St. Joseph's University
Date: April 24, 2025 Professor: Asher Roberts

Statistics Test 3

Number of questions—4

Directions: Solve each of the following problems using separate paper, while clearly indicating each problem number when solving. Irrelevant work will detract from your score, while answers without work shown will be awarded no credit. Answers with partially correct work will receive partial credit. Unless otherwise specified, round all answers to 3 decimal places when necessary. You must work alone, but you may use a graphing calculator and the provided appendix tables as a supplement to your own work if you indicate the steps used. You may not use a phone, computer, computational intelligence, AI, or other tools to assist you in solving the problems.

1. A research team at Cornell University conducted a study showing that approximately 10% of all businessmen who wear ties wear them so tightly that they actually reduce blood flow to the brain, diminishing cerebral functions (Source: *Chances: Risk and Odds in Everyday Life,* by James Burke). Consider a board meeting of 20 businessmen, all of whom wear ties.

   (a) (*6 pts*) What are the n, p, q, and r that can be used to determine the probability that one tie is too tight?

   (b) (*6 pts*) What is the probability that one tie is too tight?

   (c) (*6 pts*) What is the probability that two or fewer of the ties are too tight?

   (d) (*6 pts*) What is the expected number of ties that are too tight?

   (e) (*6 pts*) What is the standard deviation of the distribution of the number of ties that are too tight?

2. How much should a healthy kitten weigh? A healthy 10-week-old (domestic) kitten should weigh an average of $\mu = 24.5$ ounces with an estimated standard deviation $\sigma = 5.25$ ounces, based on information from the *Merck Veterinary Manual*. Let x be a random variable that represents the weight (in ounces) of a healthy 10-week-old kitten. Assume that x has a distribution that is approximately normal.

   (a) (*5 pts*) What z-value corresponds to 14 ounces?

   (b) (*5 pts*) What is the probability that a healthy 10-week-old kitten will weigh less than 14 ounces?

   (c) (*5 pts*) 10% of the area under the standard normal distribution lies to the left of what z-value?

   (d) (*5 pts*) A kitten whose weight is in the bottom 10% of the probability distribution of weights is called *undernourished*. What is the cutoff point for the weight of an undernourished kitten?

3. Let x be a random variable that represents the weights in kilograms (kg) of healthy adult female deer (does) in December in Mesa Verde National Park. Assume that x has a distribution with mean $\mu = 63.0$ kg and standard deviation $\sigma = 7.1$ kg (Source: *The Mule Deer of Mesa Verde National Park,* by G. W. Mierau and J. L. Schmidt, Mesa Verde Museum Association).

   (a) (*5 pts*) To estimate the health of the December doe population, park rangers use the rule that the average weight of $n = 50$ does should be more than 60 kg. If the average weight is less than 60 kg, it is thought that the entire population of does might be undernourished. From the central limit theorem, what can you say about the probability distribution of $\bar{x}$, the average weight of the does sampled?

   (b) (*5 pts*) What are the mean and standard deviation of the $\bar{x}$ distribution?

   (c) (*5 pts*) What is the z-value corresponding to the $\bar{x}$ value of 60?

   (d) (*5 pts*) What is the probability that $\bar{x}$ is less than 60?

   (e) (*5 pts*) Let us assume that x has a distribution that is approximately normal. What is the z-value corresponding to an x value of 54?

   (f) (*5 pts*) Suppose a doe that weighs less than 54 kg is considered undernourished. What is the probability that x is less than 54? (Again, assume that x has a distribution that is approximately normal.)

4. Do you want to own your own candy store? With some interest in running your own business and a decent credit rating, you can probably get a bank loan on startup costs for franchises such as Candy Express, The Fudge Company, Karmel Corn, and Rocky Mountain Chocolate Factory. Startup costs (in thousands of dollars) for a random sample of 41 candy stores have mean $\bar{x} = 106.9$ thousand dollars and $s = 29.4$ thousand dollars (Source: *Entrepreneur Magazine,* Vol. 23, No. 10);

   (a) (*5 pts*) What distribution would be appropriate to use to compute a confidence interval for the population mean μ? Explain your answer.

   (b) (*5 pts*) Find the critical value for a 90% confidence level.

   (c) (*5 pts*) Find a 90% confidence interval for μ.

   (d) (*5 pts*) What does the confidence interval tell us in the context of the problem?