
بسم الله الرحمن الرحيم
In the name of ALLAH
the most Beneficent and the most merciful

BIO-STATISTICS

BY

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Data

- Data is a gathered body of facts
- Data is the central thread of any activity
- Understanding the nature of data is most fundamental for proper and effective use of statistical skills

Data

- The raw material of Statistics is data.
- We may define data as figures. Figures result from the process of counting or from taking a measurement.
- ***For example:***
- When a hospital administrator counts the number of patients (counting).
- When a nurse weighs a patient (measurement)

Types of data
VARIABLE & CONSTANT

CONSTANT

- Any numerical quantity which is fixed

OR

- "constant is any fixed quantity that has a single value"

OR

- "A quantity which can assume **Only One Value** is called constant"

e.g. $\pi = 22/7$ (3.14), 'g'= 9.8 m/second

VARIABLE:

- Any numerical (N) value which varies from one individual to another is called variable

OR

- It is a characteristic or attribute that varies from person to person, from place to place & from time to time.

e.g. Height of students in the class.

Weight of school boys.

. Other examples: Prices of goods

Number of children in family.

VARIABLE:

An inherent feature of all biological observations is their variability e.g. every individual varies with one another

Similarly each group of individuals is different from other groups. For example, the pulse rate, hemoglobin level, the number of white cells varies from person to person .

Again this varies from one group to other . e.g. pulse rate among infants varies from that of old age group.

Types of variables

Quantitative variables

- Quantitative continuos
- Quantitative descrete

Qualitative variables

- Qualitative nominal
- Qualitative ordinal

Types of variables

QUALITATIVE VARIABLE

A characteristic which varies only in **quality** from one individual to another individual is called **"qualitative variable"** e.g.

beauty, intelligence, severity of disease, color,

ABO blood group, gender.

It is also called as attribute or categorical variable.

Types of variables

QUANTITATIVE VARIABLE

Characteristic which can be measured *numerically* & varies from one individual to another individual e.g.

height, weight, B.P, temperature of patients, hemoglobin level, blood sugar level, mid-arm circumference,

Body mass index(BMI),Serum cholesterol level.

Types of variables

DISCRETE VARIABLE

A variable is called discrete variable if it can take some selected values in a given interval

OR

A variable whose value is taken from some counting process e.g.

number of patients in a ward, rooms in a house , trees in a row

Types of variables

CONTINUOUS VARIABLE

If the variable takes any value within an interval that variable is called continuous variable.

OR

The variable whose value is taken from some measuring process e.g.

B.P, temperature, height & weight of patients

Types of variables

DICHOTOMOUS(BINARY) VARIABLE

It is variable that has only two possible value.

Examples

Gender

weight more than 80 kg

Obesity

Rh blood group

Types of variables

POLYOTOMOUS VARIABLE

It is a variable that has more than two possible values.

Examples

ABO blood group

Weight

Height

SCALES OF MEASUREMENT

Categorical scales

Nominal scale

Based on NOM(names), no specific order e.g. Race/ethnicity, Religion, Sex of child/gender,

ABO blood group

Country of birth

Type of anemia

Dimensional scales

Metric Scale

Based on ME(measurement)

In terms of quantities

Blood glucose

Mid –arm circumference

Hemoglobin level

Weight, height,

Blood pressure

SCALES OF MEASUREMENT

Categorical scales

ORDINAL SCALE

Based on ORD(order)

Grading into categories

Severity of disease

Social classes

Socioeconomic status

Dimensional scales

Metric scale is of 2 types

Interval scale

(absence of absolute 0)

No ratios are possible

e. g,

Centigrade/Fahrenheit temperature scale

Ratio scale

(Presence of absolute 0)

Ratios are possible e. g, weight, height

SCALES OF MEASUREMENT

- Statistically most preferable scale of measurement is "metric scale"
- Statistically least preferable scale of measurement is "nominal scale"

EXERCISE

- Severity of anemia
- Type of anemia
- Hemoglobin level & serum ferritin level

EXERCISE

- Weight
- Height
- B P
- Pulse rate
- Temperature
- ABO blood group
- Rhesus blood group
- Gender


Thank You

Presentation of Statistical Data

- Statistical data, once collected, must be arranged purposively, in order to bring out the important points clearly and strikingly. Therefore the manner in which statistical data is presented is of utmost importance.

Presentation of Statistical Data

- There are several methods of presenting data –
- tables,
- charts,
- diagrams,
- graphs,
- pictures and
- special curves.

TABULATION

- Tables are devices for presenting data simply from masses of statistical data.
- Tabulation is the first step before the data is used for analysis or interpretation.

TABULATION

- A table can be simple or complex, depending upon the number or measurement of a single set or multiple sets of items.
- Whether simple or complex, there are certain general principles which should be borne in mind in designing tables

TABULATION

- (a) The tables should be numbered e.g., Table 1, Table 2, etc.
- (b) A title must be given to each table. The title must be brief and self-explanatory,
- (c) The headings of columns or rows should be clear and concise,

TABULATION

- (d) The data must be presented according to size or importance; chronologically, alphabetically or geographically,
- (e) If percentages or averages are to be compared, they should be placed as close as possible,
- (f) No table should be too large,

TABULATION

- (g) Most people find a vertical arrangement better than a horizontal one because, it is easier to scan the data from top to bottom than from left to right,
- (h) Foot notes may be given, where necessary, providing explanatory notes or additional information.

