

Al-Mansour University College

قسم الهندسة المدنية
المرحلة الثانية

Civil Eng. Dept
2nd. Stage

Engineering Statistics

2022 - 2023

الأحصاء الهندي

1

Al-Mansour University College
Civil Engineering Department

Engineering Statistics

Lectures

By

Esraa Thamir Al Azawee

Haider Qais

2nd Level
2021-2022

Chapter One

Introduction

□ Statistics:

Is the Science of collecting Organizing, summarizing, analyzing and making inferences from data.

الإحصاء (بالإنجليزية Statistics) : هو أحد فروع الرياضيات الهامة ذات التطبيقات الواسعة. وهو علم جمع ووصف وتفسير البيانات وبمعنى آخر صندوق الأدوات الموضوع تحت البحث التجريبي. يهتم علم الإحصاء بجمع وتلخيص وتمثيل وإيجاد استنتاجات من مجموعة البيانات المتوفرة، محاولاً التغلب على مشاكل مثل عدم تجانس البيانات وتباعدتها. كل هذا يجعله ذا أهمية تطبيقية واسعة في شتى مجالات العلوم من الفيزياء إلى العلوم الاجتماعية وحتى الإنسانية، كما يلعب دوراً في السياسة والأعمال.

في تحرير البيانات، هدف العلماء لوصف فهمنا للعالم، أوصاف العلاقات المستقرة بين الظواهر الجديرة باللحظة على شكل نظريات أحياناً مدعومة بأن تكون توضيحية. أي اختراع نظرية عملية مبدعة لإعادة هيكلة المعلومات التي ضمنت في إيجاد (وقبول) النظريات، وتنزع المعلومات القابلة للاستغلال من العالم الحقيقي.

❖ Types of Statistics:

A. Descriptive

• الاحصاء الوصفي

B. Inferential Statistics

• الاحصاء الاستنتاجي

Descriptive Statistics

Includes:

- Collecting.
- Organizing.
- Summarizing.
- Presenting Data.

Inferential Statistics.

Includes:

- Making Inferences الاستدلالات.
- Hypothesis Testing اختبار الفرضيات .
- Determining Relationships ايجاد العلاقات .
- Making Predictions التنبؤ او التوقع .

Variables

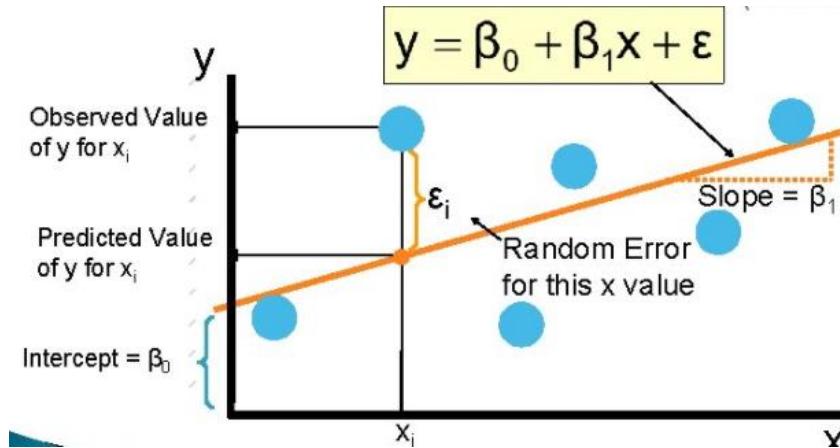
whose values are determined by chance are called

Random Variables

Discrete Variables: النقطة

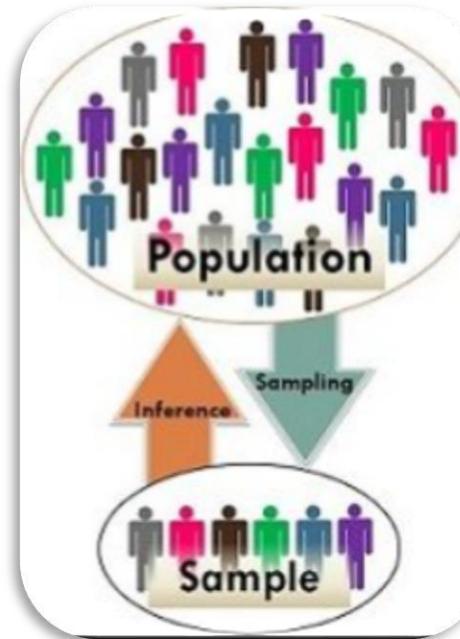
Continuous Variables: are variables that can assume all values between given minimum and maximum values.

