

Claim: Mean = 50

H_0 : Mean = 50

H_1 : Mean $\neq$ 50

p-value = 0.03

Decision:

$0.03 < 0.05 \rightarrow \text{Reject } H_0$ ❌

👉 Conclusion: Claim is wrong

EXCEL PRACTICAL

Steps:

1. Enter data
 2. Go to Data tab
 3. Click Data Analysis
 4. Select t-test
 5. Check p-value
-

EXAM TIPS

- ✓ Always write H_0 first
 - ✓ Learn p-value rule
 - ✓ Understand errors clearly
 - ✓ Practice examples
-

MEMORY TRICKS

- ✓ H_0 = No effect
- ✓ H_1 = Effect

👉 “Small p = Reject”

MCQs (EXAM LEVEL)

Q1. H_0 means:

- A) Alternative
 - B) Null hypothesis ✓
-

Q2. H_1 means:

A) Alternative hypothesis ☒

Q3. $p\text{-value} < 0.05$:

A) Accept

B) Reject H_0 ☒

Q4. Type I error:

A) Reject true H_0 ☒

Q5. Type II error:

A) Accept false H_0 ☒

Q6. α means:

A) Significance level ☒

Q7. One-tailed test:

A) Directional ☒

Q8. Two-tailed test:

A) Non-directional ☒

Q9. Hypothesis testing is:

A) Guess

B) Statistical decision method ☒

Q10. Small p-value means:

- A) Accept
B) Reject 
-



SHORT QUESTIONS (WITH ANSWERS)

Q1. What is hypothesis?

-  Statement about population
-

Q2. What is H_0 ?

-  Null hypothesis
-

Q3. What is p-value?

-  Probability of result
-

Q4. Define Type I error

-  Reject true H_0
-

Q5. Define Type II error

-  Accept false H_0
-



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain hypothesis testing

-  Steps:

- H_0 & H_1
- α

- Test statistic
 - p-value
 - Decision
-

Q2. Explain errors

- 👉 Type I $\rightarrow$ reject true
 - 👉 Type II $\rightarrow$ accept false
-

Q3. Explain p-value

- 👉 Used to decide whether to reject H_0
-

PRACTICAL QUESTION

- 👉 Given data:

- Form hypothesis
 - Find p-value
 - Make decision
-

FINAL REVISION

- ✓ H_0 = No effect
- ✓ H_1 = Effect
- ✓ $p \leq 0.05 \rightarrow$ Reject
- ✓ Type I = Reject true
- ✓ Type II = Accept false

CHAPTER 8: NON-PARAMETRIC TESTS & SPSS

What are Non-Parametric Tests?

Parametric vs. Non-Parametric Tests

Parametric Tests

Assumptions

- Normality
- Homogeneity of variance
- Independence



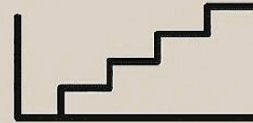
Examples

- T-tests
- ANOVA
- Pearson correlation

Non-Parametric Tests

When to Use

- Data is not normally distributed
- Small sample size
- Ordinal/nominal data
- Presence of outliers



Examples

- Mann-Whitney U test
- Wilcoxon signed-rank test
- Kruskal-Wallis test
- Spearman's rank correlation

The Wilcoxon signed rank sum test

- Wilcoxon signed rank sum test is used to test the null hypothesis that the median of a distribution is equal to some value.
- It can be used in place of a one-sample t-test
- **Procedure:**
 - 1. State the null hypothesis - the median value is equal to some value M .
 - 2. Calculate the difference between each observation and the hypothesised median,
 $d_i = x_i - M$.
 - 3. Rank the d_i 's, ignoring the signs (i.e. assign rank 1 to the smallest $|d_i|$, rank 2 to the next etc.)

