# Expected Values and Standard Errors

The **mean** of a list of numbers $x_1, \ldots, x_n$ is

$$\text{mean} = \frac{1}{n}\left(x_1 + x_2 + \cdots + x_n\right) = \frac{1}{n}\sum_{i=1}^{n} x_i.$$

The **population standard deviation** is

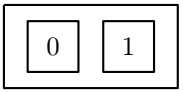
$$\text{SD} = \sqrt{\frac{1}{n}\left((x_1 - \text{mean})^2 + \cdots + (x_n - \text{mean})^2\right)}$$

The **sample standard deviation** is

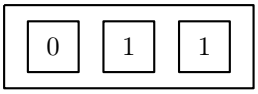
$$\text{sd} = \sqrt{\frac{1}{n-1}\left((x_1 - \text{mean})^2 + \cdots + (x_n - \text{mean})^2\right)}$$

1. When we are working with a box model and know what all the tickets are, then we should use the population standard deviation. Compute the mean and SD for each box.

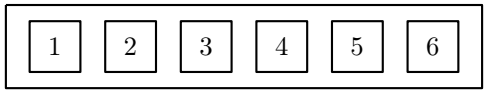
a) Flipping a Coin:

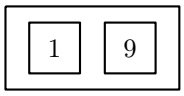


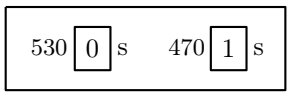

b) Flipping an Unfair Coin:




c) Rolling a die:



d) A Box with Two Different Numbers: 


e) A Zero-One Box: 


2. Write down a box model for the following random experiments.

a) Flipping a fair coin (0 = tails and 1 = heads)

b) Flipping a coin for which the chance of heads is 2/3.

c) Rolling a fair die.

d) Rolling a fair die and counting the number of times you get a 5.

e) Rolling a fair die and counting the number of times you get a 3 or a 5.