NORMAL DISRIBUTION

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PROBABILITY DISTRIBUTION

- Observed frequency distribution are results of actual observations. But sometimes the knowledge of distribution which are not based in real observations become essential.

- Knowledge of the expected behavior of a phenomenon or, in other words , the " expected frequency distribution" is of great help in a large number of problems in practical life.

- For example, the properties of a shoe maker must know something about the distribution of a size of his potential customer's feet; otherwise , he may find himself with huge stock of shoes which have no market.

- Amongst theoretical or expected frequency distributions, there are three popular distributions (1) Normal distribution(2) Binomial distribution(3) Poisson distribution

NORMAL DISTRIBUTION

- If measures of distribution arranged in linear fashion and vary continuously on both the sides from the central curve, then the distribution is called Normal Distribution.

- In normal distribution, measures are concentrated closely around the centre and taper off from this central high point to the left and right.

- There are relatively few measures at the "low score" end of the scale, an increasing number upto a maximum at the middle position; and a progressive 'falling off' towards the 'high score' end of the scale.

Examples of Normal Distribution

- Example 1: If we study the height of Americans, the height of most of the Americans will be between 162 to 192 cm. Height of very few Americans will be between152 to 167 cm (lower end of the scale) and between 182 to 215 cm (higher end of the scale).

- Example 2: Normal frequency distribution will be more clear taking this example (Figure 1).

Table											
Wt. of fish(gm)	15	17	19	21	23	25	27	29	31	33	35
Frequencies	9	11	13	15	17	19	17	15	13	11	9