Mann Whitney U Test

- To compute the Mann Whitney U:
 - Rank the scores in both groups (together) from highest to lowest.
 - Sum the ranks of the scores for each group.
 - The sum of ranks for each group are used to make the statistical comparison.

Income	Rank	No Income	Rank
25	12	27	10
32	5	19	17
36	3	16	20
40	1	33	4
22	14	30	7
37	2	17	19
20	16	21	15
18	18	23	13
31	6	26	11
29	8	28	9
	85		125

6

✓ Simple Definition:

Non-parametric tests are statistical tests that:

- Do NOT assume normal distribution
- Use **ranks instead of actual values**

👉 Simple words:

“Data normal na ho → non-parametric use karo”

📌 When to Use?

- ✓ Small sample size
- ✓ Non-normal data
- ✓ Ordinal data (ranking)



TYPES OF NON-PARAMETRIC TESTS

◆ 1. Wilcoxon Signed-Rank Test

✓ Use:

👉 Compare **two related samples**

Example:

- Before vs After treatment
-



Idea:

- Convert values into ranks
 - Compare differences
-

◆ 2. Mann–Whitney U Test

✓ Use:

👉 Compare **two independent groups**

Example:

- Class A vs Class B
-



Idea:

- Rank all values
 - Compare groups
-

◆ 3. Kruskal–Wallis Test

✓ Use:

👉 Compare more than two groups



PARAMETRIC vs NON-PARAMETRIC

Parametric **Non-Parametric**

Normal data No assumption

Mean used Rank used

Powerful Flexible



MEMORY TRICK

👉 “No Normal → Non-Parametric”



SPSS (VERY IMPORTANT)



What is SPSS?



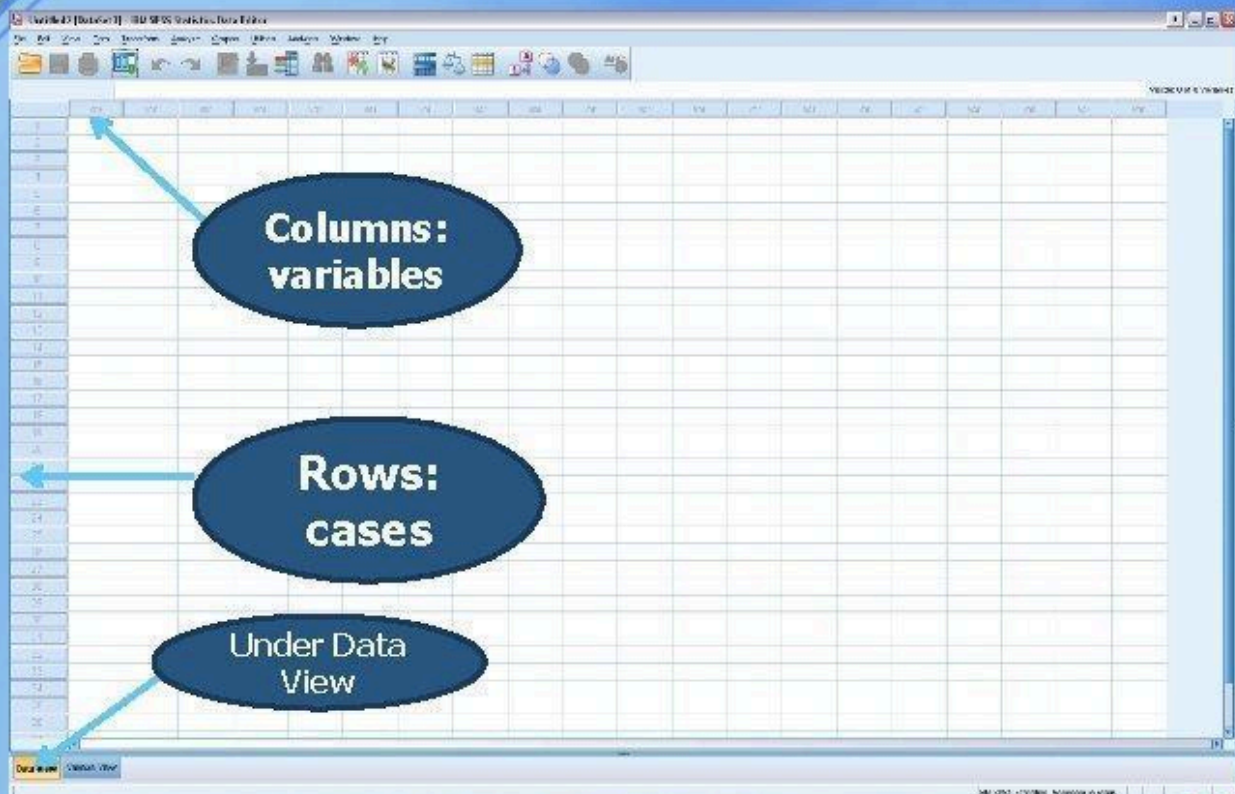
Definition:

