Exam – STAT 3650/5650

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The true mystery of the world is the visible, not the invisible.
-- Oscar Wilde

Prediction is very difficult, especially if it's about the future.
-- Nils Bohr.

No rational argument will have a rational effect on a person who does
not want to adopt a rational attitude. -- Karl Popper

I told my psychiatrist that everyone hates me. He said I was being
ridiculous - everyone hasn't met me yet. -- Rodney Dangerfield

The theory of our modern technique shows that nothing is as practical
as theory. -- Julius Robert Oppenheimer commenting on quantum mechanics

It requires a very unusual mind to undertake the analysis of the
obvious. -- Alfred North Whitehead

Just think of the tragedy of teaching children not to doubt.
-- Clarence Darrow
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1. Sketch a skewed left distribution and roughly indicate where the mean, median, and mode would be located.

2. Of all the female students at Bemidji High 23% carry a backpack, 60% wear earrings, and 12% carry a backpack and wear earrings.
   a. Create a Venn diagram to illustrate this situation.
   b. If a female student at Bemidji High is randomly chosen, what is the probability she is carrying a backpack?
   c. If a female student at Bemidji High is randomly chosen, what is the probability she is carrying neither a backpack nor wearing earrings?

3. Let $P(A)=1/3$ and $P(B)=1/4$. Find the following:
   a. $P(A \cup B)$ if A and B are mutually exclusive.
   b. $P(A \cup B)$ if A and B are independent.
   c. $P(A \cap B)$ if A and B are mutually exclusive.
   d. $P(A \cap B)$ if A and B are independent.

4. One morning three men toss one coin each to see who pays for coffee. If all three match, they toss again. Otherwise, the "odd man" pays for coffee.
   a. What is the probability that they will need to toss coins more than once to see who pays for coffee?
   b. What is the probability of tossing at most twice?

5. Two hunters, Bill and Trent, each fire one shot at an antelope. The probability that Bill hits the antelope is 0.3 and the probability that Trent hits the antelope is

0.4. Suppose that the shots are independent. Find the conditional probability that Trent hit the antelope given that exactly one shot hit the antelope.

6. A mysterious stranger approaches you on a train ride in central Siberia. She asks if you would take part in a simple coin game. You agree. She explains that she will flip a coin repeatedly until one of two events occurs: Two heads (HH) in a row occur, or a tail then a head (TH) in a row occur. If TH occurs she wins and if HH occurs you win. Is it a fair game? If not, who has the advantage?

7. Suppose the weights of English Mastiffs (a bread of dog) are normally distributed with a mean of 135 pounds and a standard deviation of 15 pounds.
    a. What percentage of English Mastiffs weigh more than 175 pounds?
    b. What percentage of English Mastiffs weigh between 120 and 160 pounds?
    c. What is the median weight of English Mastiffs?

8. Doctors have long claimed that the temperature of the human body is 98.6° F. Students at a school in Norway tested this long held belief by measuring the temperatures of 20 students. From the sample, they calculated the sample mean to be 8.20 and the sample standard deviation to be $S = 0.62$.
    a. Compute a 99% confidence interval for the average temperature of the human body based on the data from this experiment. Assume that human body temperatures are normally distributed.
    b. Interpret your confidence interval and comment on the doctors' long held belief.

9. Seymour Simmes was hired to be a typist in the nursing department. Seymour claims that the stress of the job has caused him to smoke more cigarettes per day than he did before taking the job. Below is a random sample of the number of cigarettes Seymour smoked per day for 15 different days while being a typist in the nursing department. Note that the sample mean is 53.4 and the sample standard deviation is 3.5.

