

Some Key Statistical Concepts

Population: the complete collection of all items of interest

- All Iowa farmers
- A collection of pennies in a can

Parameter: a numerical characteristic of the population

- The mean number of acres of corn planted by Iowa farmers last spring
- The mean age of the pennies in a can

1

Some Key Statistical Concepts (cont.)

Sample: the subset of the population that is observed

- 100 farmers selected at random from a list of all Iowa farmers
- 10 pennies selected at random from a can of pennies

2

Some Key Statistical Concepts (cont.)

Statistic: a numerical characteristic of the sample

- The average number of acres of corn planted by the 100 randomly selected farmers
- The average age of the 10 pennies selected at random from a can of pennies

3

We often use Greek letters to denote population parameters.

- μ usually denotes the population mean
- σ usually denotes the population standard deviation

We estimate a population parameter by computing a sample statistic.

- The average of a sample \bar{Y} is used to estimate the mean of a population μ .
- The standard deviation of a sample s is used to estimate the standard deviation of a population σ .

4

One of the great things about statistics is that we can use the information in a random sample to compute

1. statistics that estimate population parameters, AND
2. **standard errors** that tell us how far from the population parameters the statistics are likely to be.

5

standard error: the estimated standard deviation of a statistic

Suppose \bar{Y} is the average of a simple random sample of n items drawn from a population with mean m and standard deviation s . Then . . .

- The standard deviation of \bar{Y} is $\frac{s}{\sqrt{n}}$
- The standard error of \bar{Y} is $\frac{s}{\sqrt{n}}$

6

At first it is difficult to understand how a statistic can have a standard deviation. After all a standard deviation measures variability in a set of numbers, and a statistic is only one number. To make sense out of this, it is necessary to understand that there are many possible samples. The statistic that we compute from a sample is only one of many possible statistics that we could have seen.

7

Imagine that we write down the value of the statistic for each possible sample. The standard deviation of these values is the standard deviation of the statistic. The fact that we can get an estimate of a statistic's standard deviation by seeing only one sample is really quite amazing.

8