- **Independent Variable:** Controlled by the researcher (X-axis)
- **Dependent Variable:** The Variable being measured (Y-axis)



Basic Terms:

- ◆ Population: All Possible data.
- ◆ Unit: a single entity of interest
- ◆ Sample: is subset of population



Types of Data:

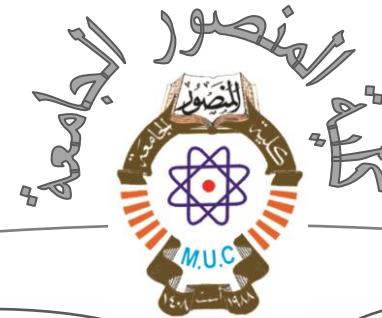
- Quantitative Data numerical: Deals with numbers, data can be measured(length ,height , area ,volume ,weight ,speed , time ,Temp ,cost ,...etc).

Example: The grade point averages of five students are listed in the table. Which data are qualitative data, and which are quantitative data?

Student	Grade Point Average (GPA)
Mohamed	3.22
Mostafa	4
Abd Al-Rahman	3.98
Yousuf	3.24
Hamza	3.84

Qualitative

Quantitative



Al-Mansour University College

قسم الهندسة المدنية
المرحلة الثانية

Civil Eng. Dept
2nd. Stage

Engineering Statistics

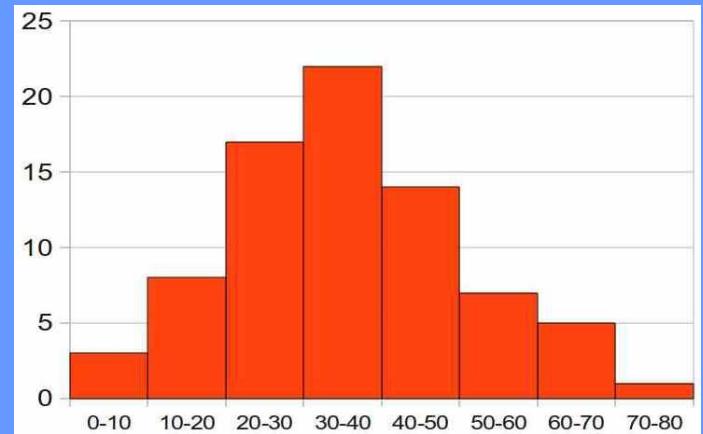
2022 - 2023

الإحصاء الهندي

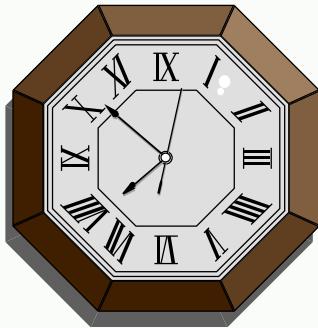
2

LECTURE 2

Frequency Distributions and Their Graphs



Frequency Distributions



Minutes Spent on the Phone

102	124	108	86	103	82
71	104	112	118	87	95
103	116	85	122	87	100
105	97	107	67	78	125
109	99	105	99	101	92

Make a frequency distribution table with five classes.

Key values:

Minimum value = 67

Maximum value = 125

Steps to Construct a Frequency Distribution

1. Choose the number of classes

Should be between 5 and 15. (For this problem use 5)

2. Calculate the Class Width

Find the range = maximum value – minimum. Then divide this by the number of classes. Finally, round up to a convenient number. $(125 - 67) / 5 = 11.6$ Round up to 12

3. Determine Class Limits

The lower class limit is the lowest data value that belongs in a class and the upper class limit is the highest. Use the minimum value as the lower class limit in the first class. (67)

4. Mark a tally | in appropriate class for each data value.

After all data values are tallied, count the tallies in each class for the class frequencies.

