Unit Exam #2

Statistics 300: Introduction to Probability and Statistics

Spring Semester 2009
Cosumnes College

Instructor: L.C. Larsen

Instructions

Time: 2 hours & 5 minutes on 10/31, 11/3, or 11/4, 2008

Materials: Open book, notes, homework, etc.

Instruments: Calculator/Laptop of student's choice

**No phones or consultants
Except to call the instructor : 346-6324 or 322-3988**

Answers to confidence interval problems and sample size problems must include the expression (the formula) in symbolic form and the expression with all of the values inserted in the proper places. Then, the final answer can be calculated by any method or device.

Answers to hypothesis test problems must include all four parts of the traditional approach to hypothesis tests, including the expression (the formula) for the test statistic in symbolic form and the expression with the values in the right places. The result can then be calculated by whatever method you like (TI-83, laptop computer, etc.).

If more space is needed for a problem, continue your work on the back of the page.

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(8 points : 8 minutes)

1. X is a random variable and X ~ N(m = 80, s = 15).
   A random sample of values from <u>another</u> "normally distributed " population (y) has the statistics shown
   in the box below. Test the idea that the sample comes from a population with variabilty less than
   the variability of X.
   For this test (not a confid. interval), use a 0.05 significance level.

Sample   statistics
$\overline{y}$ = 39.2
s_y = 11.8
n = 28

   H₀: _____

   H₁: _____

(7 points : 7 minutes)

   2. Consumer reports followed the experience of 568 randomly selected people who bought Yugo
   cars. Major engine repairs were needed on 96 of the cars during the 3 year or 30,000 mile
   warranty period. Use these results to make a 94% confidence interval for the proportion of all
   Yugo cars that needed major engine repairs during the warranty period.

   Based on your results, was it reasonable for the Yugo company to claim that less than 20% of all
   Yugos would need major engine repairs during the warranty period.
   Circle "Yes" or "No" and say why.

   YES   NO   Why: _____

   _____

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(6 points : 6 minutes)

**3. When testing poisons on ants, the dose that kills 50% of the ants is called the LD50 (lethal dose 50%).
     When testing the % killed by different doses, a company wants to be 95% sure that the proportion of
     ants killed in each of their samples is within one percentage point of the true percent of all ants
     that would die at that dose. Help plan the company's experiments by deciding how many ants they
     need to test for a dose near the LD50.**
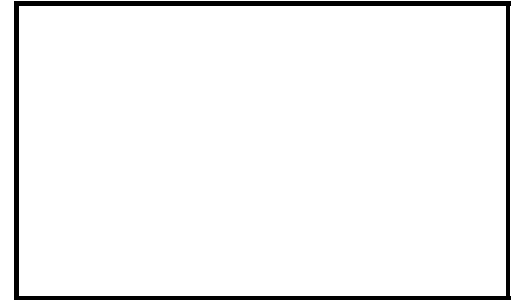
(6 points : 6 minutes)

**4. To determine the number of calories in a so-called "serving" of cookies, a laboratory
     uses a method of measurement that has variability characterized by a standard deviation of
     0.65 calories. If the laboratory must estimate the true mean calorie content of all "servings" of
     these cookies within 0.1 calories with 90% confidence, how many servings must they test?**

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(5 points : 4 minutes)

5. Given: X has a Normal distribution with m = 61.7 and s = 7.8
What is the probability that a random value of X will be
between 52.7 and 65.3?

Draw the picture for the problem and calculate the probability.

(3 points : 3 minutes)

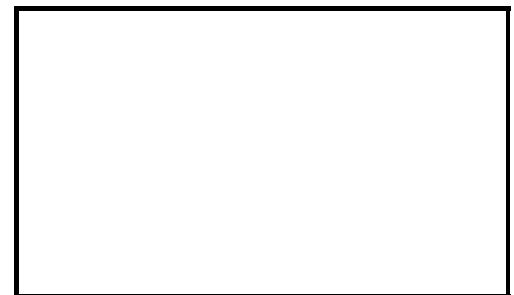**6. What is the 5th percentile of the "t" distribution with 17 degrees of freedom?**

Draw the picture for the problem and determine the value
of the percentile.