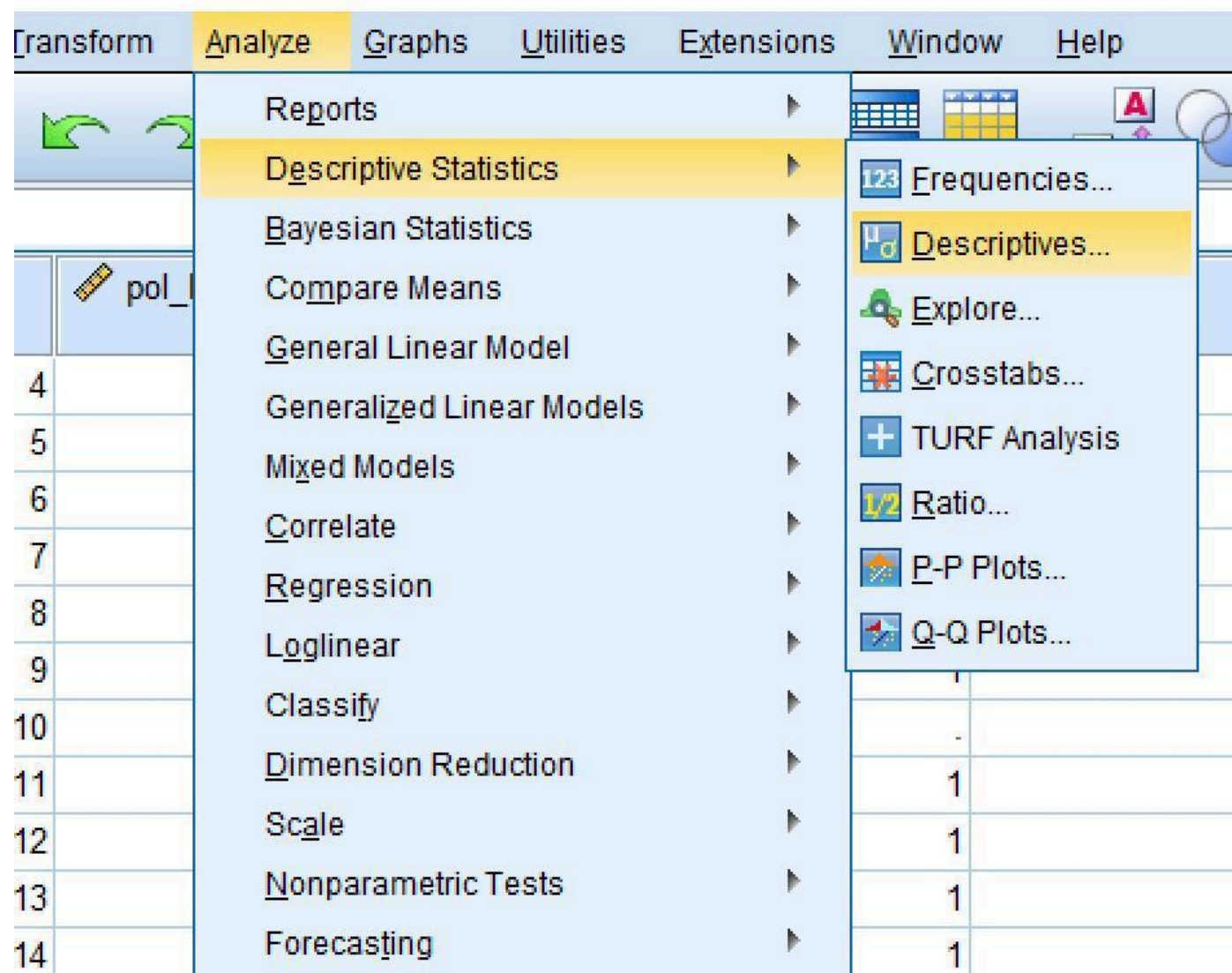
SPSS is software used for:

