Problem 1: Matching Notations to Definitions

Match the following notations (1-7) to correct definitions (A-I). Some notations may have more than one correct definition.

Notation	Definition
$\bar{x}$	B. The mean of a sample of n observations
μ	A. The mean of the population, expected value of the distribution of X, $E(X)$
$\mu_{\bar{x}}$	C. The mean of all possible sample means from repeated drawing of random samples of n observations D. The mean of the sampling distribution of sample mean
s	F. Standard deviation of a sample of n observations
σ	H. How much individual responses vary in the entire population E. The population standard deviation, the standard deviation of the probability distribution of X
$\sigma_{\bar{X}}$	G. How much sample means vary about the population mean when we repeatedly draw a random sample of n observations and calculate the sample mean **Note:** For any random sample with fixed sample size n, $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$. We often call the standard deviation of a statistic the **Standard Error (SE)**.
n	I. Sample size

Recall

A **statistic** is numeric a quantity (such as the mean of a sample) that is computed from a sample. Examples of statistics are: sample mean, sample proportion, sample standard deviation, etc.

Problem 2: Understanding Standard Deviation of a Statistic

Which of the following is **not** correct? The standard deviation of a statistic describes:

(a) The standard deviation of the sampling distribution of that statistic.

(b) The standard deviation of the observed measurements in the sample.

(c) How close that statistic falls to the parameter that it estimates.

(d) The variability in the values of the statistic from sample to sample of the same size.

Answer

(B). In this option the observed measurements is NOT a statistic because it is not computed from the sample, rather observed. Hence, standard deviation of observed measurements does not describe the standard deviation of a statistic.

Why not A,C or D?

(A) The sampling distribution is the distribution of the statistic across many repeated samples. The spread of this distribution is measured by its standard deviation, also called the standard error (SE).

(C) The standard deviation of a statistic helps us understand how close that statistic (like the sample mean) is to the population parameter (like the true population mean). A smaller standard deviation means the sample statistic is more reliable in estimating the true value.

(D) The standard deviation of a statistic describes how much the statistic varies from one sample to another. If we take multiple random samples of the same size, the statistic (like the sample mean) will not always be exactly the same. The variability in these values is captured by the standard deviation of the statistic.