Examples of tabulation

- 1. Simple tables

DHQs HOSPITALS	NO. OF PATIENTS ADMITTED
Sargodha	1950
Khushab	1200
Mianwali	1600

TWO-WAY TABLE

The table, which provides two inter related information in one table, is called two- way table

NO. OF PATIENTS ADMITTED			
DHQs HOSPITALS	NO. OF PATIENTS (RURAL)	NO.OF PATIENTS (URBAN)	TOTAL
Sargodha	1200	750	1950
Khushab	850	350	1200
Mianwali	1000	600	1600

THREE- WAY TABLE

The table, which provides 3 inter-related information in a table.

NO. OF PATIENTS ADMITTED					
DHQs HOSPITALS	RURAL MALE	RURAL FEMALE	URBAN MALE	URBAN FEMALE	TOTAL
Sargodha	700	500	350	400	1950
Khushab	500	300	250	150	1200
Mianwali	650	450	300	200	1600

HIGHER ORDER TABLE

- The table which provides more than 3 inter related information in a table, is called higher order table.

CHARTS AND DIAGRAMS

- Charts and diagrams are useful methods of presenting simple statistical data. They have a powerful impact on the imagination of people. Therefore, they are a popular media of expressing statistical data, especially in newspapers and magazines.

CHARTS AND DIAGRAMS

- Diagrams are better retained in the memory than statistical tables. The data that is to be presented by diagrams ought to be simple. Then there is no risk that the reader will misunderstand

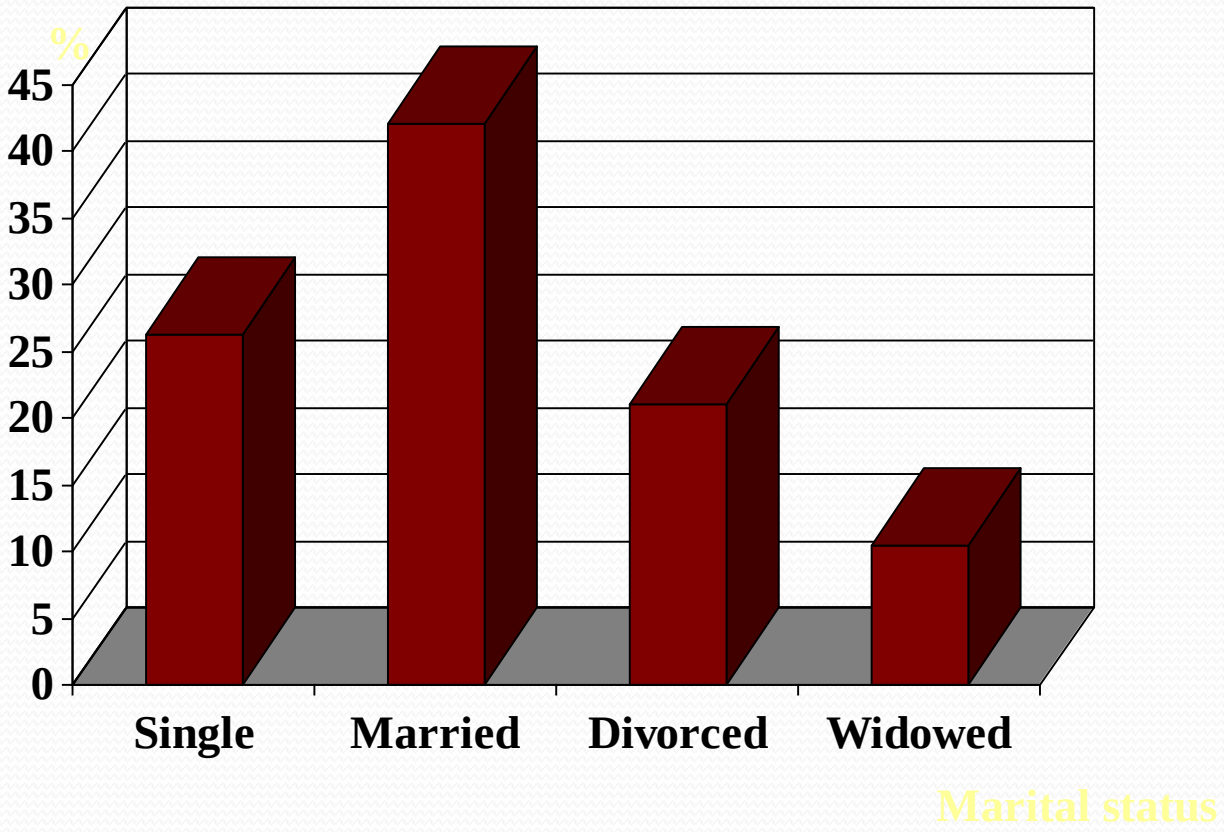
CHARTS AND DIAGRAMS

- 1. Bar charts
- Bar charts are merely a way of presenting a set of numbers by the length of a bar, the length of the bar is proportional to the magnitude to be represented. Bar charts are a popular media of presenting statistical data because they are easy to prepare, and enable values to be compared visually.

CHARTS AND DIAGRAMS

- (a) SIMPLE BAR CHART
- Bars may be vertical or horizontal . The bars are usually separated by appropriate spaces with an eye to neatness and clear presentation. A suitable scale must be chosen to present the length of the bars.

