Midterm 2 - STAT 301 Section 501/502 Version 1
Spring 2012

1. Do not open this test until told to do so.
2. Turn in your exam with your answers circled when you are done with the exam. You should not take the exam with you.
3. This is a closed book examination. You may use two single-sided sheets of formulas that you have brought with you, calculator and the tables. You should have no other printed or written material with you on the exam.
4. You have 50 minutes to work on this exam. There are 15 multiple choice questions. If you cannot do one question move on to the next.
5. You may use a calculator but not a phone during the exam.
6. If there is no correct answer or if multiple answers are correct, select the **best** answer.
7. If you are unsure of what a question is asking for, do not hesitate to ask the instructor or course assistant for clarification.
8. Good Luck!!!

(1-8) The number of heart beats per minute of a tortoise varies from minute to minute. Suppose that the number of beats per minute of an animal is taken fifteen times and the average heart number of beats per minute over the 15 minutes is taken. The results are summarised in the Statcrunch table below (where L-Lim and U-Lim refer to the 95% CI).

variable	sample mean	s.e.	d.f.	L-Lim	U-Lim
beats	39	0.8	14	37.29	40.71

(1) How do we interprete the confidence interval?

(A) 95% of the time the true mean lies in the interval $[37.29, 40.71]$

(B) The probability that the true mean lies inside the interval $[37.29, 40.71]$ is 95%.

(C) The probability of this interval is 95%.

(D)* The probability of generating an interval (calculated with the same method) which contains the true parameter is 95%

(E) The probability the sample average lies in this interval is 95%.

(2) In what (reasonable) way could the animal owner decrease the length of the confidence interval for the mean number of beats per minute?

(A) Decrease the population standard deviation.

(B)* Either decrease the level of confidence for the interval or increase the sample size.

(C) Increase the level of confidence.

(D) Decrease the sample size.

(E) It is impossible.

(3) Suppose you want the margin of error in your 95% CI to be 0.5. Approximately how large a sample size do you need?

(A) $(\frac{1.64\times 0.8}{0.5})^2$

(B) $(\frac{1.96\times 0.8}{0.5})^2$

(C)* $(\frac{1.96\times 0.8\times\sqrt{15}}{0.5})^2$

(D) $(1.96 \times 0.5)^2$

(E) None of the above

(4) If the mean number of beats per minute exceeds 40, then the animal is said to be in a state of 'exercise'. Based on the information in the table, which statement is correct?

(A) Since the sample average is less than 40, then the mean number of beats does not exceed 40.

(B) The mean number of beats per minute is less than 40.

(C) There is no way of drawing any conclusion, since we only have an estimate of the mean number of beats.

(D)* It could be that the mean number beats per minute of the animal is above 40 since the confidence interval contains values above 40.

(E) None of the above.

(5) Suppose you want to test $H_0 : \mu = 41$ against $H_A : \mu \neq 41$. Where does the p-value lie?

(A) Above 30%, thus at the 10% level we would not be able to reject the null.

(B) 10% – 30%, thus at the 10% level we would not be able to reject the null.

(C) 5% – 10%, thus at the 10% level we would not be able to reject the null (since it is two-sided).

(D)* 1% – 5%, thus at the 10% level we would reject the null.

(E) Less than 0.1%, thus at the 10% level we would reject the null.

(6) Which statement is correct?

(A) For a Simple Random Sample the quality of an estimator depends on how large the population is.

(B) It is unclear how the standard error is related to the sample average.

(C)* The sample standard deviation stays about the same but the standard error gets smaller as the sample size grows, this increases the chance of the sample average being close to the true mean.

(D) The sample standard deviation and the standard error are the same, hence if there is a lot of spread in the estimator, even for large sample sizes the sample average will always be a bad estimator of the mean.

(E) None of the above.

(7) Suppose the mean number of beats of a healthy animal is 36 beats per minute. Animals in the top 10th percentile may be stressed and should be looked at by a doctor. What is the top 10% percentile for the average (taken over 15 observations).

(A) Using the normal distribution it is approximately $39 - 1.28 \times 0.8$

(B)* Using the t-distribution distribution it is approximately $36 + 1.345 \times 0.8$.

