Mathematics 263 Section 4 Solutions to Final Examination Spring 2005

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

   _x__ σ

   ___s

   _x__ 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

   _x__s

   ___ μ

   _x__ $\bar{x}$

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

   _x_ The mean award would be reduced

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

   _x_ The standard deviation of the awards would be reduced.

   _x_ The range of the awards would be reduced.

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

____x___	An increase in sample size from $n = 16$ to $n = 25$ produces a sampling distribution of 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.
___x____	The mean of the sampling distribution of sample means for samples of size $n = 50$ will be the same as the mean of the sampling distribution for samples of size $n = 100$.
____x___	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.

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

___x___ 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.

___x___ 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.)

_x__ 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.

__x__ 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.

__x__ 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.

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 tell 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.

17. 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

16.

(a) The null hypothesis, H_0, is $p = 0.4997.$
(b) The alternative hypothesis, H_a, is $p > 0.4997$.
(c) The test statistic is $\hat{p} = 27/29 = 93.10\%$, so

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} = \frac{27/29 - 0.4997}{\sqrt{\frac{0.4997(1-0.4997)}{29}}} = 4.65.$$

(d) Standard normal.
(e) Since *z* is not in the table, we see that the probability of such a large value is extremely small. From a calculator $p(Z > 4.65) = \text{normalcdf}(4.65,5,0,1) = 0.0000017.$
(f) Since this *P*-value is so small, we reject the null hypothesis.
(g) We conclude that there is evidence that Jews have been excluded more often than other people.

17.

(a) Frozen yogurt.
(b) All three types of desert have the same mean rating.
(c) One or more of the deserts has a different mean.
(d) For Type, DF = 2, for Total, DF = 26. Thus F = 3182/126 = 25 with DF = (2, 24). Looking in the table for (2, 20), we see the largest *F* value is 9.95, so the *P*-value is very close to 0.

Using a calculator, we see P = Fcdf(25, 1000, 2, 24) = 0.0000013.

(e) The deserts do not all have the same means. This is also clear from the box plots.

18.

(a) Amount of coffee drunk.
(b) Frequency of heart attack.
(c) 88/260 = 0.338.
(d) 88/354 = 0.255.
(e) We test the null hypothesis that amount of coffee drunk and having a heat attack are not related. From the Minitab output, we see that $\chi^2 = 4.79$ and P-value = 0.029 = 2.9%.Thus, at the 5% level of significance, we reject the null hypothesis. There is evidence that heart attacks and coffee drinking are related. However, the evidence is not especially strong, as we do not reject the null hypothesis at the 1% level.

19.

(a) IV or X (b) I (c) V (d) X (e) III (f) IX