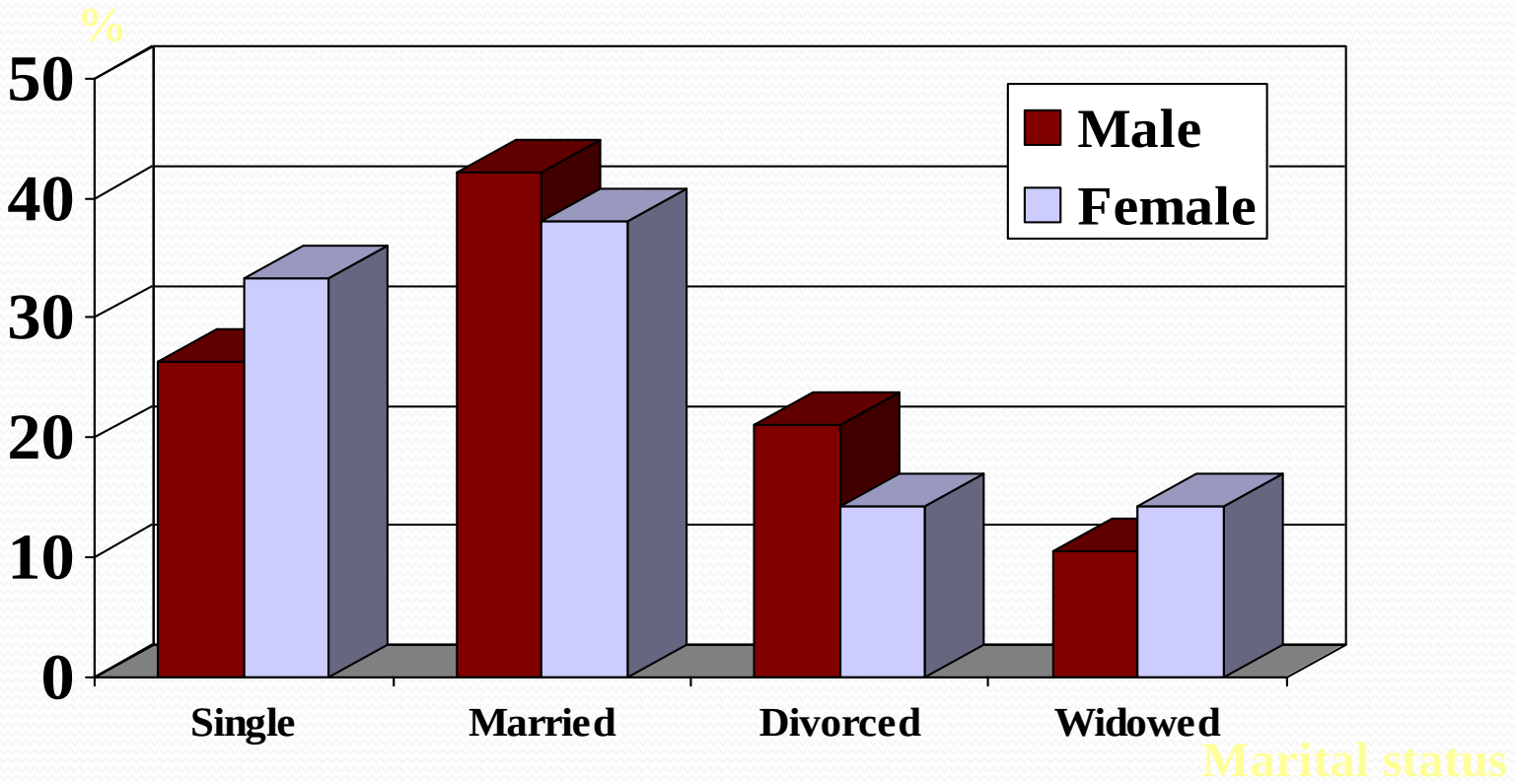
Bar chart


%
45
40
35
30
25
20
15
10
5
0
Single
Married
Divorced
Widowed
Marital status

CHARTS AND DIAGRAMS

- (b) MULTIPLE BAR CHART
- In multiple bar diagrams the simple bars are placed side by side to provide more than one information in same diagram . For the sake of distinction the bar should be colored.

