# Worksheet 01

**1**. Assume we have a random sample of size $n = 5$ with the following data: $x_1 = 2$, $x_1 = 6$, $x_1 = 1$, $x_1 = 0$, $x_1 = 6$. What is the observered sample mean $\bar{x}$? [1]

[1] I am using the standard convention that we replace upper-case random variable names with lower-case variables when we have specific observations of them.

**2**. Let $X_1, \ldots, X_n \overset{\text{i.i.d.}}{\sim} \mathcal{G}$ be a random sample from a distribution with mean $\mu_X$ and variance $\sigma_X^2$. What is the expected value of the sample mean $\bar{X}$?[2] Does this imply that $\bar{X}$ is an unbiased estimator of $\mu_X$?

[2] I gave the answer on the handout. Make sure that you can justify the result.

**3**. Using the same set-up as the previous question, what is $Var(\bar{X})$?

**4**. Let $Y$ be a random variable with mean $m$ and variance $v$. Chebyshev's Inequality tells us that if for any $a > 0$,

$$\mathbb{P}[|Y - m| \geq a] \leq \frac{v}{a^2}.$$

Use this result to show that $\bar{X}$ is a consistent estimator of $\mu_X$.

**5**. Assume that $\mathcal{G}$ has a normal distribution. Define the following:

$$Z = \frac{\mu_X - \bar{X}}{\sqrt{\sigma_X^2 / n}}$$

What is the distribution of $Z$?