Mathematics 263 Section 4 **Name**_____
Final Examination
Spring 2005

Calculators and two note cards are allowed. Tables will be supplied.

Good luck! Thanks for a great semester and enjoy your summer.

Question	**Points**	**Score**
1-6	60	
7-15	45	
16	20	
17	19	
18	20	
19	36	
Total	**200**	

For Problems 1-6, check as many answers as apply. (2 point per part; 60 points total.)

1. Which of the following symbols represent population parameters? (*Check all that apply*.)

___ σ

___s

___ μ

___ $\bar{x}$

2. Random samples are selected from a large population of measurements. Which of the following quantities generally vary from sample to sample? (*Check all that apply*.)

___ σ

___s

___ μ

___ $\bar{x}$

3. An effort is currently under way to cap (or limit) awards given by the courts to patients who successfully sue doctors for malpractice. If the cap were established, and if the cap affected only a few very large awards, *check all* ***true*** *statements*:

__ The median award would be reduced

__ The mean award would be reduced

__ The IQR (inter-quartile range) of the awards would be reduced

__ The standard deviation of the awards would be reduced.

__ The range of the awards would be reduced.

4. Which of the following statements is/are ***true*** according to the Central Limit Theorem? (*Check all that apply*.)

_____ An increase in sample size from $n = 16$ to $n = 25$ will produce a sampling distribution of the sample means with a smaller standard deviation.

_____ The mean of a sampling distribution of sample means is equal to the population mean divided by the square root of the sample size.

_____ The larger the sample size, the more the sampling distribution of sample means resembles the shape of the population.

_____ The mean of the sampling distribution of sample means for samples of size $n = 50$ is the same as the mean of the sampling distribution for samples of size $n = 100$.

_____ The larger the sample size, the more the sampling distribution of sample means resembles a normal distribution.

_____ The larger the sample size, the closer the standard deviation of the sampling distribution of sample means is to the standard deviation of the population.

5. In a February 17, 2005, report on a model of global warming by Dr. Tim Barnett, the BBC said

> "This model reproduced the observed temperature changes in the oceans with a statistical confidence of 95%, conclusive proof—say the researchers—that global warming is being caused by human activities."

Which of the following are ***correct interpretations*** of this statement or ***follow directly*** from it? (*Check all that apply*.)

_____ There is a 95% chance that human activity caused global warming.

_____ If human activity caused global warming, there is a 95% chance that the researchers would have observed the temperature changes they did.

_____ There is a 5% chance that lurking variables caused the temperature changes observed.

_____ If human activity caused global warming, there is a 5% chance that the model would not have reproduced the observed temperature changes.

6. A market research company was asked to determine how much money teenagers (ages 13 - 19) spend on recorded music (cassette tapes, CDs and records). The company randomly selected 80 malls located around the country. A field researcher stood in a central location in the mall and asked passers-by who appeared to be the appropriate age to fill out a questionnaire. A total of 2,050 questionnaires were completed by teenagers. On the basis of this survey, the research company reported that the average teenager in this country spends $155 each year on recorded music. (*Check all **true** statements*.)

____ The average is based on teenagers' estimates of what they spend and therefore could be quite different from what teenagers actually spend.

____ They should have done the survey at more than 80 malls if they wanted an average based on teenagers throughout the country.

____ The sample of 2,050 teenagers is too small to permit drawing conclusions about the entire country.

____ They should have asked teenagers coming out of music stores.

____ The average could be a poor estimate of the spending of all teenagers given that teenagers were not randomly chosen to fill out the questionnaire.

____ The average could be a poor estimate of the spending of all teenagers given that only teenagers in malls were sampled.

____ Calculating an average in this case is inappropriate since there is a lot of variation in how much teenagers spend.

For Problems 7-15, circle *one* answer. (5 points per question; 45 points total.)

7. The standard error of the mean approximates the standard deviation of the

   (a) Sample
   (b) Population
   (c) Sampling distribution of the variance
   (d) Sampling distribution of the mean
   (e) Sample proportions

8. Alice, Ben, Connie and Dwayne each take a random sample of students from their college to estimate the variability in amount spent on movie tickets this semester. Alice asked 10 people, Ben 30, Connie 50, and Dwayne 70. Whose sample standard deviation probably differs ***most*** from the population parameter?