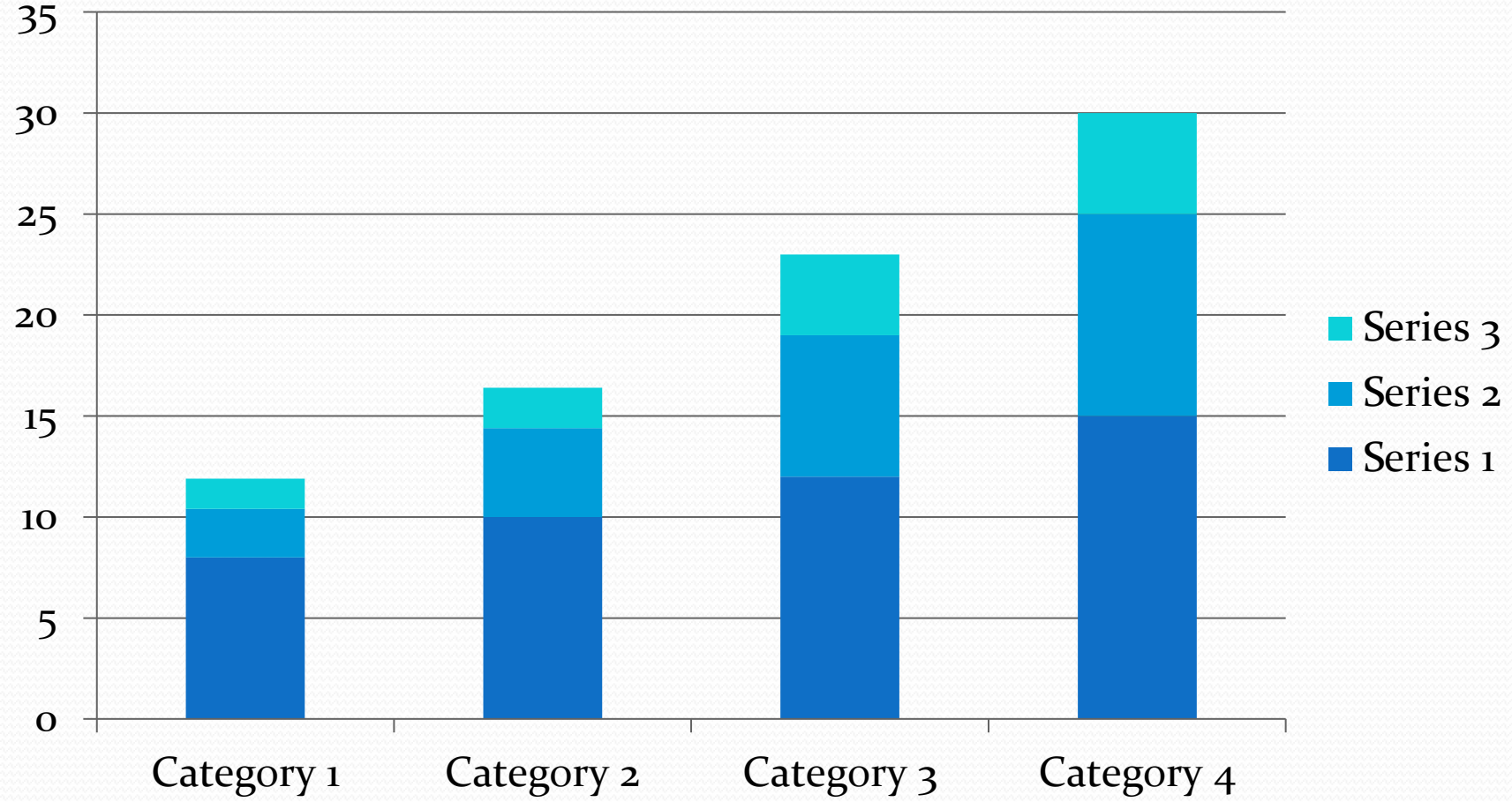
Bar chart


%
50
40
30
20
10
0
Male
Female
Single
Married
Divorced
Widowed
Marital status

CHARTS AND DIAGRAMS

- (c) COMPONENT BAR CHART The bars may be divided into two or more parts … each part representing a certain item and proportional to the magnitude of that particular item

COMPONENT BAR CHART



CHARTS AND DIAGRAMS

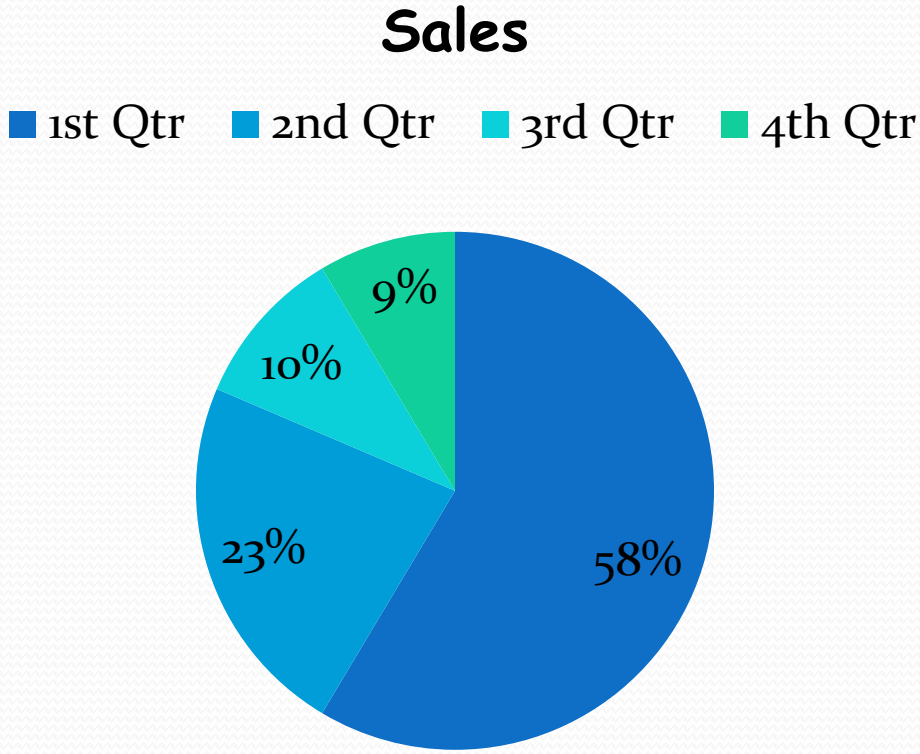
- Pie charts
- Instead of comparing the length of a bar, the areas of segments of a circle are compared. The area of each segment depends upon the angle. Pie charts are extremely popular with the laity, but not with statisticians who consider them inferior to bar charts. It is often necessary to indicate the percentages in the segments

CHARTS AND DIAGRAMS

t is an improvement over a bar diagram. It is a circular diagram, in which the frequencies of observations are shown as sectors or wedges in a circle, the size of each sector being proportional to the frequency. Degrees of angle denote the frequency and area of sector gives comparative difference at a glance.