        56 53 55 53 50
        57 58 54 48 47
        50 57 57 51 55

    a. State the null and alternative hypotheses to test if the mean number of cigarettes Seymour smokes per day has increased. Note that before Seymour took the typing job he averaged 51 cigarettes per day.
    b. Compute the appropriate test statistic for this problem.
    c. Find the critical value and the rejection region for alpha = 0.05.
    d. Draw a picture to illustrate these items.
    e. What is your conclusion from this experiment?
    f. State all the assumptions that were made when you conducted this hypothesis test
    g. Compute the P-value for this problem.

10. Farmer Myrtle Field grew 2 types of pumpkins to see which type yielded bigger pumpkins. She grew 30 of the first type and their average weight was 110 pounds with a standard deviation of 7 pounds. She grew 31 of the second type and their average weight was 104 pounds with a standard deviation of 5 pounds. Assume the population standard deviations can be considered equal for this problem.
    a. Write out the null and alternative hypotheses for testing whether or not the 2 pumpkin types, on average, yield pumpkins of the same weight.
    b. Compute the appropriate test statistic for this problem.
    c. Find the critical values and the rejection region and draw a picture to illustrate these items. Let alpha = 0.05.
    d. What is your conclusion from this experiment? State your conclusion in terms of the problem.
    e. State all the assumptions that are made concerning this hypothesis test. Are any of these assumptions suspect?
    f. Construct a 95% confidence interval for the difference between the mean weights of the two pumpkins.
    g. Interpret the confidence interval that you constructed in the previous item and comment on how the interpretation of the confidence interval compares with the conclusions of the hypothesis test.

11. A Reader's Digest/Gallup Survey on the drinking habits of Americans examined the percentage of adults across the country who drink beer, wine, or hard liquor, at least occasionally. Of the 1516 adults interviewed, 985 said that they drank. Determine a 95% confidence interval for the proportion of all Americans who drink beer, wine, or hard liquor, at least occasionally.

12. In the late Gene Siskel and Roger Ebert's TV show *Sneak Preview*, the two Chicago movie critics reviewed the week's new movie releases and then rated them thumbs up (positive), mixed, or thumbs down (negative). These two critics often saw the merits of a movie differently. But, in general, were the ratings given by Siskel and Ebert associated? The answer to this question was the focus of the paper "Evaluating Agreement and Disagreement Among Movie Reviewers" by Alan Agresti and Larry Winner that appeared in *Chance* 1997, Vol. 10(2), pp.10-14. Following is a contingency table that summarizes the ratings by Siskel and Ebert for 160 movies.

		Ebert's Ratings		
		Thumbs Up	Mixed	Thumbs Down
	Thumbs Up	24	8	13
Siskel's Ratings	Mixed	8	13	11
	Thumbs Down	10	9	64

    a. State the null and alternative hypotheses to be tested.
    b. At the 1% significance level, do the data provide sufficient evidence to conclude that as association exists between the ratings of Siskel and Ebert?

13. A survey was conducted to determine the distribution of Californian's favorite hamburger restaurant, n=150 people were surveyed. Before the survey it was believed that the distribution was as follows:

Restaurant:	Burger King	McDonald's	In-N-Out	Other
Percent:	25%	25%	25%	25%

    The survey data follow. Use this data to test the claim that the distribution of Californian's favorite hamburger restaurant is as stated above. Use alpha = 0.05.

Restaurant:	Burger King	McDonald's	In-N-Out	Other
Data:	50	30	45	25

14. During late 1999, the computer magazine *PC World* hired Research Results of Fitchburg, Massachusetts, to survey their readers on what they would decide if they had a say in the software giant Microsoft's antitrust case with the United States Justice Department. Of 1853 respondents, 53 were against the proposed breakup of Microsoft. Subsequently, on April 3, 2000, a federal judge ordered the breakup of Microsoft for violating antitrust laws. The following day a *Harris Pole* asked, "Do you agree with the ruling against Microsoft for violation of antitrust laws?" Of 4699 respondents, 171 said that they did not agree with the ruling. At the 1% significance level, do the data suggest that a higher percentage of people were against the breakup after the judge's decision?