

# Bunker Hill Community College

Final Statistics Exam 2019-05-02

Exam ID 018

**Name:** \_\_\_\_\_

This take-home exam is due **Wednesday, May 8**, at the beginning of class.

You may use any notes, textbook, or online tools; however, you may not request help from any other human.

You will show your work on the pages with questions. When you are sure of your answers, you will **put those answers in the boxes** on the first few pages.

Unless you have an objection to doing so, please **copy the honor-code text below and sign**.

*I understand that outside help is NOT allowed on this exam. On my honor, the work herein is my own.*

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**Signature:** \_\_\_\_\_

1. (a)
- (b)
- (c)
- (d)
- (e)
- (f)
2.
3.
4. (a)
- (b)
5.
6. (a)
- (b)
- (c)
- (d)
- (e)
- (f)
- (g)
7. (a)
- (b)

8. (a)
- (b)
- (c)
- (d)
- (e)
- (f)
- (g)

1. In a deck of strange cards, there are 809 cards. Each card has an image and a color. The amounts are shown in the table below.

	green	teal	violet	white
bike	32	48	62	29
cat	76	59	58	83
shovel	15	18	86	71
tree	28	97	20	27

- (a) What is the probability a random card is a tree given it is white?
- (b) What is the probability a random card is white?
- (c) What is the probability a random card is white given it is a tree?
- (d) What is the probability a random card is either a shovel or teal (or both)?
- (e) What is the probability a random card is a tree?
- (f) What is the probability a random card is both a tree and white?

2. In a deck of strange cards, each card has an image and a color. The chance of drawing a cat is 39.2%. If a cat is drawn, there is a 29.2% chance that it is teal. If a card that is not a cat is drawn, there is a 50.9% chance that it is teal.

Now, someone draws a random card and reveals it is teal. What is the chance the card is not a cat?

3. In a very large pile of toothpicks, the mean length is 74.2 millimeters and the standard deviation is 3.33 millimeters. If you randomly sample 169 toothpicks, what is the chance the sample mean is between 74 and 74.7 millimeters?

4. In a game, there is a 31% chance to win a round. You will play 90 rounds.
- (a) What is the probability of winning exactly 28 rounds?
  - (b) What is the probability of winning at least 21 but at most 32 rounds?

5. As an ornithologist, you wish to determine the average body mass of *Dendroica coronata*. You randomly sample 34 adults of *Dendroica coronata*, resulting in a sample mean of 11.97 grams and a sample standard deviation of 1.28 grams. Determine a 80% confidence interval of the true population mean.



6. A treatment group of size 10 has a mean of 93.5 and standard deviation of 22.3. A control group of size 21 has a mean of 116 and standard deviation of 17.9. If you decided to use a significance level of 0.02, is there sufficient evidence to conclude the treatment causes an effect?

By using the Welch-Satterthwaite equation, I've calculated the degrees of freedom should be 14.

- (a) State the null hypothesis.
- (b) State the alternative hypothesis.
- (c) Evaluate the critical value. (The critical value is either  $z^*$  or  $t^*$ . Determine its value.)
- (d) Determine the standard error of the relevant sampling distribution.
- (e) Evaluate the absolute value of the test statistic. (The test statistic is either  $z_{\text{obs}}$  or  $t_{\text{obs}}$ . Determine its absolute value.)
- (f) If possible, evaluate the  $p$ -value. Otherwise, describe an interval containing the  $p$ -value.
- (g) Do we reject or retain the null?

7. From a very large population, a random sample of 90000 individuals was taken. In that sample, 91.9% were messy. Determine a 95% confidence interval of the population proportion.
- (a) Find the lower bound of the confidence interval.
  - (b) Find the upper bound of the confidence interval.

8. An experiment is run with a treatment group of size 62 and a control group of size 46. The results are summarized in the table below.

	treatment	control
happy	27	31
not happy	35	15

Using a significance level of 0.02, determine whether the treatment causes an effect on the proportion of cases that are happy.

- (a) State the null hypothesis.
- (b) State the alternative hypothesis.
- (c) Evaluate the critical value. (The critical value is either  $z^*$  or  $t^*$ . Determine its value.)
- (d) Determine the standard error of the relevant sampling distribution.
- (e) Evaluate the absolute value of the test statistic. (The test statistic is either  $z_{\text{obs}}$  or  $t_{\text{obs}}$ . Determine its absolute value.)
- (f) If possible, evaluate the  $p$ -value. Otherwise, describe an interval containing the  $p$ -value.
- (g) Do we reject or retain the null?