"Pie means a piece or a sector"

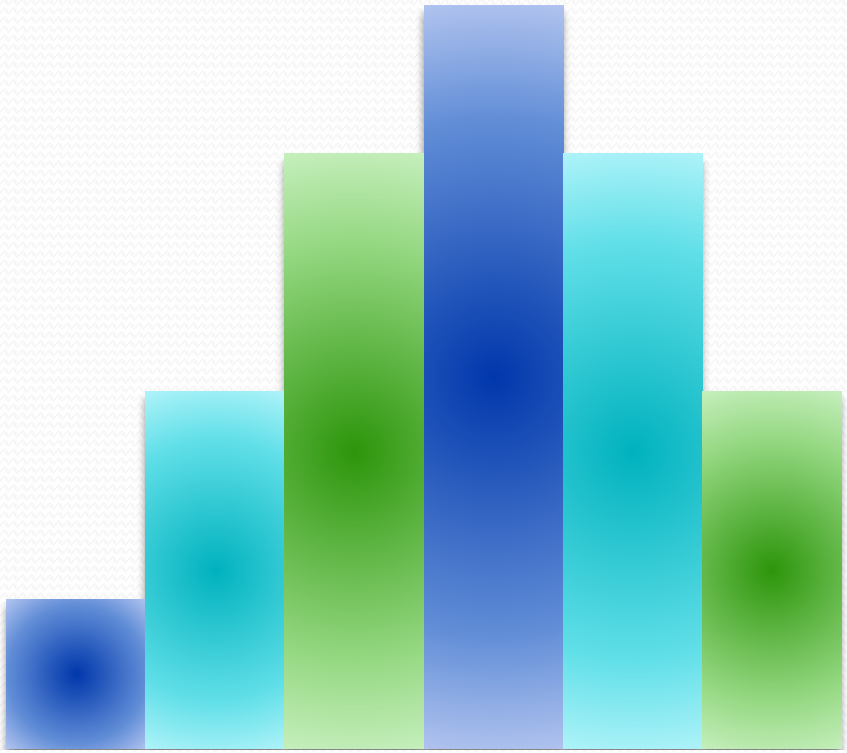
CHARTS AND DIAGRAMS



CHARTS AND DIAGRAMS

- Histogram
- It is a pictorial diagram of frequency distribution. It consists of a series of blocks. The class intervals are given along the horizontal axis and the frequencies along the vertical axis. The area of each block or rectangle is proportional to the frequency.

