Math 115 Practice Final

Also look at the practice and real midterms. At least one question on the final will be off of your homework. The real final will obviously be shorter than this. You can bring a hand-written notecard to the final, and use a calculator (but **not** any of its statistical functions). I will give you any necessary tables.

1. The following is a list of tests and procedures that we've discussed this semester: 1-sample t test, 2-sample t test, ANOVA F test, matched-pairs t test, chi-square test, linear regression, 1-sample z test, 2-sample z test. Define parameters and state hypotheses to answer each of the following questions, and identify the appropriate statistical technique. (Some questions may have more than one correct answer.)

(a) Do Macs and PC's take the same time to restart? You record the time to restart 10 Macs and 10 PC's.

(b) Do computers restart faster or slower when they are connected to the internet? You record restart times with and without a connection for each of 20 Macs.

(c) You and a friend play 25 games of ping-pong to test whether or not you are both equally likely to win in a particular game.

(d) Are the mean calcium levels the same for women in different U.S. states, or do they differ? You record the calcium level for samples of women in each of 3 randomly chosen states.

(e) Does a student's score on a midterm help to predict his or her score on the final? You have midterm and final scores for 50 students.

(f) Are seniors more or less likely than juniors to participate in a varsity sport? You consider a random sample of ASC juniors and seniors.

(g) Does birth order (first born, second born, etc.) affect a student's choice of major? You consider a random sample of college seniors.

2. Pfizer, the company that manufactures the impotence drug Viagra, conducted a clinical trial involving 100 male subjects complaining of impotence. 50 subjects were assigned at random to receive Viagra, with the remaining 50 subjects receiving a placebo. 30 of the 50 treated men reported "success," compared with only 12 of the untreated men.

(a) Construct a 99% confidence interval for the probability of "success" among those men taking the placebo.

(b) Pfizer would like to report that taking Viagra improves the success probability to something greater than 0.5. Is this claim supported by the data at level $\alpha = 0.05$? State null and alternative hypotheses and report a P-value for the test.

(c) The CEO of Pfizer says that "We saw a 60% success rate, so of course we can say its over 0.5!" Explain why this isn't true in a way that a statistically challenged CEO might understand.

(d) Find a 95% confidence interval for the difference in success probabilities for the two treatment groups.

3. A baker recorded the number of delicious blueberry pies that she made each day over an 11-day period. Here are the data:

$$33, 38, 43, 30, 29, 40, 51, 27, 42, 23, 31$$

(a) Construct a stemplot.

(b) Give the five-number summary.

4. In a class survey at Angus Scott College in Scotland, 11 of the 67 females (16.42%) were left-handed, compared to 7 of the 31 males (22.58%). Is this strong evidence that there is an

association between gender and handedness? State hypotheses, carry out a test, and report your conclusion.

5. You plan to do a temperature study to see if normal human body temperature really is different from 98.6 degrees Fahrenheit. Assume that the standard deviation of body temperatures is approximately $\sigma = 0.8$ degrees Fahrenheit.
   (a) How large a sample would you need to get a margin of error of 0.1 for a 95% CI?
   (b) With this sample size, what values of the sample average would lead you to reject the null hypothesis of 98.6 at the 0.01 significance level?

6. You've decided to spend next year wandering through Nepal in search of the abominable snowman of the Himalayas, also known as the elusive yeti. You plan to sell your used Chrysler LeBaron so that you can purchase a yak when you get there. LeBarons of the year and mileage of yours are selling for a mean of $6940 with a standard deviation of $250. Your research shows that yaks in Nepal are going for about 65,000 Nepalese rupees with a standard deviation of 500 rupees. You have to survive on your profit, so you want to estimate what you can expect in your pocket (in rupees) after the sale and subsequent purchase. One U.S. dollar is worth about 43 Nepalese rupees.

7. Everyone knows that crunchy peanut butter is better than creamy, so if you're smart, you should prefer crunchy. To see if there's statistical evidence for this, we surveyed 200 smart people and 200 dumb people, with the following results:

	Prefer crunchy	**Prefer creamy**	**No preference**	**Total**
Smart	100	80	20	200
Dumb	50	120	30	200
Total	**150**	**200**	**50**	**400**

Is there an association between intelligence level and peanut butter preference? State hypotheses and perform an appropriate statistical test. What do you conclude?

8. A researcher wishes to try three different techniques to lower the blood pressure of individuals diagnosed with high blood pressure. The subjects are randomly assigned to three groups; the first group takes medication, the second group exercises, and the third group follows a special diet. After four weeks, the reduction in each person's blood pressure is recorded. We want to run an ANOVA to find out whether there is evidence at the level $\alpha = 0.05$ that there is any difference among the means. The data are as follows:

Medication	**Exercise**	**Diet**
10	6	5
12	8	9
9	3	12
15	0	8
13	2	4

   (a) State null and alternative hypotheses.
   (b) I calculated in my head that for these data, MSG=80.07, and MSE=8.73. Explain, in words, the meanings of MSG and MSE.
   (c) Find the F statistic and the corresponding P-value.
   (d) What do you conclude?

9. The ages and systolic blood pressures of six randomly selected subjects are in the table below.

Subject	**Age** x	**Pressure** y
A	43	128
B	48	120
C	56	135
D	61	143
E	67	141
F	70	152

(a) Compute the equation of the least-squares regression line giving blood pressure (y) as a function of age (x).
(b) What fraction of the variation in pressures is explained by the variation in ages?
(c) Use your regression line to predict the blood pressure of a 50-year-old. How confident are you of your result?
(d) Use your regression line to predict the blood pressure of a 20-year-old. How confident are you of your result?

10. A group of adults who swim regularly for exercise were evaluated for depression. It turned out that these swimmers were less likely to be depressed than the general population. The researchers said the difference was statistically significant.
(a) What does "statistically significant" mean in this context?
(b) Is this an experiment or an observational study? Explain.
(c) News reports claimed that this study proved that swimming can prevent depression. Explain why this conclusion is not justified by the study. Include an example of a possible lurking or confounding variable.

11. According to the M&M's website, 16% of plain chocolate M&M's are green, 20% orange, 24% blue, 13% red, and 14% yellow, while the rest are brown. Assume that you have an enormous bag of over one million M&M's.
(a) If you pick an M&M at random, what is the probability that
  (i) it's brown?
  (ii) it's yellow or green?
  (iii) it's not red?
(b) If you pick four M&M's in a row, what is the probability that
  (i) they are all orange?
  (ii) the first is yellow and the second is green?
  (iii) the third one is the first one that's red?
  (iv) none are yellow?
  (v) under half (i.e., zero or one) are orange?
(c) If you pick four thousand M&M's in a row, what is the probability that over half are orange?
(d) Let Y be the number of letters in the color of an M&M picked at random (so if you pick red, $Y = 3$). Find the mean μ_Y and standard deviation σ_Y.

12. A spokesperson for the commonwealth of Pennsylvania claims that the average size of state parks in western Pennsylvania is at least 2000 acres. You suspect that the average size is actually smaller. A random sample of five parks is selected, and the number of acres is shown. At $\alpha = 0.01$, is there enough evidence to reject the spokeperson's claim?

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