

4.1: Normal Distributions

The normal distribution is the most important and most widely used distribution in statistics. It is sometimes called the “bell curve,” although the tonal qualities of such a bell would be less than pleasing. It is also called the “Gaussian curve” of Gaussian distribution after the mathematician Karl Friedrich Gauss.

Strictly speaking, it is not correct to talk about “the normal distribution” since there are many normal distributions. Normal distributions can differ in their means and in their standard deviations. Figure 1 shows three normal distributions. The green (left-most) distribution has a mean of -3 and a standard deviation of 0.5, the distribution in red (the middle distribution) has a mean of 0 and a standard deviation of 1, and the distribution in black (right-most) has a mean of 2 and a standard deviation of 3. These as well as all other normal distributions are symmetric with relatively more values at the center of the distribution and relatively few in the tails. What is consistent about all normal distribution is the shape and the proportion of scores within a given distance along the x-axis. We will focus on the Standard Normal Distribution (also known as the Unit Normal Distribution), which has a mean of 0 and a standard deviation of 1 (i.e. the red distribution in Figure 4.1.1).

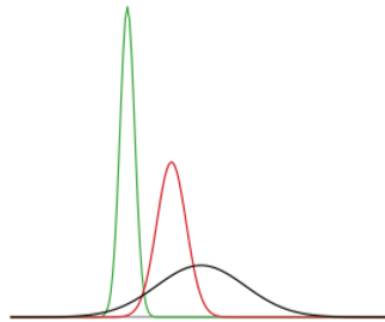


Figure 4.1.1: Normal distributions differing in mean and standard deviation.

Seven features of normal distributions are listed below.

1. Normal distributions are symmetric around their mean.
2. The mean, median, and mode of a normal distribution are equal.
3. The area under the normal curve is equal to 1.0.
4. Normal distributions are denser in the center and less dense in the tails.
5. Normal distributions are defined by two parameters, the mean (μ) and the standard deviation (σ).
6. 68% of the area of a normal distribution is within one standard deviation of the mean.
7. Approximately 95% of the area of a normal distribution is within two standard deviations of the mean.

These properties enable us to use the normal distribution to understand how scores relate to one another within and across a distribution. But first, we need to learn how to calculate the standardized score than make up a standard normal distribution.

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