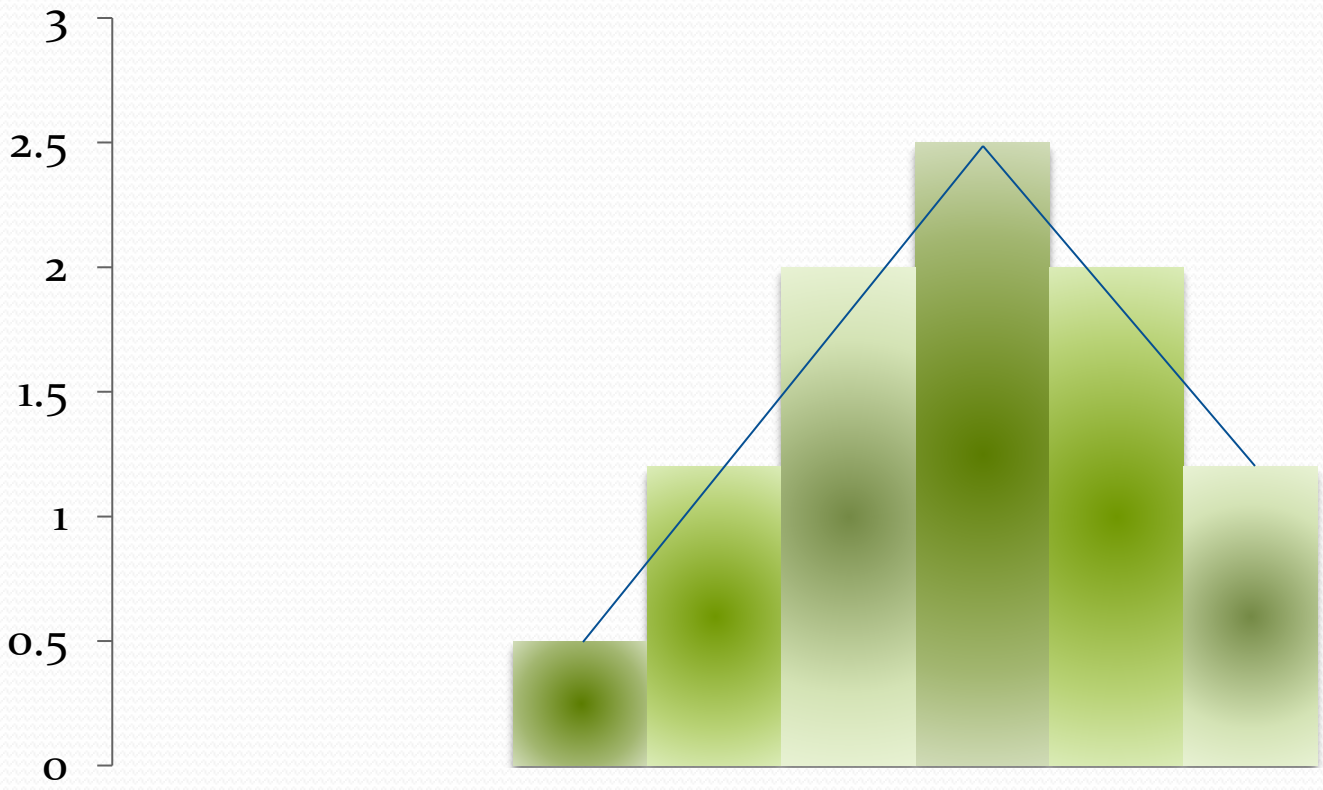
Histogram



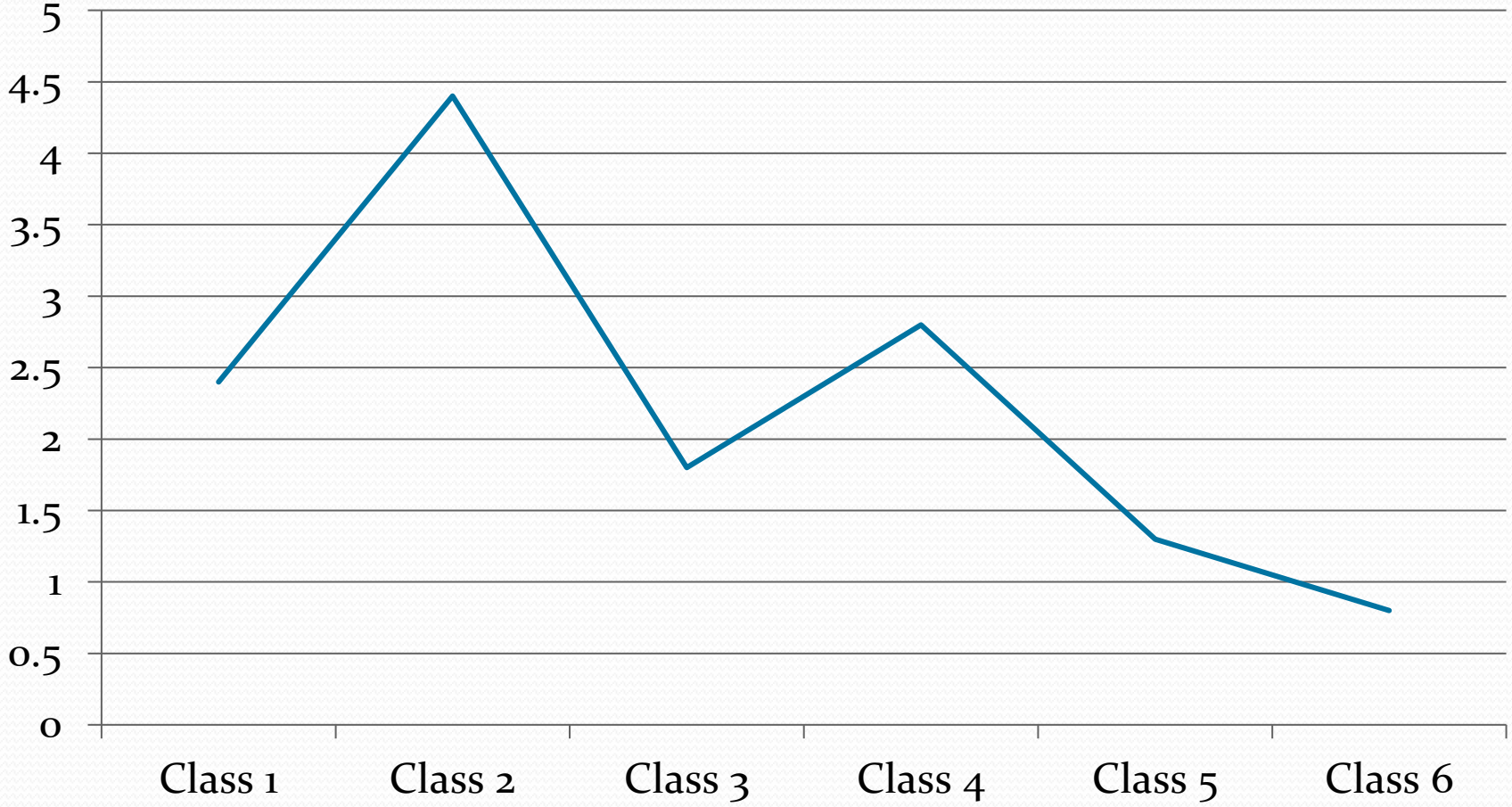
CHARTS AND DIAGRAMS

- FREQUENCY POLYGON
- A frequency distribution may also be represented diagrammatically by the frequency polygon. It is obtained by joining the mid-points of the histogram blocks.

