**Chapter 6 – C: Normal Distribution**

A special and very common type of distribution represented by a bell-shaped curve; it formally called a **normal distribution**. All normal distributions have the same characteristic bell shape, but they can differ from one another in two ways.

1. The location of central peak: Normal distribution is symmetric; the peak represents the mean, median and mode of the data set.
2. The variation or the spread of data values around the peak.

**Condition for a Normal Distribution**

A data set that satisfies the following criteria is likely to have a nearly normal distribution.

1. Most data values are clustered near the mean, giving the distribution a well-defined single peak.
2. Data values are spread evenly around the mean, making the distribution symmetric.
3. Larger deviations from the mean become increasingly rare, producing the tapering tails of the distribution.
4. Individual data values results from a combination of man different factors, such as genetic and environmental factors.

Example 1

Which of the following variables would you expect to have a normal or nearly normal distribution?

1. Scores on a very easy test.
2. Shoe sizes of a random sample of adult women.

**Standard Deviation in Normal Distributions**

In statistics, the **68–95–99.7** rule is a way to remember the percentage of values that lie within a band around the [mean](https://en.wikipedia.org/wiki/Arithmetic_mean) in a [normal distribution](https://en.wikipedia.org/wiki/Normal_distribution) with a width of one, two and three [standard deviations](https://en.wikipedia.org/wiki/Standard_deviation), respectively; more accurately, 68.27%, 95.45% and 99.73% of the values lie within one, two and three standard deviations of the mean, respectively.



 Example 2

` Each test that makes up the SAT is designed so that its scores are normally distributed with a mean of 500 and a standard deviation of 100. Interpret this statement according to the 68-95-999.7 rule.

 Example 3

A survey finds that the prices paid for 2-years-old Ford Fusion cars are normally distributed with a mean of $10,500 and a standard deviation of $500. Consider a sample of 10,000 people who bought 2-years-old Ford Fusions.

1. How many people paid between $10,000 and $11,000?
2. How many people paid less than $10,000?
3. How many people paid more than $12,000?

**Standard Scores**

The **68–95–99.7** rule applies to data values that are exactly 1, 2 or 3 standard deviations from the mean. The number of standard deviations a data value lies above or below the mean is call its standard score (or *z-score*), which is often abbreviated by the letter *z*.

The standard score of the mean is *z* = 0, because it is 0 standard deviations from the mean.

The standard score of a data values 1.5 standard deviations above the mean is *z* = 1.5.

The standard score of a data value 2.4 standard deviations below the mean is *z* = -2.4.

$$z=standard score= \frac{data value-mean}{standard deviation}$$

 Example 4

Stanford-Binet IQ test is designed so that scores are normally distributed with a mean of 100 and a standard deviation of 16. Find the standard scores for IQ scores of 95 and 125.

**Standard Scores and Percentile**

The ***n*th percentile** of a data set is the smallest value in the set with the property that *n*% of the data values are less than or equal to it. A data value lies between two percentiles is said to lie in the lower percentile.

 Table

 Example 5

Cholesterol levels in men 18024 years of age are normally distributed with a mean of 178 and a standard deviation of 41.

1. In that percentile is a man with a cholesterol level of 190?
2. What cholesterol level corresponds to the 90th percentile, the level at which treatment may be necessary?

 Example 6

The height of American women aged 18-24 are normally distributed with a mean of 65 inches and a standard deviation of 2.5 inches. In order to serve in the U.S Army, women must be between 58 and 80 inches tall. What percentage o women are ineligible to serve based on their height?

Homework: Quick Quiz 1-10

 Does It Make Sense? 5-6

 Basic Skills & Concepts: 19, 21, 23, 25, 27, 29