Review for Test 3

YOU NEED TO KNOW

1. **Confidence Interval for the mean when σ is known (know the conditions, the formula, and how to interpret them)**
2. **Confidence Interval for the mean when σ is unknown (know the conditions, the formula, and how to interpret them)**
3. **how to find the margin of error**
4. **how to find the sample mean and the margin of error if the CI is given**
5. **how the CIs behaves as we increase the confidence, or we change the sample size**
6. **how to find the minimum sample size when the margin of error is given**
7. **how to carry out a hypothesis test for the mean (check conditions, state claims, find the test statistic, find the p-value, give the conclusion)**
8. **which test to use for the mean: the z-test, or the t-test**
9. **how to find the sample proportion**
10. **large-sample confidence intervals for a proportion (know the conditions, the formula, and how to interpret them)**
11. **how to find the minimum sample size when the margin of error is given (for proportions)**
12. **how to carry out a hypothesis test for the proportion (check conditions, state claims, find the test statistic, find the p-value, give the conclusion)**
13. **how to carry out a hypothesis test to compare two population means or proportions (state the claims, find the test statistics, find the p-value, give the conclusion)**

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1. **From a random sample of 36 days in a recent year, the closing stock prices of Hasbro had a mean of $19.31. From past studies we know that the population standard deviation is $2.37.**

a. Should you use the *z*-distribution, or the *t*-distribution to construct a CI for the population mean for closing stock prices of Hasbro?

b. Construct the 90% and 95% confidence intervals for the population mean. Interpret the CIs.

c. Which interval is wider? What are the margins of errors?

2. **You randomly select 20 mortgage institutions and determine the current mortgage interest rate at each. The sample mean rate is 6.93% with a sample standard deviation of 0.42%.** Find the 99% confidence interval for the population mean mortgage interest rate. Assume the interest rates are approximately normally distributed. ($t^* = 2.861$)

3. **A biologist reports a CI of (2.1cm, 3.5cm) when estimating the mean height of a sample of seedlings.** Find the sample mean and the margin of error.

4. **Determine the minimum required sample size if you want to be 95% confident that the sample mean is within one unit of the population mean when the population's standard deviation is 4.8.** Assume that the population is normally distributed.

5. A random sample of airfare prices in dollars for a one-way ticket from New York to Houston is given:

288, 290, 292, 295, 298, 300, 305, 305, 306, 307, 314, 320, 322, 326, 327

Assuming that the prices of tickets are normally distributed, find and interpret the 90% CI for the mean price of all tickets from New York to Houston. (sample mean = 306.3, sample s.d. = 12.97, and t* = 1.761)

6. The following table shown is from a survey of randomly selected 900 U.S. adults.

Who are the more dangerous drivers?	
Teenagers	63%
People over 75	33%
No opinion	4%

a. Construct a 95% CI for the proportion of adults who think that teenagers are the more dangerous drivers. What's the margin of error?

b. Construct a 95% CI for the proportion of adults who think that people over 75 are the more dangerous drivers. What is the margin of error?

7. You are running a political campaign and wish to estimate, with 99% confidence, the proportion of registered voters who will vote for your candidate. Your estimate must be accurate within 3% of the true population. Find the minimum sample size needed if

a. no preliminary estimation is available

b. a preliminary estimation gives $\hat{p} = 0.31$.

8. A used car dealer says that the mean price of a 2002 Ford F-150 Super Cab is $18,800. You suspect this claim is too high. You find that a random sample of 14 similar vehicles has a mean price of $18,250 and a standard error of $1,250. Is there enough evidence to reject the dealer's claim at α=0.05? Assume the population is normally distributed. Is your conclusion the same at the 10% level? (p-value: 0.062) Can you reach the same conclusion by using a CI?

