Practice Final Exam

Questions 1 through 3 are based on the following information: The standard normal variable, \( Z \), has normal density with mean equal to 0.0 and standard deviation equal to 1.0, i.e., \( Z \sim N(\mu, \sigma) \sim N(0, 1) \). Use Table II and III to answer the following questions.

1. What percentage of the values of a standard normal variable are greater than -1.9?
   (a) 0.0287   (b) 0.9713   (c) 0.0247   (d) 0.4714

2. What is the 10\(^{th}\) percentile of a standard normal variable?
   (a) -1.282   (b) 1.282   (c) 0.4602   (d) -0.4602

3. Find the value of \( Z \) such that 80% of the values are between -\( Z \) and +\( Z \)?
   (a) \( Z = 1.28 \) (-1.28 to +1.28)   (b) \( Z = 1.65 \) (-1.65 to +1.65)
   (c) \( Z = 0.842 \) (-0.84 to +0.84)   (d) \( Z = 0.2 \) (-0.2 to +0.2)

Questions 4 through 8 are based on the following information: In the state of New York, 18% of its 22,000,056 of all individuals over the age of 18 voted in the election. In my survey of 200 students at Stony Brook over the age of 18, 60 or 30% indicate that they voted in the election.

4. In this situation, the value 18% is the value of a _____.
   (a) sample statistic  (b) population parameter
   (c) test statistic     (d) sample size.

5. In this situation, the value 30% is a __________.
   (a) population parameter    (b) sample statistic
   (c) sample size        (d) sample statistic

6. The sample size, \( n = \) _____.
   (a) 22,000,046   (b) 200   (c) 60   (d) 30

7. The value of a population size equals_____.
   (a) 22,000,046   (b) 200   (c) 60   (d) 30

8. The value 0.30 is a point estimate of ____, the population proportion
   (a) \( \mu \)   (b) \( \sigma \)   (c) \( p \)   (d) \( n \)
Questions 9 through 10 are based on the following information: In a neighborhood called Gold Harbor everyone has at least one car. Let \( X \) be the random variable representing the number of cars per household. Below we give the probability mass function for \( X \).

<table>
<thead>
<tr>
<th>( X )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P(X=x) )</td>
<td>0.1</td>
<td>0.15</td>
<td>0.2</td>
<td>0.55</td>
</tr>
</tbody>
</table>

9. What is the probability that a randomly sampled household has 2 or more cars?
   (a) 0.9  (b) 0.75  (c) 0.25  (d) 0.15

10. What is the mean value of \( X \)?
    (a) 3.2  (b) 2.5  (c) 4.0  (d) 0.0

11. There are two boxes, Box A and Box B. Box A has 40 tags with the number 1, 50 tags with the number 10, and 10 tags with the number 100. Box B has 40 tags with the number 100, 50 tags with the number 10, and 10 tags with the number 1. A box is picked at random and exactly one tag is drawn at random from that box. You do not know if the box picked was Box A or Box B. To test the null hypothesis that the box drawn from was Box A versus the alternative that the box drawn from was Box B, a decision rule is proposed in which we reject \( H_0 \) if a tag value of 100 is obtained.
   a) Calculate \( \alpha \), the chance of a Type I error.
   b) Calculate \( \beta \), the chance of a Type II error.
   c) What is the direction of extreme? To the left? To the right? Two sided?
   d) If the tag drawn is a 10, what is the numerical value of the p-value?

12. A small locally-owned pizza company is trying a new pizza-crust. An experiment is conducted to find the optimal baking time (20, 25, or 30 minutes), baking temperature (400°F, 425°F, 450°F), and amount of cheese (2 cups or 2.5 cups). Five batches of pizza-crust dough will be assigned to each treatment. Professional taste-testers will rate the crusts on a five-point scale with respect to flavor, texture, and appearance.
   a) Give the response variable(s).
   b) Give the factor(s) and the corresponding number of levels for each.
   c) How many treatment combinations are there?
   d) What are the experiment units?
   e) How many total observations would there be for this experiment?

13. The instructor is interested in studying the sleeping habits of students who fall asleep during his lectures. He recorded the actual times (in minutes) from the start of the lecture at which students fall asleep. The data is provided below:
   a) Find the five-number summary
   b) Sketch the modified boxplot and determine if there are any outliers for the instructor.
   c) Calculate the mean and standard deviation.
14. Suppose that only two factories make Playstation machines. Factory 1 produces 70% of the machines and Factory 2 produces the remaining 30%. Of the machines produced at Factory 1, 2% are defective. Of the machines produced at Factory 2, 5% are defective.
   a) What proportion of Playstation machines produced by these two factories are defective?
   b) Suppose that you purchase a Playstation machine and it is defective. What is the probability that it was produced by Factory 1?

15. Suppose the variable U is U(20, 50)
   a) Sketch the distribution for U. Be sure to mark all important features.
   b) What is the mean for this distribution?
   c) Sketch the boxplot for the distribution of U. Be sure to mark all important features.

16. Let X be the random variable representing the level of cholesterol in the blood of 14-year-old boys. Suppose that X follows a normal distribution with mean 170 mg/dl and standard deviation 30 mg/dl. Levels above 240 mg/dl may require medical attention.
   a) What is the probability that a randomly selected 14-year-old boy has more than 240 mg/dl? That is, find P(X>240).
   b) Suppose that a random sample of four 14-year-old boys is selected. State the distribution for the sample mean blood cholesterol level \( \bar{X} \). Include all important features.
   c) What is the probability that the mean blood cholesterol level of four randomly selected 14-year-old boys will exceed 190 mg/dl? That is, find P( \( \bar{X} > 190 \)).

17. A particular manufacturing system consists of four components that work independently from one another. According to the manager of the plant, the success rate of the system under normal conditions is approximately 0.85. During the past 80 runs, the system fails 15 times. Test the hypothesis that the manufacturer overstated the success rate of the system and it is actually less than 85%.
   a) State the appropriate null and alternative hypothesis regarding p, the success rate of the manufacturing system.
   b) Calculate the value of the appropriate test statistic.
   c) What is the value of the corresponding p-value?
   d) Using a 5% significant level, what is your decision and conclusion?
   e) Find a 99% confidence interval for the market share.