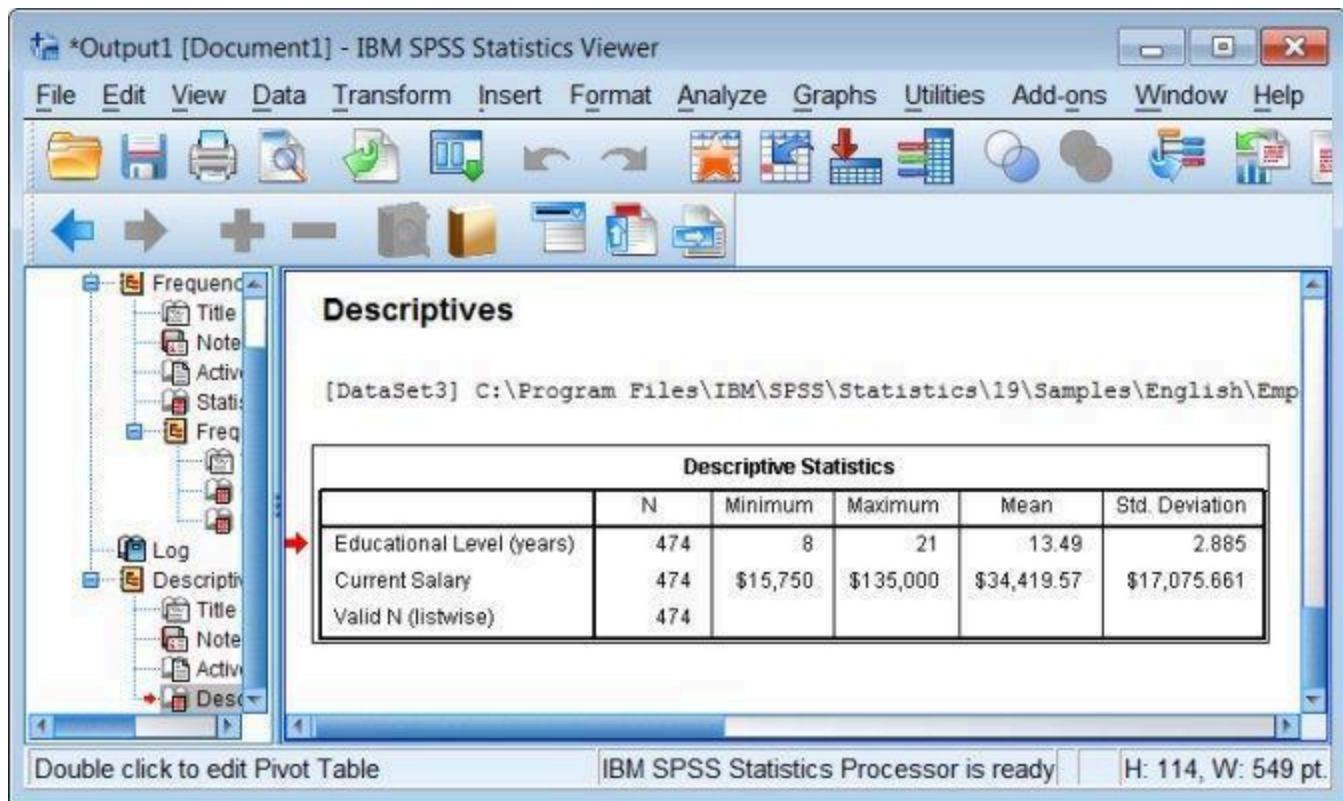
- Data analysis
 - Statistical tests
-



SPSS Interface







6

📌 Two Main Views

◆ Data View

👉 Enter data

◆ Variable View

👉 Define variables

📊 HOW TO USE SPSS (STEP BY STEP)

Step 1:

Open SPSS

Step 2:

Go to Variable View

- Enter variable names
-

Step 3:

Go to Data View

- Enter data
-

Step 4:

Click **Analyze**

Step 5:

Select test:

- Descriptive
 - t-test
 - Non-parametric
-

Step 6:

Click OK → Get results



NON-PARAMETRIC TEST IN SPSS

Steps:

1. Analyze
2. Nonparametric Tests
3. Choose test
4. Click OK



EXAM TIPS

- ✓ Learn when to use each test
 - ✓ Remember rank concept
 - ✓ Practice SPSS steps
 - ✓ Focus on definitions
-



MEMORY TRICKS

- ✓ Wilcoxon → “Before vs After”
 - ✓ Mann-Whitney → “Two groups”
 - ✓ Kruskal → “More groups”
-



EXAMPLE QUESTION

Q: Compare before & after marks

👉 Use: **Wilcoxon test**

Q: Compare two classes

👉 Use: **Mann-Whitney test**



MCQs (EXAM LEVEL)

Q1. Non-parametric test is used when:

- A) Normal data
 - B) Non-normal data ☒
-

Q2. Wilcoxon test is for:

A) Two related samples ☒

Q3. Mann-Whitney test is for:

A) Two independent groups ☒

Q4. Kruskal-Wallis test is for:

A) More than two groups ☒

Q5. SPSS is:

A) Hardware
B) Software ☒

Q6. SPSS is used for:

