AP Statistics Chapter 2 – Describing Location in a Distribution

2.1: Measures of Relative Standing and Density Curves

Density Curve

A **density curve** is a curve that

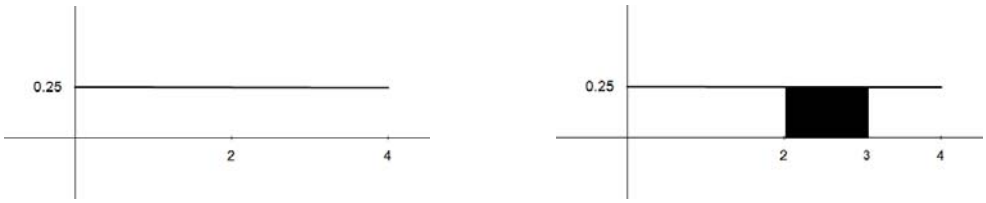
- is always on or above the horizontal axis, and
- has area exactly 1 underneath it.

A density curve describes the overall pattern of a distribution. The area under the curve and above any range of values is the proportion of all observations that fall in the range.

Example

The density curve below left is a rectangle. The area underneath the curve is $4 \cdot 0.25 = 1$.

The figure on the right represents the proportion of data between 2 and 3 ($1 \cdot 0.25 = 0.25$).



Median and Mean of a Density Curve

- The **median** of a density curve is the **equal-areas point**, the point that divides the area under the curve in half.
- The **mean** of a density curve is the **balance point**, at which the curve would balance if made of solid material.
- The median and mean are the same for a symmetric density curve. They both lie at the center of the curve. The mean of a skewed curve is pulled away from the median in the direction of the long tail.

Normal Distributions

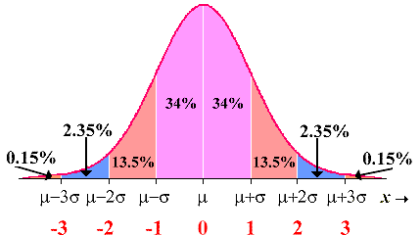
A normal distribution is a curve that is

- mound-shaped and symmetric
- based on a continuous variable
- adheres to the 68-95-99.7 Rule

The 68-95-99.7 Rule

In the normal distribution with mean μ and standard deviation σ:

- 68% of the observations fall within 1σ of the mean μ.
- 95% of the observations fall within 2σ of the mean μ.
- 99.7% of the observations fall within 3σ of the mean μ.



2.2: Normal Distributions

Standardizing and z-Scores

If x is an observation from a distribution that has mean μ and standard deviation σ, the **standardized value of x** is

$$z = \frac{x - \mu}{\sigma}$$

A standardized value is often called a **z-score**.

Standard Normal Distribution

- The standard normal distribution is the normal distribution N(0, 1) with mean 0 and standard deviation 1.
- If a variable x has any normal distribution N(μ, σ) with mean μ and standard deviation σ, then the standardized variable

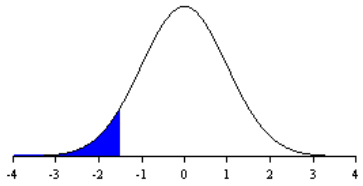
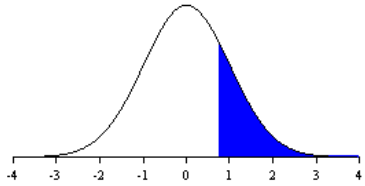
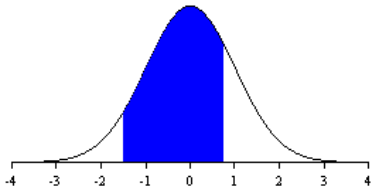
  $$z = \frac{x - \mu}{\sigma}$$

  has the standard normal distribution (see diagram below).

The Standard Normal Table

Table A is a table of areas under the standard normal curve. The table entry for each value z is the area under the curve to the left of z.

Standard Normal Calculations

Area to the left of z ($Z < z$)	Area to the right of z ($Z > z$)	Area between z_1 and z_2
		
Area = *Table Entry*	Area = 1 – *Table Entry*	Area = difference between *Table Entries* for z_1 and z_2

Inverse Normal Calculations

Working backwards from the area, we find z, then x. The value of z is found using Table A *in reverse*. The value of x is found, from z, using the formula below

$$x = \mu + z \bullet \sigma$$