Figure1 : Normal Distribution Curve

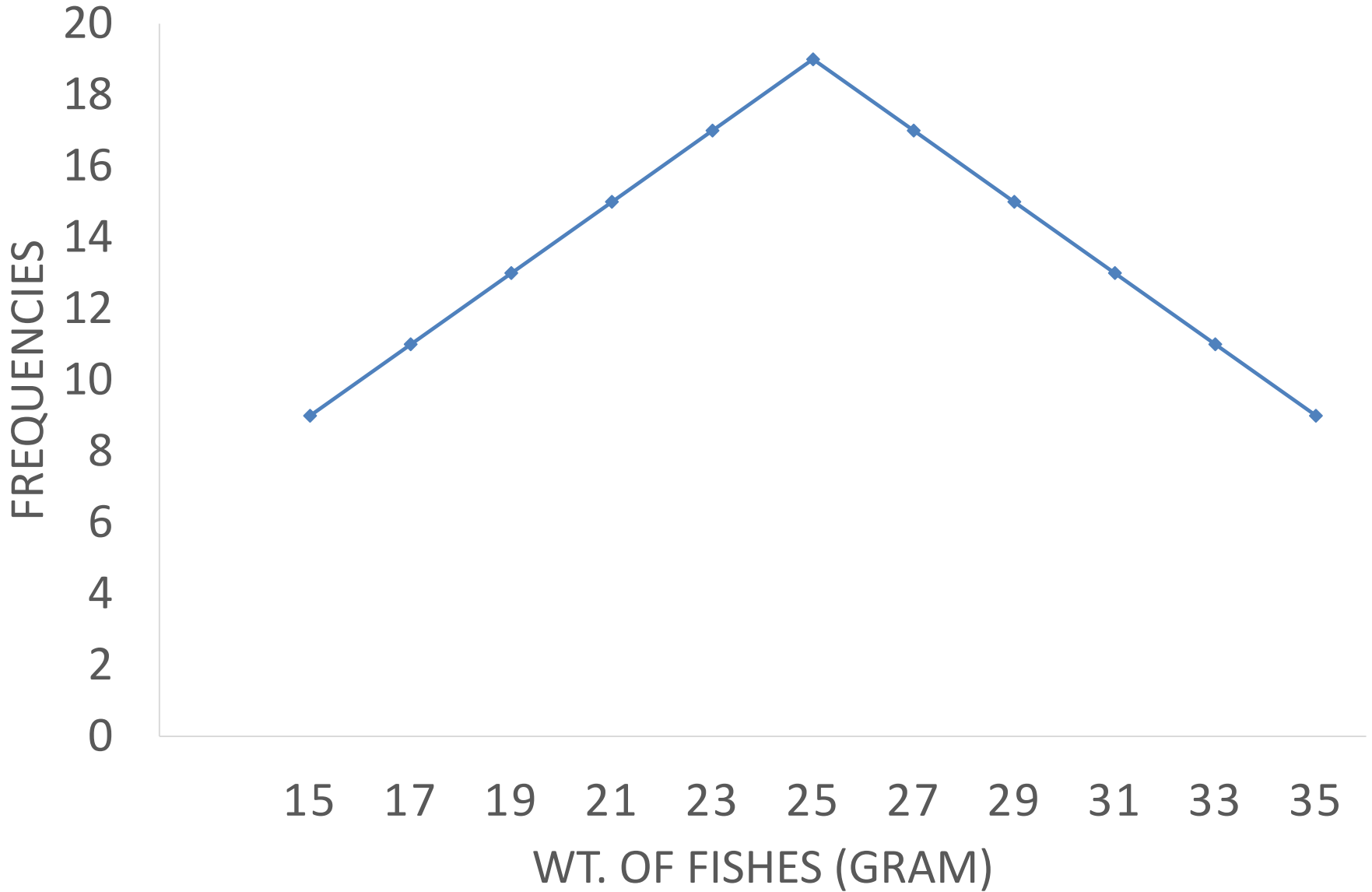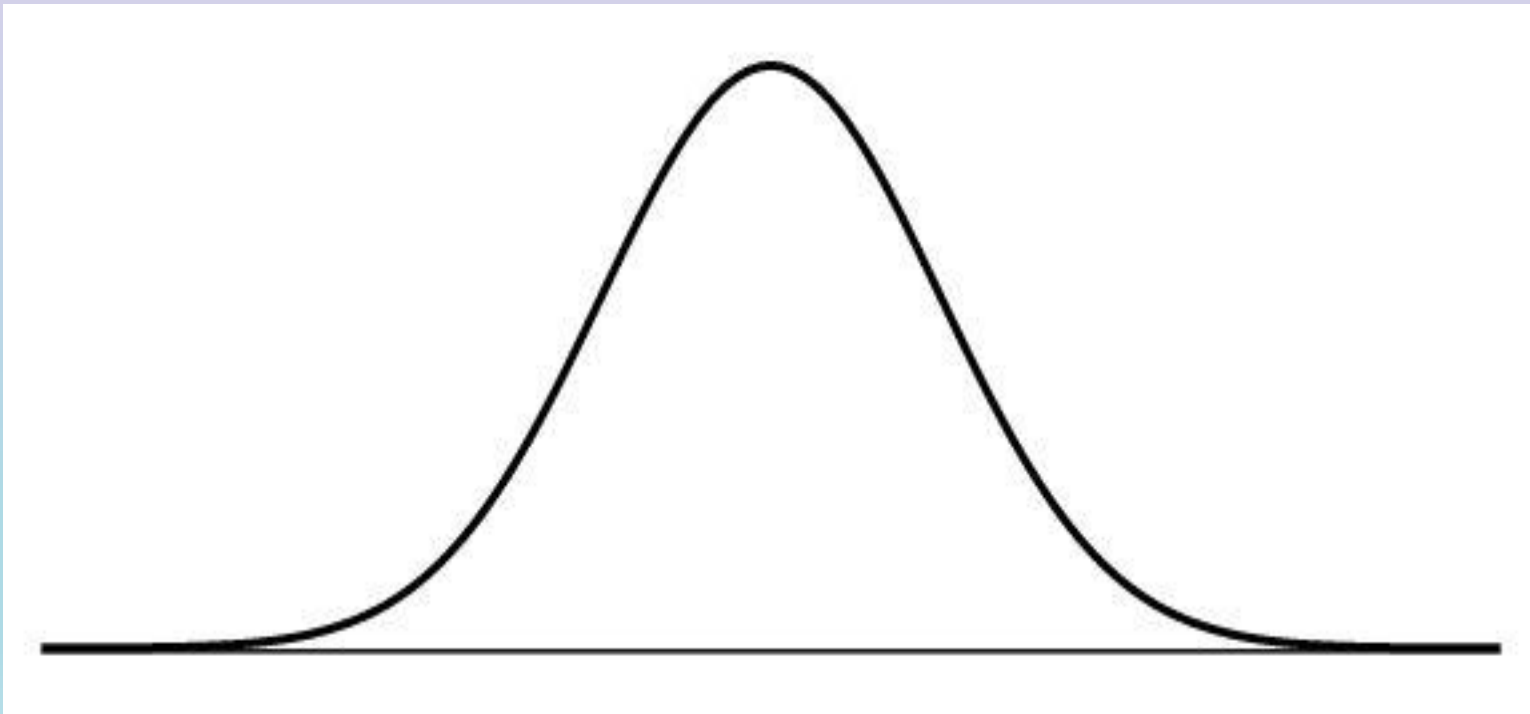Y-axis: FREQUENCIES
X-axis: WT. OF FISHES (GRAM)