Construct a Frequency Distribution

Minimum = 67, Maximum = 125

Number of classes = 5

Class width = 12

Class Limits		Tally	f
{	67		3
	79		5
	90		8
	102		9
	114		5
	126		

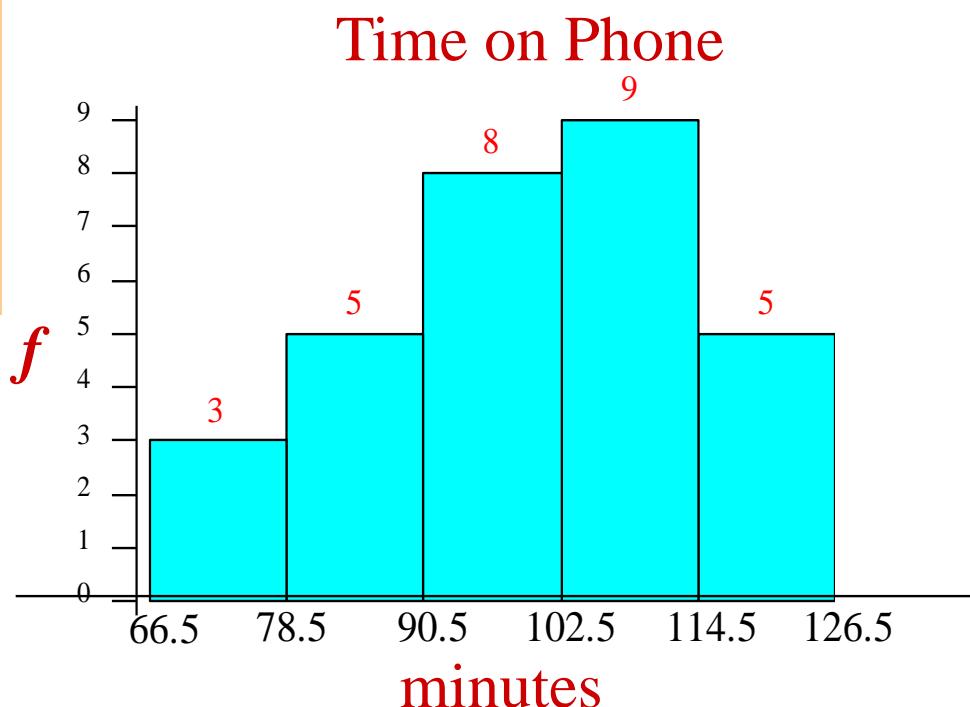
Do all lower class limits first.

