

Unit 6 REVIEW (Ch. 23 – 25)

1. The distribution of scores of students taking the LSATs is claimed to have a mean of 521. We take a sample of 100 incoming Harvard Law School freshman LSAT scores and find a mean of 589 and a standard deviation of 37. Since Harvard is an Ivy League school, they think their freshmen are smarter than average law students. Test this theory (that Harvard students score higher than average on the LSATs) at the 0.05 significance level.
2. A teacher wants to test the effectiveness of a new textbook. She believes that this new textbook is easier to read, and that her students should have better grades on their tests this year than they have in the past. She took a random sample of test scores from last year's classes, and then a random sample of test scores from this year's classes. Assume normal populations for both years. Test her theory at $\alpha = 0.01$.

Old book					New book				
85	84	91	75	65	94	62	86	89	80
75	82	84	89	62	96	88	88	79	75
74	64	58	95	50	94	84	86	78	64

3. A football coach is frustrated with his team's lack of speed. He measures each player's 40-yard dash speed and then sends all of them to a speed and agility camp. He then measures their times again after. The data is below. Is there sufficient evidence to say that the camp helped the players speed? Run a test.

Before	4.88	5.1	4.41	4.73	4.6	4.8	4.95	4.98	5.2	5.13	5.05	4.9	4.7	4.6	5.11
After	4.7	4.85	4.35	4.77	4.56	4.78	4.7	4.9	5	5.1	5.1	4.7	4.56	4.34	4.9

4. Poisoning by DDT causes tremors and convulsions and slows recovery times of muscles. In a study of DDT poisoning, researchers fed several lab rats a measured amount of DDT. They then made measurements of the rats' refractory period (the time needed for a nerve to recover after a stimulus). In their sample they find the following times: 1.61, 1.9, 1.53, 1.4, 1.33, 1.81, 1.3, 1.25, 1.65.
 - a. Estimate the average refractory period using 95% confidence.
 - b. If we know that the mean time for unpoisoned rats is 1.3 milliseconds, does your interval give evidence that the average time is different for poisoned rats?
5. The Chapin Social Insight Test is a psychological test designed to measure how accurately a person appraises other people. The possible scores on the test range from 0 to 41. During the development of the test, it was given to several groups of people. Here are the results for male and female college students at a liberal arts college:

	n	avg.	std.dev
Male	133	25.34	5.05
Female	162	24.94	5.10

Does the data support the contention that female and male students differ in average social insight? Use 96% confidence to make your conclusion.

6. Many drivers of cars that can run on regular gas actually buy premium in the belief that they will get better gas mileage. To test that belief, we use 10 cars in a company fleet in which all the cars run on regular gas. Each car is filled first with either regular or premium gasoline, decided by a coin toss, and the mileage for that tank-full is recorded. Then the mileage is recorded again for the same cars for a tank-full of the other kind of gasoline. We don't let the drivers know about this experiment. Here are the results in miles per gallon:

Regular	16	20	21	22	23	22	27	25	27	28
Premium	19	22	24	24	25	25	26	26	28	32

Is there evidence that cars get significantly better fuel economy with premium gasoline? Use 0.01 level of significance and a test.

7. For inference on means, why is Student's t-model used and not the Normal model?
8. How is Student's t-model the same as the Normal model?
9. How is Student's t-model different than the Normal model?
10. How is degrees of freedom calculated and what effect does it have on the Student's t-model?
11. A certain population is skewed to the right. We want to estimate the mean so we take a sample. What must we know about the sample if we wish to create a confidence interval to estimate the true mean?
12. If we calculate a 95% confidence interval, how can we decrease the margin of error without losing confidence?
13. What is the critical value (t^*) for a sample of 67 for 92% confidence?
14. What is the critical value for a sample of size 153 for 97% confidence?
15. What is the p-value if I have a test statistic of $t = 2.145$, sample size of 28, and am doing a 2-sided test?
16. What is the p-value if I have a test statistic of $t = -1.987$, sample size of 193, and am doing a lower-tailed test?
17. I have an interval that is (102, 105).
 - a. What is the sample mean?
 - b. What is the margin of error?
 - c. Assuming that the standard deviation is 5 and the sample size is 40, what is the confidence level?

Use the following information for problems #18 – 25.

We wish to see if the dial indicating the oven temperature for a certain model oven is properly calibrated. 12 ovens of this model are selected at random. The dial on each is set to 300° F; after one hour, the actual temperature of each is measured with a thermometer. The temperatures measured had a mean of 302.5° F with a standard deviation of 0.25° F. Assuming that the actual temperatures for this model when the dial is set to 300° are normally distributed, we test whether the dial is properly calibrated by testing the hypotheses $H_0: \mu = 300$, $H_A: \mu \neq 300$

18. Assuming conditions are met, calculate the t-statistic and P-Value for this problem.
19. What does the P-Value mean in this context?
20. What would be a Type I error in this context?
21. What would be a Type II error in this context?
22. What is Power in this context?
23. If a 96% confidence interval were calculated what would be the critical value?
24. What does 96% confidence mean in this context?
25. If the test was redone with the same significance level on 24 ovens and the same mean and standard deviation were found:
 - a. What would happen to the P-Value?
 - b. What would happen to the Type I error?
 - c. What would happen to the Type II error?
 - d. What would happen to the Power?
 - e. How would the 96% confidence interval change?

NOTE: Extra Credit will be offered. Problems will be from Unit 5 material (proportions)