Figure 2: Bell Shaped Normal Distribution Curve

Properties of Normal Distribution Curve

1. Normal distribution presents a continuous bell shaped normal distribution curve (Figure 2).

2. There is only one maximum peak (unimodal).

3. The normal curve is symmetrical and asymptotic (touches at infinity).

4. The height of normal curve is maximum at its mean. Thus for a normal distribution all measures of central tendency are equal i.e. Mean = Median =Mode

Properties of Normal Distribution Curve

5. The area between the curve and the two upright drawn at any point gives the fraction of the total number of observations between these points.

6. Most of the observations are clustered around the mean and there are relatively a few observations at the extremes

7. The normal distribution curve has affixed mathematical characteristic feature independent of scale magnitude and unit of mean and standard deviation.

Relationship between normal curve area and standard deviation

The figures 4 & 5 shows:

1. The 1st and 3rd quartiles are equidistance from the median and at a distance of 0.674 SD

2. Mean ± 1 SD covers 68.37 % area i.e. relative frequency (34.134 % on each side)

3. Mean ± 2 SD covers 95.45 % area i.e. (47.45 % on both sides).

4. Mean ± 3 SD covers 99.73 % area i. e. relative frequency.

5. 50 % of observations lie in an area bounded by a distance of 0.6745 SD on each side of the mean (red dotted line- Fig.4).

6. $\overline{X}$ ± 1.96 SD covers 95% area ; $\overline{X}$ ± 1.96 SD ± 2.57 SD covers 99% area; $\overline{X}$ ± 0.6745 covers 50 % area.

Figure 4. Showing probability or relative frequency of an observation falling beyond Mean ± 3 SD respectively

34·134% — 34·134%.
47·275% — 47·275%.
45·865% — 45·665%.