$$\Sigma f = 30$$

Frequency Histogram

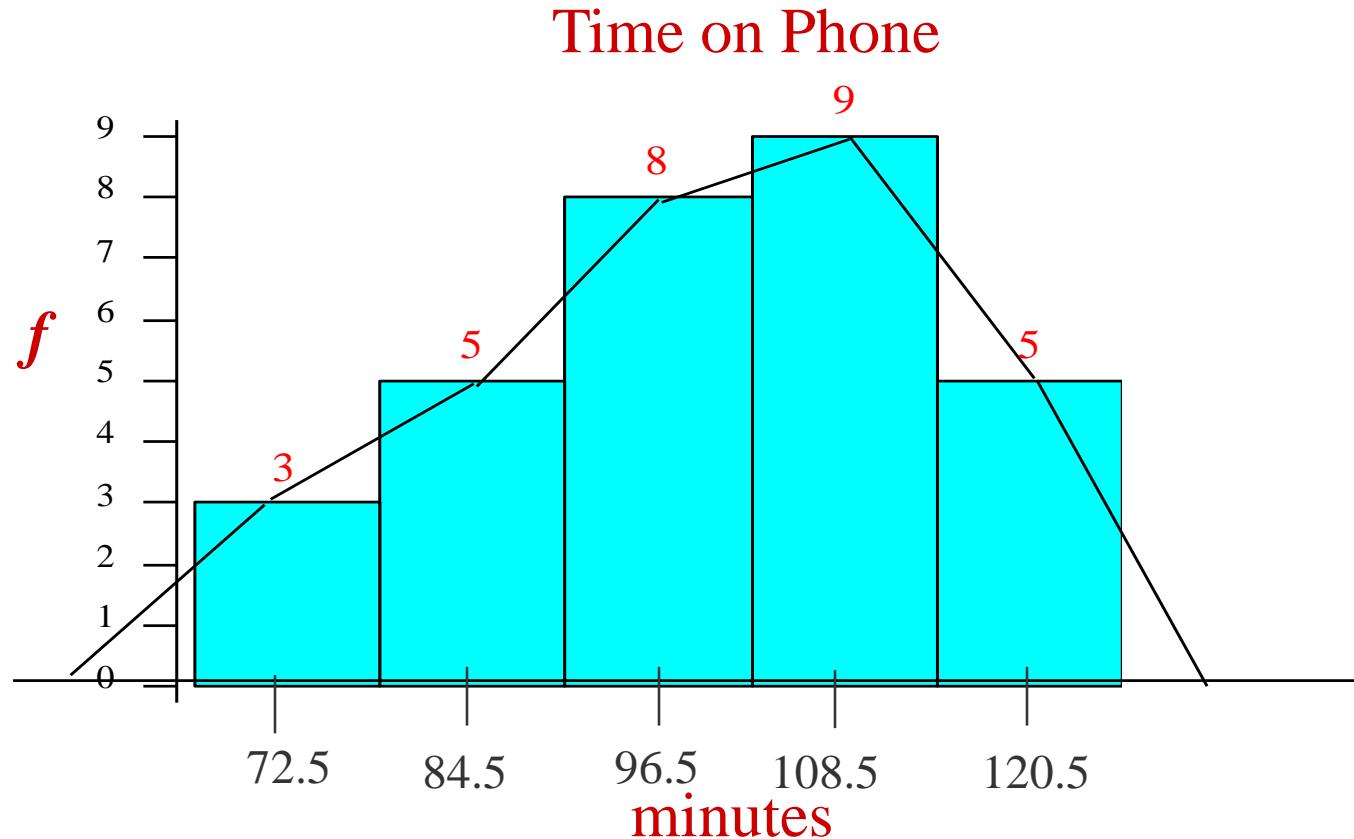
Class	f
67 - 78	3
79 - 90	5
91 - 102	8
103 -114	9
115 -126	5

102.5 -114.5
 114.5 -126.5



Frequency Polygon

Class	<i>f</i>
67 - 78	3
79 - 90	5
91 - 102	8
103 - 114	9
115 - 126	5



Mark the midpoint at the top of each bar. Connect consecutive midpoints. Extend the frequency polygon to the axis.

Other Information

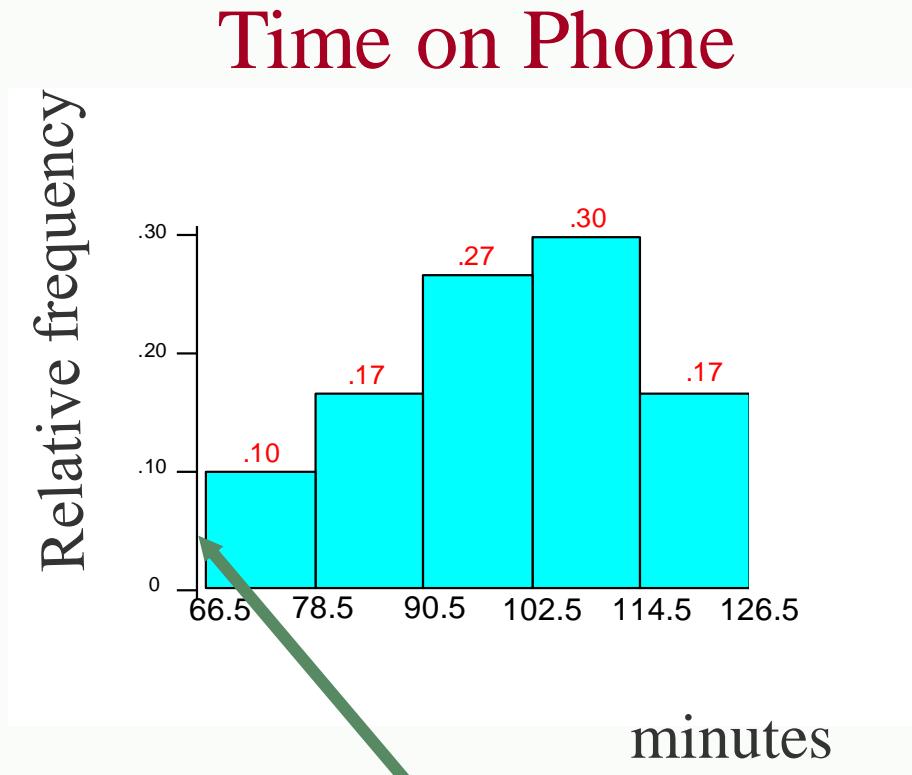
Midpoint: (lower limit + upper limit) / 2

