# Bunker Hill Community College

**Final Statistics Exam 2019-05-02** **Exam ID 009**

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

| | gray | pink | yellow |
|---|---|---|---|
| bike | 89 | 98 | 12 |
| flower | 52 | 67 | 28 |
| pig | 85 | 32 | 45 |
| tree | 65 | 53 | 58 |
| wheel | 47 | 95 | 23 |

   (a) What is the probability a random card is gray given it is a tree?

   (b) What is the probability a random card is pink?

   (c) What is the probability a random card is a bike?

   (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 flower and gray?

   (f) What is the probability a random card is a wheel given it is pink?

2. In a deck of strange cards, each card has an image and a color. The chance of drawing a bike is 45.2%. If a bike is drawn, there is a 27.7% chance that it is red. If a card that is not a bike is drawn, there is a 69.9% chance that it is red.

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

3. In a very large pile of toothpicks, the mean length is 73.12 millimeters and the standard deviation is 2.24 millimeters. If you randomly sample 100 toothpicks, what is the chance the sample mean is between 72.72 and 73.31 millimeters?

4. In a game, there is a 13% chance to win a round. You will play 245 rounds.
   (a) What is the probability of winning exactly 37 rounds?
   (b) What is the probability of winning at least 31 but at most 42 rounds?

5. As an ornithologist, you wish to determine the average body mass of *Cuculus americanus*. You randomly sample 19 adults of *Cuculus americanus*, resulting in a sample mean of 67.9 grams and a sample standard deviation of 12 grams. Determine a 99.5% confidence interval of the true population mean.

6. A treatment group of size 37 has a mean of 11 and standard deviation of 2.54. A control group of size 38 has a mean of 9.65 and standard deviation of 2.45. If you decided to use a signficance level of 0.04, 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 72.

   (a) State the null hypothesis.

   (b) State the alternative hypothesis.

   (c) Evaluate the critical value. (The critical value is either $z^\star$ or $t^\star$. 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 2400 individuals was taken. In that sample, 63.7% were asleep. 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 condifence interval.

8. An experiment is run with a treatment group of size 204 and a control group of size 217. The results are summarized in the table below.

| | treatment | control |
|---|---|---|
| special | 66 | 97 |
| not special | 138 | 120 |

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

(a) State the null hypothesis.

(b) State the alternative hypothesis.

(c) Evaluate the critical value. (The critical value is either $z^\star$ or $t^\star$. 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?