   (a) Alice
   (b) Ben
   (c) Connie
   (d) Dwayne
   (e) All differ about equally

9. A researcher uses a chi-square test to determine if there is a relationship between two categorical variables. Which of the following *P*-values indicates the strongest evidence of such a relationship?

   (a) 0.002
   (b) 0.006
   (c) 0.01
   (d) 0.05
   (e) 0.10

10. In an ANOVA with three groups, a rejection of the null hypothesis tells us that

    (a) The three population means are equal to each other
    (b) The three sample means are equal to each other
    (c) Each population mean differs significantly from all other population means
    (d) Each sample mean differs significantly from all other sample means
    (e) Some of the population means differ significantly from the other population means
    (f) Some of the sample means differ significantly from some the other sample means

11. The USA Today AD Track (3/1/00) examined the effectiveness of ads for the Pets.com Sock Puppet. They conducted a nationwide poll of 428 adults of whom 36% said they liked the ads. Suppose the sample size for this poll is increased to 1000, but the sample proportion that like the ads remains the same (36%). How does the *P*-value of the hypothesis test change?

    (a) The new *P*-value is larger than before.
    (b) The new *P*-value is smaller than before.
    (c) The new *P*-value is the same as before.
    (d) There is no way to tell without further information.

12. A psychological test is used to measure academic motivation. The average test score for all university students nationwide is 115. A university in the south of the country estimates the mean test score for its students by testing a random sample of n students and constructing a confidence interval based on their scores. Which of the following statements about the confidence interval are true?

    I. The resulting interval contains 115.

    II. The 95% confidence interval for $n = 100$ will generally be narrower than the 95% confidence interval for $n = 50$.

    III. For $n = 100$, the 95% confidence interval will generally be wider than the 90% confidence interval.

    (a) I only
    (b) II only
    (c) III only
    (d) I and II only
    (e) I and III only
    (f) II and III only
    (g) I, II, and III

13. A positive correlation between two variables X and Y means that increasing the value of X causes the value of Y to increase.

    (a) This is always true.
    (b) This is sometimes true.
    (c) This is never true.

14. If x is in years since 1850, with $0 \le x \le 155$, and y is the median age of the US population, the regression line fitting the data is $y = 18.1 + 0.107x$. Which of the following statements is ***incorrect***?

    (a) The median age was 18.1 in 1850.
    (b) The average median age over the last 155 years was 18.1.
    (c) The median age increased by about 1 year every decade.
    (d) The increase in the median age averaged about 0.107 years each year.
    (e) The median age in 2005 is about 35.

15. There are 100 different researchers studying the sleeping habits of college freshmen. Each researcher takes a random sample of size 50 from the same population of freshmen. Each researcher is trying to estimate the mean hours of sleep that freshmen get at night, and each one constructs a 95% confidence interval for the mean. Approximately how many of these 100 confidence intervals will ***not*** contain the true mean?

    (a) None
    (b) 1 or 2
    (c) 3 to 7
    (d) About half
    (e) 95 to 100
    (f) Other

For Problems 16-18, please show your work.

16. (**20 points**) On March 15, 2005, a court in Oakland, California, was told that for 25 years a judge had attempted to exclude Jews from juries in death row cases because they would not vote for the death penalty. Court records show that during this time, 29 people who were Jewish or had Jewish-sounding names had been called to serve on a jury for a death row case. Of these, 27 were excluded. Is there evidence that Jews were excluded more often than the rest of the population, whose exclusion rate is 49.97%? Use the following steps to decide:

    (a) What is the null hypothesis?

    (b) What is the alternate hypothesis?

    (c) Calculate the statistic.

    (d) What is the distribution of the statistic?