Relative frequency: class frequency/total frequency

Cumulative frequency: Number of values in that class or in lower.

Class	f	Midpoint	Relative frequency	Cumulative Frequency
		$(67+ 78)/2$	$3/30$	
67 - 78	3	72.5	0.10	3
79 - 90	5	84.5	0.17	8
91 - 102	8	96.5	0.27	16
103 -114	9	108.5	0.30	25
115 -126	5	120.5	0.17	30

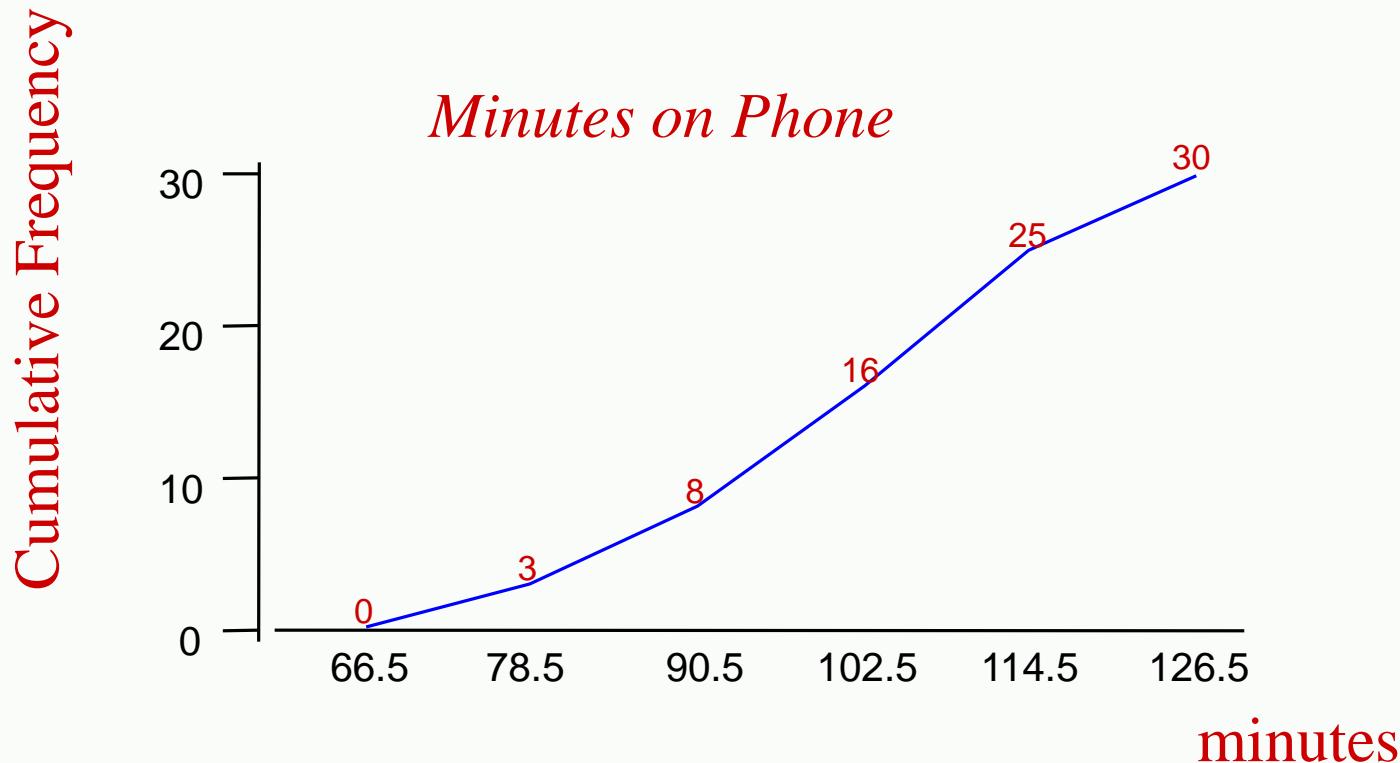
Relative Frequency Histogram



Relative frequency on vertical scale

Ogive

An ogive reports the number of values in the data set that are less than or equal to the given value, x .



Pie Chart

- Used to describe parts of a whole



- Percentage for each category

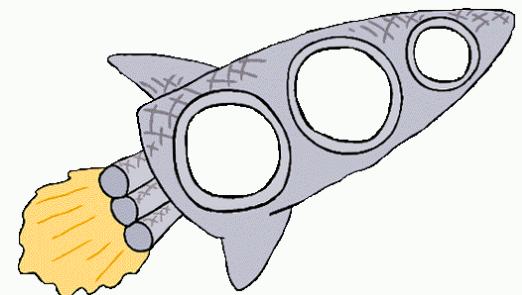
