**Proportions**

**Definition**

A proportion in a population or sample is the number of Observational Units (OUs) with a certain value of a characteristic divided by the total number in the population or sample.[[1]](#footnote-1)

The proportion parameter for a population is denoted by the Greek symbol pi, π.

The proportion statistic for a sample is denoted by p-hat, $\hat{p}$.

**Examples**

Example 1: A population may be all individuals over the age of 18 living in the United States. A characteristic of this population may be gender. One value of gender is male. The proportion of males to the total population is the number of males divided by the total number of individuals.

Example 2: A population may be all cars registered in New York State. A characteristic may be make, and a value of the characteristic is Toyota. The proportion of Toyotas registered in NYS to the total number of cars registered in NYS is the number of Toyotas in the population divided by the total number of cars in the population.

Example 3: The sample is jellybeans from a jar. A characteristic of the jellybeans is color. Values of the jellybean colors are pink, white, red, purple, green, and black. The proportion of black jellybeans in the sample is the number of black jellybeans in the sample divided by the total number of jellybeans in the sample.

**Characteristics**

Proportion is always greater than zero and less than one: 0 ≤ π ≤ 1, 0 ≤ $\hat{p }$≤1

If the proportion is 0, then the population or sample contains none.

If the proportion is 1, then the population is comprised entirely of the characteristic with that value.

Sample Proportion, $\hat{p}$, is an *unbiased estimator.* This means that the estimator $\hat{p}$ predicts the true value of π, and not a value a little less or a little more. i.e. as the sample size approaches the population size, the value of $\hat{p}$ approaches the value of π.

**Relationship to Percentage**

Proportion is often depicted in terms of percentage. “The class is 35% transfer students”

Percentage is obtained from a proportion by multiplying the proportion by 100.

**Calculating Proportion**

Example 1: Number of individuals living in the United States over the age of 18: N=220,000,000.

Number of males in this population: Nm=107,074,000

The proportion of males to this population is π = Nm/N=107074000÷220000000=.4867

The percentage of males is .4867x100 = 48.67%

In stacked equation form: π = $\frac{Nm}{N}=$ $\frac{107074000}{220000000}=$.467

Example2: The population of registered automobiles in NYS in 2012 was N=10,791,198. The number of registered vehicles in Onondaga county in 2012 was NOC= 351,095. The proportion vehicles registered in NYS that were registered in Onondaga County in 2012 was π=N OC/N=351095/10791198=0.03253531257, or approximately .033

The percentage is 0.03253531257x100 = 3.253531257% ≈ 3.3% (‘≈’ means approximately)

Example 3: A sample of jellybeans from a jar contains 2 pink, 3 white, 2 red, 5 purple, 2 green, 0 orange, and 2 black jellybeans. n=2+3+2+5+2+0+2=16 jellybeans. The proportion of warm color (pink, red, orange) jellybeans to the total number in the sample is:

$$\hat{p=}\frac{2+2+0}{16}=\frac{4}{16}= .25$$

The percentage of warm color jelly beans in the sample is .25 x 100 = 25%

1. The number of OUs in the population is denoted by large N, and for a sample it is denoted by small n. [↑](#footnote-ref-1)