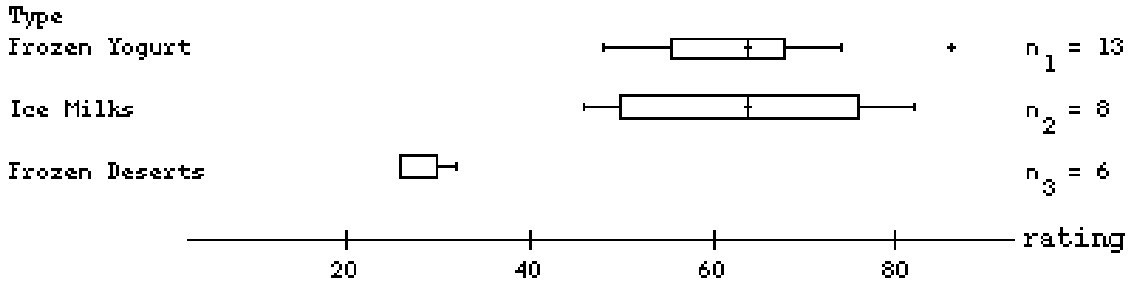
    (e) Find the *P*-value.

    (f) What is your conclusion about the null hypothesis?

    (g) What is your conclusion about the juries in Oakland?

17. (**19 points**)A panel of trained testers judged the flavor quality of different vanilla deserts (frozen yogurts, ice milks, other frozen desserts) measured on a scale from 0 to 100. The data are from a Consumer Reports article "Low-fat frozen desserts: Better for you than ice cream?" (August, 1992). Use the following computer output to compare the flavor quality of these three deserts.

Note: In the computer output, "type" may also be referred to as "group".



Here is most of the ANOVA output from the computer:

ANALYSIS OF VARIANCE ON rating

SOURCE	DF	SS	MS	F	p
TYPE	_____	6364	3182	_____	_____
ERROR	24	3031	126		
TOTAL	_____	9395			

(a) Which, if any, of the ratings contained outliers? (*Check all that apply*.)
Frozen yogurt ____Ice milks ____Frozen deserts_____

(b) What is the null hypothesis?

(c) What is the alternative hypothesis?

(d) Fill in the four blanks in the table, estimating where necessary.

(e) What is your conclusion about deserts?

18. (**20 points**) A researcher studied the relationship between coffee drinking and heart attacks in young women. The table below summarizes the results.

		HEART ATTACK		
		No	Yes	
COFFEE	Light	172	88	260
DRINKER	Heavy	45	40	85
		217	128	345

(a) What is the explanatory variable?

(b) What is the response variable?

(c) Find the probability that a randomly selected light coffee drinker has a heart attack.

(d) Find the probability that a randomly selected woman is a light coffee drinker and has a heart attack.

(e) Use the computer output below to determine if the amount of coffee drunk and heart attacks are related. *Show all the steps in your reasoning clearly*.

Chi-Square Test: Coffee Drinking and Heart Attacks

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Chi-Sq = 4.792, DF = 1, P-Value = 0.029
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19. (**36 points**) Match each part (a) – (e) with a test (I)-(X) that could be used to answer the question. *Do not carry out the test! No reasons needed.*

(I) One sample *z*-test for mean
(II) Two sample *z*-tests for means
(III) One sample *t*-test for mean
(IV) Two sample *t*-tests for means
(V) One sample *z*-test for proportion
(VI) Two sample *z*-tests for proportions
(VII) One sample *t* test for proportion
(VIII) Two sample *t*-tests for proportions
(IX) Chi-square test
(X) ANOVA (analysis of variance)

(a) To decide if a new drug to lower blood pressure is better than the old one, a clinical study compares the amount by which the blood pressure for two groups of randomly selected patients is reduced over a six-month period.

Use Test: _____

(b) In 2000, the average salary of a full professor of psychology was $84,173, with standard deviation $22,063. To decide whether salaries in the southwest are higher or lower than average, an administrator samples 30 professors of psychology at southwestern universities.

Use Test: _____

(c) In 2000, 31% of US adults were obese. The city health department wants to determine whether a larger fraction of Tucsonans are obese by sampling 200 adult residents.

Use Test :_____

(d) A weight loss clinic wants to decide whether four diets are equally effective using a sample of 80 patients, each of whom is randomly assigned to one of the diets and whose weight loss is recorded.

Use Test: _____

(e) In 2002, the average salary in the US was $36,764. Economists want to decide if salaries in Massachusetts are higher than average by surveying 200 employed people.

Use Test: _____

(f) School children in Michigan were asked whether grades, sports, or friends were the most important to them. Decide if their choice is affected by race.

Use Test: _____