CHARTS AND DIAGRAMS



CHARTS AND DIAGRAMS



CHARTS AND DIAGRAMS

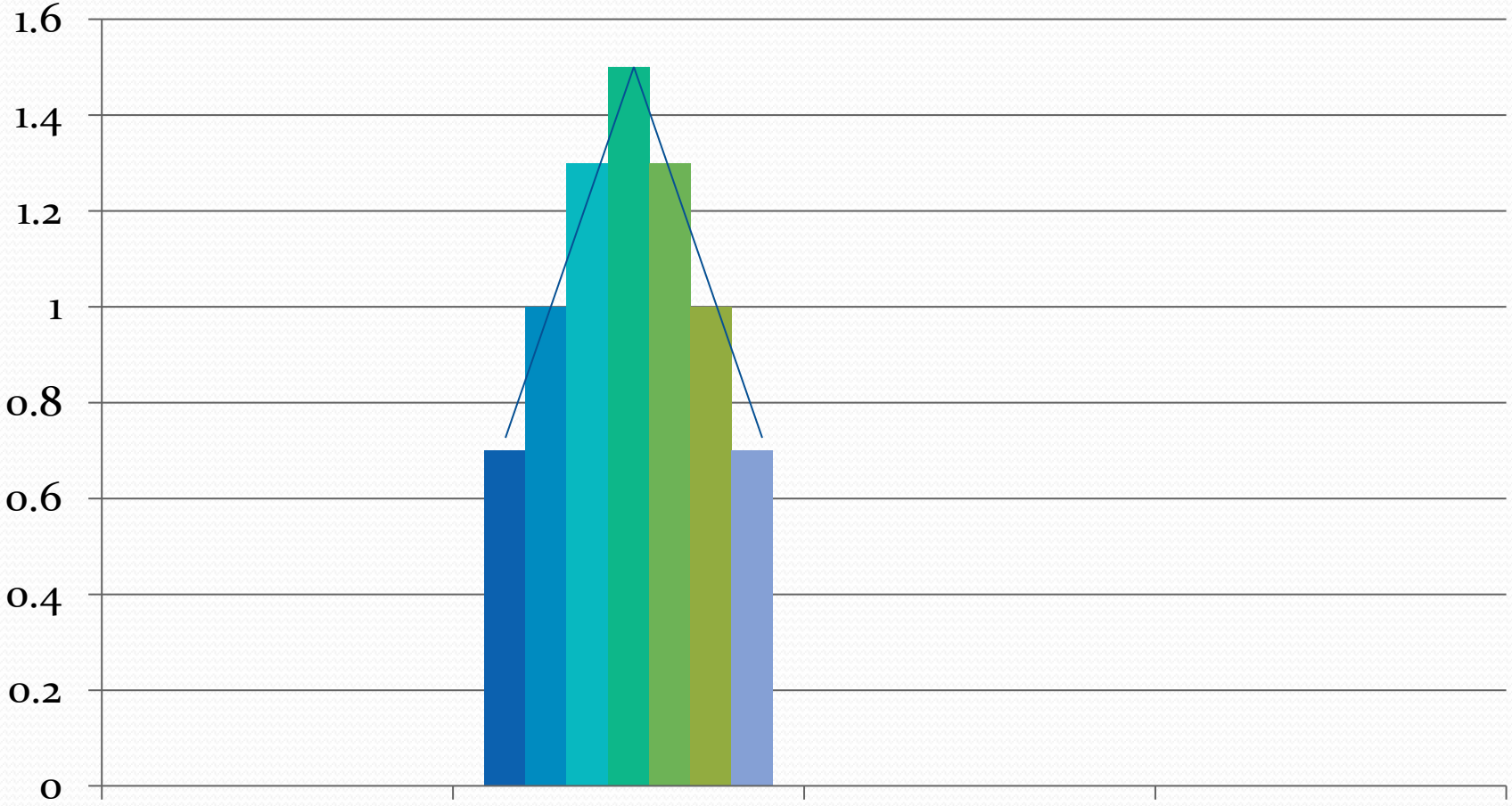
- THIS type of diagram is useful especially, when it is necessary to compare two or more frequency distributions. The curves for different distributions should be drawn with different types of lines on the same graph paper for easy comparison, which is not possible through histograms because of overlapping of rectangles, resulting in confusion.

CHARTS AND DIAGRAMS

FREQUENCY CURVE

When no. of observations is very large and group interval is reduced, the frequency polygon tends to lose its angulations, resulting in a smooth curve, known as "**Frequency curve**"

CHARTS AND DIAGRAMS



CHARTS AND DIAGRAMS

CUMULATIVE FREQUENCY CURVE

Cumulative frequency

C—I	f	Cumulative frequency
10-20	7	7
21-30	5	12
31-40	10	22
41-50	7	29
51-60	3	32
Σ =	32	

CHARTS AND DIAGRAMS

CUMULATIVE FREQUENCY CURVE

It is a line diagram, representing the cumulative frequency distribution of quantitative data.

To draw it, an ordinary frequency table in quantitative data has first to be converted into a cumulative frequency table