A) Drawing
B) Data analysis ☒

Q7. Data View is used for:

A) Enter data ☒

Q8. Variable View is used for:

A) Define variables ☒

Q9. Non-parametric uses:

A) Mean
B) Rank ☒

Q10. If data not normal:

- A) Parametric
 - B) Non-parametric 
-



SHORT QUESTIONS (WITH ANSWERS)

Q1. What is non-parametric test?

-  Test without normal assumption
-

Q2. What is Wilcoxon test?

-  Test for related samples
-

Q3. What is Mann-Whitney test?

-  Test for two independent groups
-

Q4. What is SPSS?

-  Statistical software
-



LONG QUESTIONS (WITH ANSWERS)

Q1. Explain non-parametric tests

-  Types:
 - Wilcoxon
 - Mann-Whitney
 - Kruskal-Wallis
-

Q2. Explain SPSS steps

👉 Steps:

- Enter data
 - Analyze
 - Select test
 - Get results
-

Q3. Difference between parametric & non-parametric

👉 Parametric → normal

👉 Non-parametric → no assumption

(IMPORTANT – 30+)

♦ Chapter 1–2 (Excel + Central Tendency)

1. Excel file is called:
👉 **Workbook** ✓
 2. Cell reference consists of:
👉 **Column + Row** ✓
 3. Formula must start with:
👉 **= sign** ✓
 4. Mean formula is:
👉 **Sum / n** ✓
 5. Median requires:
👉 **Sorting data** ✓
 6. Mode is:
👉 **Most frequent value** ✓
 7. Which is affected by outliers?
👉 **Mean** ✓
 8. Excel function for mean:
👉 **=AVERAGE()** ✓
-