(4 points : 3 minutes)

7. A random variable, X, has a Uniform distribution on the interval [140,180].
What is the probability that a random value from this
**distribution will be greater than 157?**

Draw the picture for the problem and calculate the probability.

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(8 points : 8 minutes)

8. An engineer tests materials for strength. Force is applied to each item until it breaks. A random sample of 14 items is tested and the force needed to break each one is recorded. The breaking forces averaged 3.465 tons with a standard deviation of 0.122 tons. A histogram of the breaking forces is shown below. Use the data to construct a 95% confidence interval for the true mean breaking force for the whole population of items from which the sample was selected.
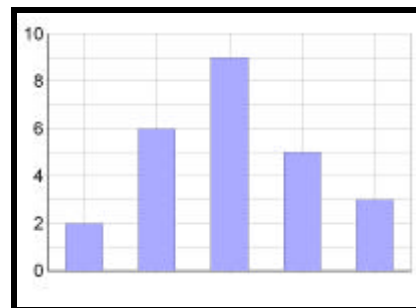
Based on your confidence interval, is it reasonable for the engineer to claim that the population of materials satisfies the goal of m▷ 3.7 tons breaking strength?
YES   NO   Why? _____

_____

(7 points : 7 minutes)

9. A company supplies a specific part to a client that makes high quality refrigerators. All of the parts must be very uniform in length to be acceptable. A random sample of 23 parts is selected and the length of each one is measured. The results are summarized below. Use these results to prepare a 95% confidence interval for the standard deviation of the lengths of all the parts that the company manufactures for their client. (The distribution of lengths is rather bell-shaped.)

Results from sample
4.002 cm = $\overline{X}$
0.004 cm = s
23 = n

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(6 points : 6 minutes)

10. The birthweights of all babies born in the USA last year had an average of 3.08 kg and a standard deviation of 0.62 kg. If a random set of 15 babies is selected from those born last year in the USA, what is the probability that the average weight of the 17 babies will be greater than 3.15 kg? (The distribution of birth weights is known to be "bell-shaped".)
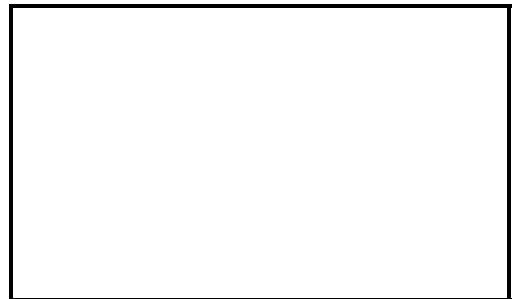
Picture is worth two of the 6 points!

(5 points : 6 minutes)

11. The birthweights of all babies born in the USA last year had an average of 3.08 kg and a standard deviation of 0.62 kg. If these weights were Normally distributed, what was the 90th percentile of those weights?

Picture is worth two of the 5 points!

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(8 points)

12. An auto insurance company advertises that 95% of its customers are satisfied with the company's products and services. A random sample of the company's customers included 770 that were satisfied and 60 that were not satisfied. Use these results to test whether the company's advertized percentage is too high. (Use a 2% significance level for your test.)

Claim : _____

H_0: _____

H_1: _____

**If the null hypothesis (H_0:) is true, what is
the probability of a "Type I" error for this test?   P(Type I error) =** _____

(8 points : 12 minutes)

13. **The form (tablets or liquid) of a sleeping aid medication may affect the speed at which the medication works. Use the results of the experiment below to test the claim that the average amount of time (elapsed time) before patients fall asleep is at least 2 minutes longer for tablets than for liquid. It is interesting but not especially important that the variation in time was about the same for both tablets and liquid. The seven patients who participated in the study did not like the flavor of the liquid.**
(Let $\alpha = 0.05$ for this test.)

H$_0$: _____

H$_1$: _____

Minutes Before Sleep for		
Patient	Tablet	Liquid
1	30	25
2	18	14
3	29	23
4	19	14
5	24	25
6	23	17
7	21	16
$\bar{x}$ =	22.33	18.17
s =	3.98	4.71
n =	7	7

(5 points)
Extra Credit Problem

      **A random variable (call it "X") has a Chisquare distribution with 30 degrees of freedom.
In a random sample of 10 values of X, what is the probability that at least one of the 10
will be above 43.773 ?**