Standard Error Worksheet (Answer Key)

KEY TERMS

- **Population:** *a collection of persons, things, or objects under study*
  - Notation: N
- **Parameter:** *a numerical characteristic of the whole population that can be estimated by a statistic*
  - Notation: p
- **Sample:** *a portion (or subset) of the larger population that is studied to gain information about the population*
  - Notation: n
- **Statistic:** *a number that represents a property of the sample*
  - Notation: p̂ ("p-hat")
- **Standard error:** *the standard deviation of the sampling distribution that measures how much an estimator typically varies from sample to sample*
  - $SE = \sqrt{(p(1-p))/n}$ or $SE = \sqrt{(\hat{p}(1-\hat{p}))/n}$

Illowsky, B., & Dean, S. (2018). Introductory statistics.
Gould, R., & Ryan, C. N. (2015). Introductory statistics: Exploring the world through data. Pearson.

EXERCISE 1: Salinity

During June 2020, 2,395 salinity measurements were taken in the Mokauea loko i'a. From an analysis of this data, approximately 33% of the salinity measurements were greater than 22.5 PSU. Suppose you examined 100 random data points from this set of data.

With the above information, fill in the following:

- **N =** 2,395
- **n =** 100
- **p =** 0.33
- **p̂ =** Unknown, but ~0.33 is expected

With this information, calculate the standard error of this scenario. Round to the nearest thousandth. Then interpret your answer as a percentage.

$SE = \sqrt{(p(1-p))/n} = \sqrt{(0.33(1-0.33)/100} = 0.047$

Example Interpretation: We expect 33% of salinity measurements being greater than 22.5 PSU, give or take 4.7%.

The above data is real data collected from research at Mokauea loko i'a.
Additional Mokauea loko i`a data can be explored here: http://grogdata.soest.hawaii.edu/

EXERCISE 2: Electrical Conductivity

During June 2020, 2,395 electrical conductivity measurements were taken in the Mokauea loko i'a. From an analysis of this data, approximately 45% of the electrical conductivity measurements were less than 36.4 mS/cm. Suppose you examined 200 random data points from this set of data.

With the above information, fill in the following:

- **N =** 2,395
- **n =** 200
- **p =** 0.45
- **p̂ =** Unknown, but ~0.45 is expected

With this information, calculate the standard error of this scenario. Round to the nearest thousandth. Then interpret your answer as a percentage.

$SE = \sqrt{(p(1-p))/n} = \sqrt{(0.45(1-0.45)/200} = 0.035$

Example Interpretation: We expect 45% of electrical conductivity measurements being less than 36.4 mS/cm, give or take 3.5%.

EXERCISE 3: Bottom Temperature

During June 2020, 15,103 bottom temperature measurements were taken in the Mokauea loko i'a. From an analysis of this data, approximately 11% of the bottom temperature measurements were greater than 22.3°C. Suppose you examined 500 random data points from this set of data.

With the above information, fill in the following:

- **N =** 15,103
- **n =** 500
- **p =** 0.11
- **p̂ =** Unknown, but ~0.11 is expected

With this information, calculate the standard error of this scenario. Round to the nearest thousandth. Then interpret your answer as a percentage.

$SE = \sqrt{(p(1-p))/n} = \sqrt{(0.11(1-0.11)/500} = 0.014$

Example Interpretation: We expect 11% of bottom temperature measurements being greater than 22.3°C, give or take 1.4%.