

## CHAPTER – 14

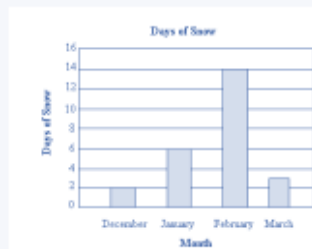
### STATISTICS

| S.no | Term             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Statistics       | Statistics is a broad mathematical discipline which studies ways to collect, summarize, and draw conclusions from data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2    | Data             | <p>A systematic record of facts or different values of a quantity is called <b>data</b>.</p> <p>Data is of two types - Primary data and Secondary data.</p> <p><b>Primary Data:</b> The data collected by a researcher with a specific purpose in mind is called primary data.</p> <p><b>Secondary Data:</b> The data gathered from a source where it already exists is called secondary data</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 3    | Features of data | <ul style="list-style-type: none"> <li>Statistics deals with collection, presentation, analysis and interpretation of numerical data.</li> <li>Arranging data in an order to study their salient features is called presentation of data.</li> <li>Data arranged in ascending or descending order is called arrayed data or an array</li> <li><b>Range</b> of the data is the difference between the maximum and the minimum values of the observations</li> <li>Table that shows the frequency of different values in the given data is called a <b>frequency distribution table</b></li> <li>A frequency distribution table that shows the frequency of each individual value in the given data is called an ungrouped frequency distribution table.</li> <li>A table that shows the frequency of groups of values in the given data is called a grouped frequency distribution table</li> <li>The groupings used to group the values in given data are called classes or class-intervals. The number of values that each class contains is called the class size or class width. The lower value in a class is called the lower class limit. The higher value in a class is called the upper class limit.</li> </ul> |

- **Class mark** of a class is the mid value of the two limits of that class.
- A frequency distribution in which the upper limit of one class differs from the lower limit of the succeeding class is called an **Inclusive or discontinuous Frequency Distribution**.
- A frequency distribution in which the upper limit of one class coincides from the lower limit of the succeeding class is called an **exclusive or continuous Frequency Distribution**

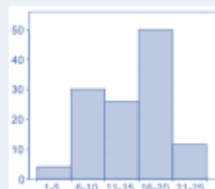
#### 4 Bar graph

A bar graph is a pictorial representation of data in which rectangular bars of uniform width are drawn with equal spacing between them on one axis, usually the x axis. The value of the variable is shown on the other axis that is the y axis.



#### 5 Histogram

A histogram is a set of adjacent rectangles whose areas are proportional to the frequencies of a given continuous frequency distribution



#### 6 Mean

The mean value of a variable is defined as the sum of all the values of the variable divided by the number of values.

$$a_m = \frac{a_1 + a_2 + a_3 + a_4}{4} = \frac{\sum_0^n a}{n}$$

|          |               |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>7</b> | <b>Median</b> | <p>The <b>median</b> of a set of data values is the middle value of the data set when it has been arranged in ascending order. That is, from the smallest value to the highest value</p> <p>Median is calculated as</p> $\frac{1}{2}(n + 1)$ <p>Where n is the number of values in the data</p> <p>If the number of values in the data set is even, then the <b>median</b> is the average of the two middle values.</p> |
| <b>8</b> | <b>Mode</b>   | Mode of a statistical data is the value of that variable which has the maximum frequency                                                                                                                                                                                                                                                                                                                                |

| <b>S.no</b> | <b>Term</b>                             | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>    | <b>Mean for Ungroup Frequency table</b> | <p>Mean is given by</p> $M = \frac{\sum f_i x_i}{\sum f_i}$                                                                                                                                                                                                                                                                                                                                                |
| <b>2</b>    | <b>Mean for group Frequency table</b>   | <p>In these distribution, it is assumed that frequency of each class interval is centered around its mid-point i.e. class marks</p> $\text{Class mark} = \frac{\text{Upper class limit} + \text{Lower class limit}}{2}$ <p>Mean can be calculated using three method</p> <p>a) Direct method</p> $M = \frac{\sum f_i x_i}{\sum f_i}$ <p>b) Assumed mean method</p> $M = a + \frac{\sum f_i d_i}{\sum f_i}$ |

Where

a=> Assumed mean

$d_i \Rightarrow x_i - a$

c) Step deviation Method

$$M = a + \frac{\sum f_i u_i}{\sum f_i} h$$

Where

a=> Assumed mean

$u_i \Rightarrow (x_i - a)/h$

**3**

**Mode for  
grouped  
frequency table**

*Modal class: The class interval having highest frequency is called the modal class and Mode is obtained using the modal class*

$$M_o = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$

Where

l = lower limit of the modal class,

h = size of the class interval (assuming all class sizes to be equal),

$f_1$  = frequency of the modal class,

$f_0$  = frequency of the class preceding the modal class,

$f_2$  = frequency of the class succeeding the modal class.

**4**

**Median of a  
grouped data  
frequency table**

For the given data, we need to have class interval, frequency distribution and cumulative frequency distribution

Median is calculated as

$$M_m = l + \left( \frac{\frac{n}{2} - cf}{f} \right) h$$

Where

l = lower limit of median class,

n = number of observations,

cf = cumulative frequency of class preceding the median class,

f = frequency of median class,

h = class size (assuming class size to be equal)

**5**

**Empirical  
Formula between  
Mode, Mean and  
Median**

$$3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$$