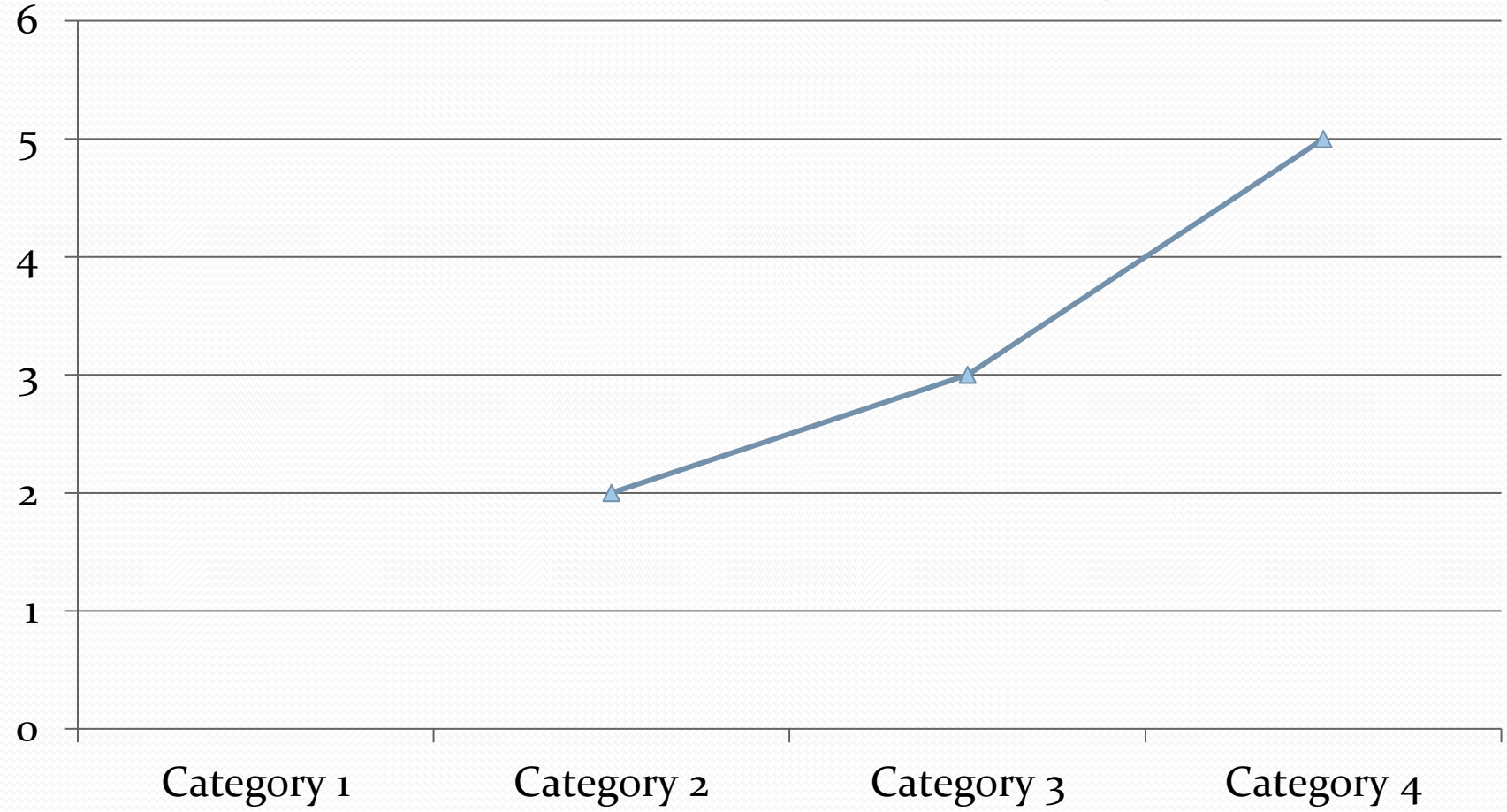
The curve is plotted by taking the variable on x-axis and cumulative frequency on y-axis.

CHARTS AND DIAGRAMS

LINE DIAGRAM

This diagram provides a simple, easily understandable and highly effective means of understanding the trend or behavior of event over a period of time, e.g. rising or falling or fluctuations, such as birth rate, death rate, population rate etc.

CHARTS AND DIAGRAMS



CHARTS AND DIAGRAMS

SCATTER DIAGRAM OR DOT DIAGRAM

When observations for two variables(e. g weight & mid arm-circumference or weight & height) are made in each of the individuals in a group, it helps to study the relationship between two variables. One variable is represented on x-axis and another variable on y-axis. Perpendiculars drawn from these readings meet, to give one scatter point.

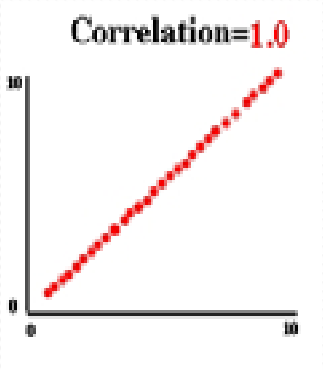
CHARTS AND DIAGRAMS

There will be as many points as there are individuals in the observation. When all the points are plotted, the diagram gives the picture of scatter. Hence the name “scatter diagram” (Dot diagram).

The direction of scatter helps to determine presence or absence of the association

CHARTS AND DIAGRAMS

- If the dots cluster round a straight line, it shows evidence of a relationship of a linear nature.
- If there is no such cluster, it is probable that there is no relationship between the variables.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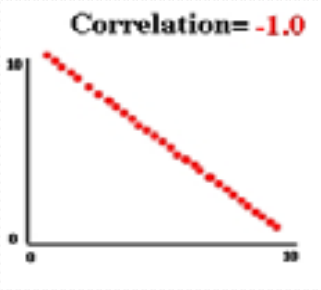
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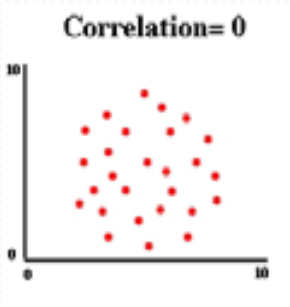
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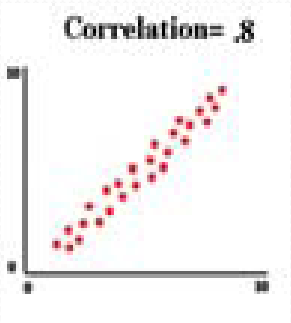
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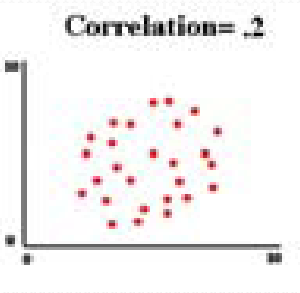
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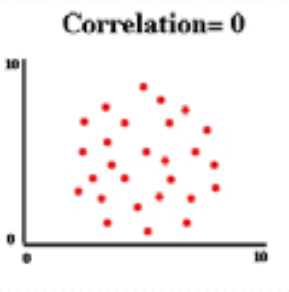
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