

# Bunker Hill Community College

Final Statistics Exam 2019-05-02

Exam ID 028

**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.*

---

---

---

**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 1054 cards. Each card has an image and a color. The amounts are shown in the table below.

	black	blue	orange	red	yellow
dog	46	70	22	23	32
flower	49	36	55	65	26
gem	62	90	67	96	31
tree	80	40	13	78	73

- (a) What is the probability a random card is both a gem and blue?
- (b) What is the probability a random card is orange given it is a dog?
- (c) What is the probability a random card is a dog?
- (d) What is the probability a random card is yellow?
- (e) What is the probability a random card is a gem given it is red?
- (f) What is the probability a random card is either a flower or orange (or both)?

2. In a deck of strange cards, each card has an image and a color. The chance of drawing a shovel is 29.4%. If a shovel is drawn, there is a 65.3% chance that it is pink. If a card that is not a shovel is drawn, there is a 81.6% chance that it is pink.

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

3. In a very large pile of toothpicks, the mean length is 64.94 millimeters and the standard deviation is 1.74 millimeters. If you randomly sample 196 toothpicks, what is the chance the sample mean is between 64.77 and 65.05 millimeters?

4. In a game, there is a 21% chance to win a round. You will play 249 rounds.
- (a) What is the probability of winning exactly 53 rounds?
  - (b) What is the probability of winning at least 45 but at most 66 rounds?

5. As an ornithologist, you wish to determine the average body mass of *Helmitheros vermivorus*. You randomly sample 18 adults of *Helmitheros vermivorus*, resulting in a sample mean of 16.21 grams and a sample standard deviation of 2.5 grams. Determine a 80% confidence interval of the true population mean.



6. A treatment group of size 40 has a mean of 11 and standard deviation of 1.89. A control group of size 30 has a mean of 9.92 and standard deviation of 1.66. If you decided to use a significance level of 0.01, 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 66.

- (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 6400 individuals was taken. In that sample, 27.7% were tasty. Determine a 80% 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 172 and a control group of size 157. The results are summarized in the table below.

	treatment	control
sick	14	7
not sick	158	150

Using a significance level of 0.2, determine whether the treatment causes an effect on the proportion of cases that are sick.

- (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?