♦ Chapter 3 (Dispersion)

9. Range formula:
👉 **Max – Min** ✓
10. Variance uses:
👉 **Squared differences** ✓
11. Standard deviation is:
👉 **Square root of variance** ✓

12. Small SD means:

👉 **Data close** ✓

13. CV is:

👉 **Percentage variation** ✓

♦ Chapter 4 (Graphs)

14. Histogram has:

👉 **No gaps** ✓

15. Bar chart has:

👉 **Gaps** ✓

16. Pie chart shows:

👉 **Percentage** ✓

17. Ogive is:

👉 **Cumulative graph** ✓

♦ Chapter 5 (Control Charts)

18. CL represents:

👉 **Mean** ✓

19. UCL formula:

👉 **Mean + 3σ** ✓

20. LCL formula:

👉 **Mean - 3σ** ✓

21. Outside limits means:

👉 **Process out of control** ✓

♦ Chapter 6 (Correlation & Regression)

22. Range of r:

👉 **-1 to +1** ✓

23. $r = 0$ means:

👉 **No correlation** ✓

24. Regression is used for:

👉 **Prediction** ✓

25. Equation:

👉 **$y = b_0 + b_1x$** ✓

♦ Chapter 7 (Hypothesis)

26. H_0 means:
👉 Null hypothesis ✓
27. $p < 0.05$:
👉 Reject H_0 ✓
28. Type I error:
👉 Reject true H_0 ✓
-

♦ Chapter 8 (SPSS)

29. SPSS is:
👉 Statistical software ✓
30. Wilcoxon test is for:
👉 Related samples ✓
-

SECTION B: SHORT QUESTIONS (IMPORTANT)

♦ With Answers

Q1. Define Mean

👉 Average of data

Q2. Define Median

👉 Middle value

Q3. Define Range

👉 Difference between max and min

Q4. Define Standard Deviation

👉 Measure of spread

Q5. What is histogram?

👉 Graph without gaps

Q6. What is correlation?

👉 Relationship between variables

Q7. What is regression?

👉 Prediction method

Q8. What is H_0 ?

👉 Null hypothesis

Q9. What is p-value?

👉 Probability value

Q10. What is SPSS?

👉 Statistical software

SECTION C: LONG QUESTIONS (IMPORTANT)

♦ Q1. Explain Mean, Median, Mode

👉 Mean = Average

👉 Median = Middle

👉 Mode = Most frequent

♦ Q2. Explain Measures of Dispersion

👉 Includes:

- Range
 - Variance
 - SD
 - IQR
 - CV
-

♦ Q3. Explain Control Chart

👉 Components:

- CL
- UCL
- LCL

👉 Used for quality control

♦ Q4. Explain Correlation & Regression

👉 Correlation → relationship

👉 Regression → prediction

♦ Q5. Explain Hypothesis Testing

👉 Steps:

- H_0 & H_1
 - p-value
 - Decision
-

♦ Q6. Explain Non-Parametric Tests

👉 Wilcoxon

👉 Mann-Whitney

👉 Kruskal-Wallis

SECTION D: NUMERICAL QUESTIONS (VERY IMPORTANT)

◆ Q1. Mean

Data: 2, 4, 6

👉 Mean = $(2+4+6)/3 = 4$

◆ Q2. Median

Data: 1, 3, 5

👉 Median = 3

◆ Q3. Range

Data: 5, 10, 15

👉 Range = $15 - 5 = 10$

◆ Q4. SD (Simple)

Data: 2, 4, 6

👉 SD = 2

◆ Q5. Control Chart

Mean = 50, SD = 5

👉 UCL = 65

👉 LCL = 35

◆ Q6. Regression

$$y = 2 + 3x$$

$$x = 4$$

$$\text{👉 } y = 14$$