

# Bunker Hill Community College

Final Statistics Exam 2019-05-02

Exam ID 021

**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 459 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	teal	yellow
cat	29	96	98
dog	16	41	50
wheel	26	90	13

- (a) What is the probability a random card is yellow given it is a cat?
- (b) What is the probability a random card is a wheel?
- (c) What is the probability a random card is a cat given it is blue?
- (d) What is the probability a random card is either a wheel or yellow (or both)?
- (e) What is the probability a random card is both a cat and teal?
- (f) What is the probability a random card is teal?

2. In a deck of strange cards, each card has an image and a color. The chance of drawing a tree is 15.9%. If a tree is drawn, there is a 47.9% chance that it is green. If a card that is not a tree is drawn, there is a 36.7% chance that it is green.

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

3. In a very large pile of toothpicks, the mean length is 63.65 millimeters and the standard deviation is 2.3 millimeters. If you randomly sample 120 toothpicks, what is the chance the sample mean is between 63.31 and 63.96 millimeters?

4. In a game, there is a 46% chance to win a round. You will play 32 rounds.
- (a) What is the probability of winning exactly 17 rounds?
  - (b) What is the probability of winning at least 9 but at most 16 rounds?

5. As an ornithologist, you wish to determine the average body mass of *Hylocichla mustelina*. You randomly sample 35 adults of *Hylocichla mustelina*, resulting in a sample mean of 55.64 grams and a sample standard deviation of 7.77 grams. Determine a 99% confidence interval of the true population mean.



6. A treatment group of size 35 has a mean of 0.996 and standard deviation of 0.0738. A control group of size 28 has a mean of 1.04 and standard deviation of 0.101. If you decided to use a significance level of 0.05, 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 48.

- (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 49000 individuals was taken. In that sample, 85.6% were glowing. Determine a 99.5% 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 73 and a control group of size 109. The results are summarized in the table below.

	treatment	control
angry	29	28
not angry	44	81

Using a significance level of 0.05, determine whether the treatment causes an effect on the proportion of cases that are angry.

- (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?