Stat 311 Practice Midterm

Name: _____
Student #: _____
Section #: _____

This is a 50-minute closed book exam.

In order to receive credit, you must show your work or give brief explanations, where appropriate. You will be graded only on the work you show. Partial credit may be given when you show the process used to solve a problem, even if your answer is incorrect. Showing your work on computational multiple-choice problems is optional. If you show your work and have minor errors that caused you to circle the wrong answer, you may receive partial credit. You may use a calculator to calculate final answers. Any normal probabilities should be found using the attached normal table. All numerical answers should be accurate to at least two decimal places (nearest hundredth). **You should report probabilities to four decimal places, if applicable. Don't forget units where applicable.**

The exam consists of 8 problems worth a total of 69 points. Point values for question are designated in parentheses at the beginning of the problem—each part of each problem is worth three points. Take a moment to look through the exam before you begin in order to budget your time. If you don't know how to do a particular problem, move on to a new problem. Return to any unfinished problems after completing the ones that are easier for you.

GOOD LUCK!

Problem	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Total Points	3	3	6	9	6	12	15	15
Points Scored								

Problem 1 (3 points): To test whether extensive exercise lowers the resting heart rate, a study is performed by randomly selecting half of a group of volunteers to exercise 1 hour each morning, while the remaining group is instructed to perform no exercise. This is an example of (circle the best selection):

A. An experiment with a control group and blinding

B. An experiment with blocking

C. An observational study with comparison and randomization

D. An observational study with little if any bias

E. None of the above

Problem 2 (3 points): Student grade point averages (GPAs) are calculated by assigning a number to each letter grade earned, with A = 4, B = 3, C = 2, D = 1, and F = 0, then finding the average. A student proposes using the median of the numbers instead and calls this medGPA. A student has taken five courses (all an equal number of credit hours) and the grades were A, A, F, B, A. The usual GPA for these grades is 3.0. Should the student prefer using the median (medGPA)? ***Circle the best response from the four choices below.***

A. No, because med GPA is F = 0 for this student.

B. It doesn't matter, because medGPA is also B = 3.0 for this student.

C. Yes, because medGPA is A = 4.0 for this student.

D. No, because if the student takes one more course and gets an A or B, the usual GPA will go up but the medGPA will stay the same.

Problem 3 (6 points): A candy dish contains 75 peanut M&M's, of which 25 are brown, 25 are red, and 25 are yellow. A child reaches in the dish and grabs a handful of 20 candies. Let X = the number of brown candies in the child's hand.

a) What probability distribution can be used to model the random variable X? Name the distribution and specify the parameter values.

b) What is the probability that the child's handful has exactly 10 brown M&M's?

Problem 4 (9 points): In college basketball games a player may be afforded the opportunity to shoot two consecutive foul shots (free throws).

a) Suppose a player who makes 80% of his foul shots has been awarded two free throws. If the two throws are considered to be independent, the probability that the player makes **exactly one shot** is

   i) 0.64

   ii) 0.16

   iii) 0.32

b) Now suppose that the outcome on the second shot is dependent on the outcome of the first shot. The player makes 80% of their first shots. If the player makes the first shot, he makes 90% of the second shots; and, if he misses the first shot, he makes 70% of the second shots. Let F = player makes first shot and let S = player makes second shot

   i) What is the probability that the player makes the second shot?

   ii) What is the probability that the player made their first shot given they make their second shot?

Problem 5 (6 points): Some managers of companies use employee rankings to laud the best and let go of the worst. Suppose the distribution of rankings of employees at a large company is normal with a mean of 65 points and a standard deviation of 6 points.

a) The probability that a randomly selected employee has a ranking above 59 points is

   i) 0.1587

   ii) 0.8413

   iii) 0.8212

b) Managers at this large company were told to determine the top 20 percent, the bottom 10 percent and the remaining 70 percent in the middle, and then "weed out" (let go) those in that bottom tier. Using the provided model for rankings, what is the cut-off ranking for an employee to be in the bottom 10 percent?

Problem 6 (12 points): You recently purchased 10 clear containers from The Container Store to use to store office supplies. Each plastic container had a sticky label on the bottom that you proceeded to peel off. It turns out that about 8 of the labels were difficult to peel off, requiring a lot of your time and effort. You plan on buying 50 more of these containers, which will require label removal. Let X = number of containers of the 50 having labels that will be easy to remove.

a) A probability distribution that can be used to model the random variable X is

   i) $X \sim \text{Poisson}(0.8)$

   ii) $X \sim \text{Poisson}(0.2)$

   iii) $X \sim \text{Binomial}(50, 0.8)$

   iv) $X \sim \text{Binomial}(50, 0.2)$

b) The exact probability that labels will be easily removed from 16 of the 50 containers is

   i) 0.0010

   ii) 0.0164

   iii) 2.38×10^{-13}

c) What are the mean and standard deviation for the number of easily removed labels?

d) Use normal approximation **with continuity correction** to estimate the probability that you are able to easily remove labels from at least 18 of the 50 containers.

Problem 7 (15 points): Indicate whether the statement is true or false. **<u>If false, give careful explanation a as to why the statement is false</u>**. If true, just indicate true.

_____ If the correlation coefficient is –0.85, below-average values of the dependent variable are associated with below-average values of the independent variable.

_____ Histograms, bar charts and box plots can be used to visually summarize qualitative data.

_____ Voluntary response samples often underrepresent people with strong opinions.

_____ Questionnaires with non-neutral wording are likely to have response bias.

_____ If $X \sim \text{Normal}(15,\ 2)$, $Y \sim \text{Normal}(10,\ 1.5)$, and X and Y are independent, then $W = X - Y \sim \text{Normal}(5, 1.32)$.

Problem 8 (15 points). Wildlife biologists are trying to look for a way to predict the weight of young bears based on their chest diameter. To explore the relationship between weight (lbs) and chest diameter (inches) measurements were collected for 22 young bears, ages 8 to 23 months. A plot of the data suggested that simple linear regression might be a reasonable approach as a first modeling attempt. Some summary statistics that might be useful are: $\bar{x} = 27.35,\ \bar{y} = 79.82,\ SS_{xx} = 443.37,\ SS_{yy} = 29471.27,\ SS_{xy} = 3349.42$.

a) The regression equation for the regression line is

   i) $\hat{y} = -126.67 + 7.55x$

   ii) $\hat{y} = -7.55 + 126.67x$

   iii) $\hat{y} = 126.67 - 7.55x$

b) Interpret the estimated slope value in the context of the problem.

c) What is the expected value for the average bear weight when the chest diameter is 25 inches?

d) R^2 for this regression is

   i) $R^2 = 0.8586$

   ii) $R^2 = 0.9266$

   iii) $R^2 = 0.2563$

e) In one sentence, provide an interpretation of R^2 in the context of the problem.