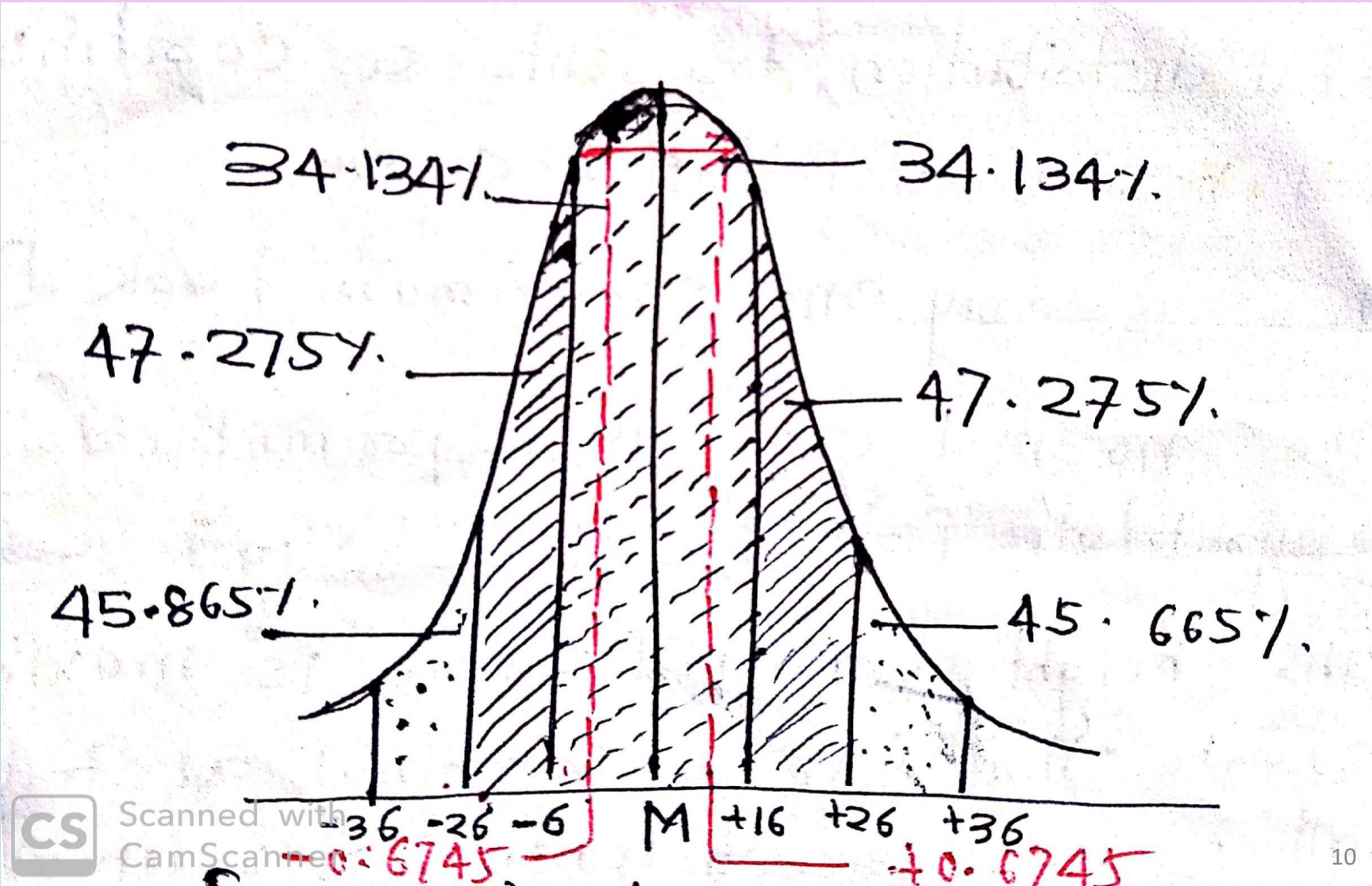-3б -2б -б   M +1б +2б +3б
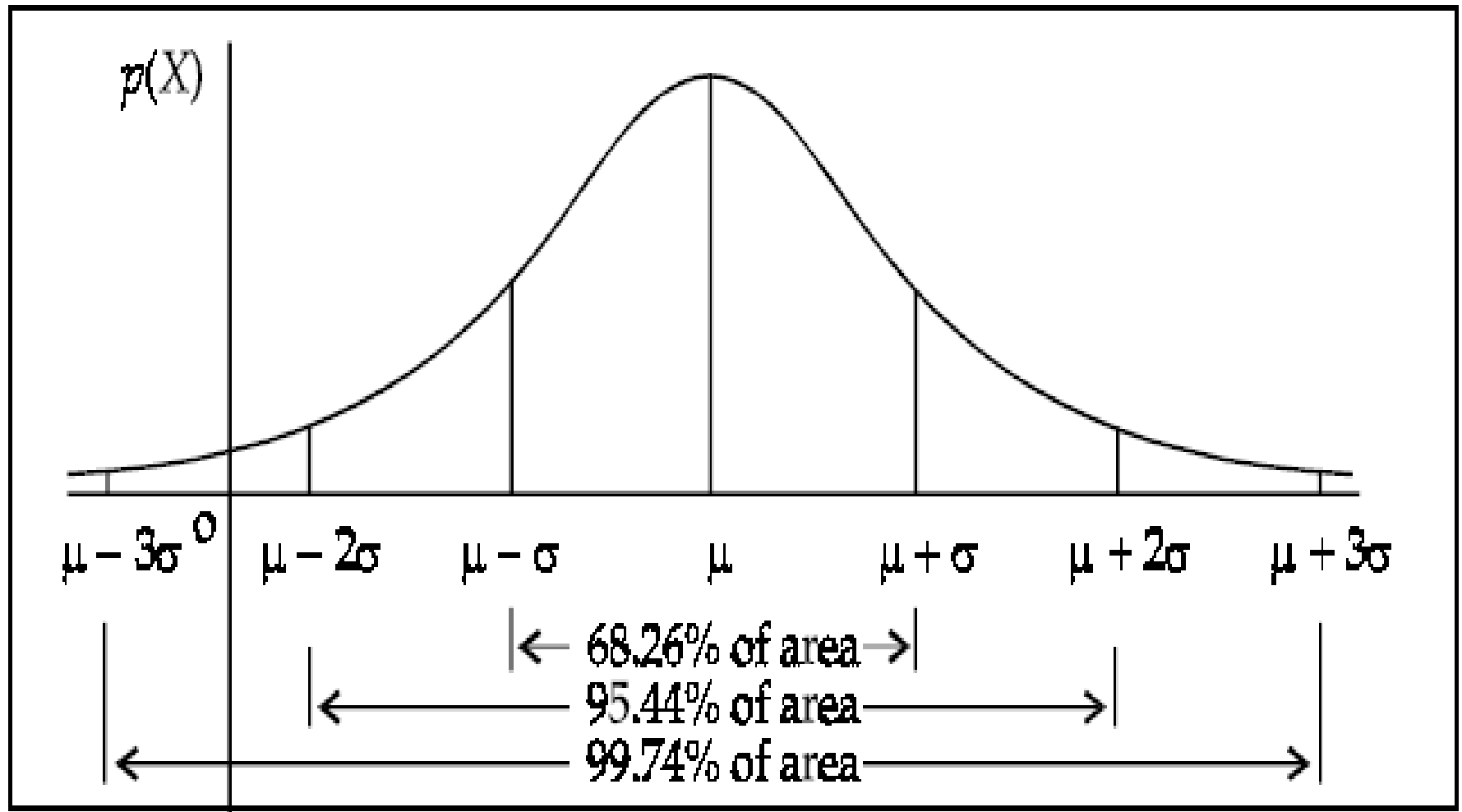-0·6745   +0·6745

Figure 5.

Significance of Normal Distribution

1. The normal distribution plays a very predominant part in medical and biological research.

2. Many populations encountered in the course of research in many fields have a normal distribution to a good degree of approximation.

3. When the distribution is normal, the mean and standard deviation describe the distribution completely.

4. Particular use of this normal distribution is made whenever we have a large sample since many other theoretical distributions approximate to a normal curve.

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Suggested Readings

- Selvin S (2007). Biostatistics how it Works. Pearson Education.

- Mahajan BK (1999) .Methods in Biostatistics. Jaypee Brothers, New Delhi.

- Sunder Rao PSS and Richard J (2001). An Introduction To Biostatistics. Prentice Hall of India Private Limited. New Delhi.

- Prasad S (2007). Elements of Biostatistics. Rastogi Publications, Meerut.

Thanks