(C) Using the t-distribution it is approximately $39 + 1.345 \times 0.8$

(D) Using the t-distribution it is approximately $39 + 1.761 \times 0.8$.

(E) The distribution is unknown, so it cannot be calculated.

(This I removed from the exam and gave everyone a bonus mark).

(8) Suppose that every hour I take 15 samples, evaluate the average and construct the confidence interval, and I do this for 100 hours. Which statement is correct?

(A)* We would expect the mean number of beats to lie in about 95 of these intervals, but this would only be true if the mean number of beats does not change over this time.

(B) Exactly 95 of the intervals will contain the mean number of beats.

(C) Exactly 5 of the intervals will contain the mean number of beats.

(D) None of the above statements is true.

(9) Suppose we want to know whether groceries are cheaper in Kroger than in HEB. We make 95% confidence intervals for the mean grocery bill in both supermarkets. In Kroger it is ($30, $75) and in HEB it is ($50, $89). Which of the following is true based on thse intervals?

(A) HEB groceries cost more since the both the lower and upper bounds for the true HEB mean are higher than those of Kroger.

(B)* HEB and Kroger could have the same mean grocery bill since the intervals overlap.

(C) HEB costs more, but some people who shop at Kroger spend more than some who shop at HEB.

(D) Kroger is cheaper than HEB, since the average cost is less than HEB.

(E) All the above are incorrect.

(10) In a statistical test about the mean μ, the null hypothesis was rejected. Based on this conclusion, which of the following statements are true?

(A) A type I error was committed.

(B) A type II error was committed.

(C)* Whether an error was committed or not is unknown, but if an error was made, then it was a type I error.

(D) Whether an error was committed or not is unknown, but if an error was made, then it was a type II error.

(E) No error was committed.

(11) Suppose the null hypothesis is that the person is innocent and the alternative is that the person is guilty. In the court, it is accepted that for every two thousand innocent people that go on trial, at most one can go to jail. Which statement is correct?

(A) The power in the test is 1/2000, but the type I error rate is never known.

(B)* The type I error rate is 1/2000, but the type II error rate is never known.

(C) The type II error rate is 1/2000, but the type I error rate is never known.

(D) We cannot reject the null at the 5% level.

(E) All of the above

(12) Suppose that you do a test for $H_0 : \mu = 6$ against $H_A : \mu \neq 6$, you obtain a sample average which is $\bar{X} = 6.5$ and a p-value of 0.06. Which of the statements below is correct.

(A) We reject the null at the 5% level.

(B) A 95% confidence interval for the mean will include 6. (yes)

(C) A 99% confidence interval for the mean will include 6. (yes)

(D)* Only two of the above.

(E) None of the above.

(13) A researcher wants to see whether a drug increases the energy level of an animal. The average time an animal stays awake without any drugs is four hours and the researcher wants to test $H_0 : \mu \leq 4$ against $H_A : \mu > 4$. He measures the amount of time three animal stay awake. All three animals stay awake longer than four hours, yet the results are not statistically significant at the 10% level. What is the best explanation for the result?

(A) The drug does not work.

(B) The drug works, but a test cannot be used to test determine its significance.

(C) There was a calculation error and the result is highly significant.

(D) The p-value is small, which is why the result was not significant.

(E)* The sample size is too small to determine if the increase cannot be explained by random chance.

(14) Which statement is true?

(A)* In a level $\alpha = 0.05$ test of a hypothesis, increasing the sample size will not affect the *level* of the test.

(B) In a level $\alpha = 0.05$ test of a hypothesis, increasing the sample size will not affect the *power* of the test.

(C) Both statements are true.

(D) All the above are false.

(15) Which statement is true?

(A) The sample size n plays an important role in testing a hypothesis because it measures the amount of data (and hence information) upon which we base a decision. If the data is quite variable (large standard deviation) and n is small, it is unlikely that we will reject the null when when the null is false.

(B) Supose we are testing the following hypothesis about the population mean μ, $H_0 : \mu \leq 4$ versus $H_A : \mu > 4$. If the sample size is very large and the variable is not highly variable (hence small standard deviation), it is highly likely we will reject the null hypothesis even when the true value of μ is only trivially larger than 4.

(C)* Both of the above are true.

(D) None of the above are true.