$$\frac{\text{number in category}}{\text{total number}} \times 360^\circ$$

$$\frac{\text{number in category}}{\text{total number}} \times 100\%$$

Example:

NASA budget (billions of \$) divided among 3 categories.

	Billions of \$
Human Space Flight	5.7
Technology	5.9
Mission Support	2.7



Construct a pie chart for the data.

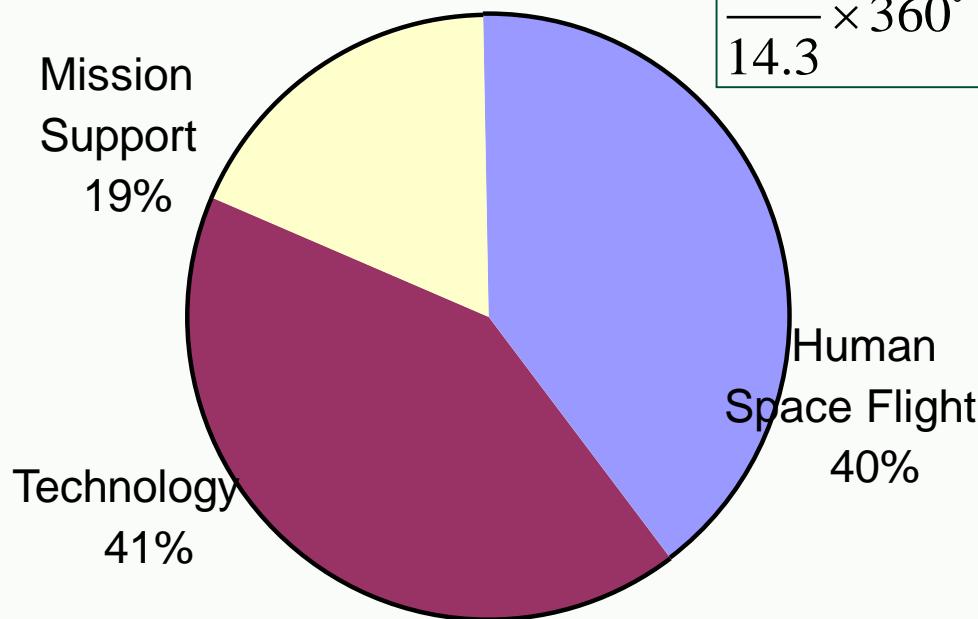
Pie Chart

Space Flight
Technology
Mission Support

	Billions of \$	Degrees	Percentage
Space Flight	5.7	143	40%
Technology	5.9	149	41%
Mission Support	2.7	68	19%
Total	14.3	360	100%

$$\frac{5.7}{14.3} \times 360^\circ = 143^\circ$$

$$\frac{5.9}{14.3} \times 360^\circ = 149^\circ$$



NASA Budget
(Billions of \$)