9. A company that makes cola drinks states that the mean caffeine content per one 12-ounce bottle of cola is 40 milligrams. You work as a quality control manager and are asked to test this claim. During your tests, you find that a random sample of 30 12-ounce bottles of cola has a mean caffeine content of 39.2 milligrams. From previous studied you know that the standard deviation of the population is 7.5 milligrams. Assume that the caffeine content is normally distributed. At α = 1% level, can you reject the company's claim? Can you reach the same conclusion by using a CI?

10. A scientist estimates that the mean nitrogen dioxide level in West London is greater than 28 parts per billion. You believe that the mean nitrogen dioxide level is actually higher. So, you determine the nitrogen dioxide levels for 36 randomly selected days. The results (in parts per billion) are listed below. At α = 10%, can you support the scientist's estimate? (p-value: 0.098). Can you reach the same conclusion by using a CI?

27, 29, 53, 31, 16, 47, 22, 17, 13, 46, 99, 15, 20, 17, 28, 10, 14, 9, 35, 29, 32, 67, 24, 31, 43, 29, 12, 39, 65, 94, 12, 27, 13, 16, 40, 62

11. **A medical researcher claims that 20% of adults in the U.S. are allergic to a medication. You think that less than 20% are allergic to a medication. In a random sample of 100 adults, 15% say they have such an allergy.** Test the researcher's claim at $\alpha = 1\%$ level. Can you reach the same conclusion using the appropriate confidence interval?

12. **USA TODAY reports that 5% of U.S. adults have seen an extraterrestrial being. You decide to test this claim and ask a random sample of 250 U.S. adults whether they have ever seen an extraterrestrial being. Of those surveyed, 8% reply yes.** At $\alpha = 5\%$, is there enough evidence to reject the claim?

13. **A medical researcher estimates that 55% of U.S. adults eat breakfast every day. In a random sample of 250 U.S. adults, 56.4% say that they eat breakfast every day.** At $\alpha = 5\%$, is there enough evidence to reject the researcher's claim?

14. **Classify the two given samples as independent or paired samples:**

    a. The SAT scores for 35 high school students who did not take an SAT preparation course.
    The SAT scores for 40 high school students who did take an SAT preparation course.

    b. The SAT scores for 44 high school students
    The SAT scores for the same 44 high school students after taking an SAT preparation course.

    c. The weights of 51 adults.
    The weights of the same 51 adults after participating in a diet and exercise program for one month

    d. The weight of 40 females
    The weight of 40 males

    e. The average speed of 23 powerboats using an old hull design
    The average speed of 23 powerboats using a new hull design

    f. The fuel mileage of 10 cars
    The fuel mileage of the same 10 cars using a fuel additive

    g. Heart rate of 10 people before exercising
    Heart rate of the same10 people after exercising

15. **Consumer Reports tested the stopping distances (in feet) of 10 randomly selected Firestone Winterfire tires and 12 Michelin XM-S Alpin tires when traveling on ice at 15 mph. Results are shown below.** Based on the results, can you conclude that there is a difference in the mean stopping distances of the two types of tires? Use 10% significance level. State the two hypothesis, and write your conclusion in context based on the p-value and CI.

    p-value: 0.163 91% CI: (-8.798, 0.798)

16. **A manufacturer claims that the calling range (in feet) of its 2.4 GHz cordless phone is greater than that of its leading competitor. You perform a study using 14 randomly selected phones from the manufacturer and 16 randomly selected phones from its competitor.** At the

5% significance level, can you support the manufacturer's claim? Assume the populations are normally distributed.
State the claims, and write your conclusion in context based on the given p-value.

Manufacturer: sample mean = 1275 ft, sample s.d. = 45 ft, sample size = 14
Competitors: sample mean = 1250 ft, sample s.d. = 30 ft, sample size = 16
p-value: 0.046

17. **A physician claims that an experimental medication increases an individual's heart rate. Twelve test subjects are randomly selected, and the heart rate of each is measured. The subjects are then injected with the medication and, after 1 hour, the heart rate of each is measured again.** The results are show below.

Before	72	81	76	74	75	80	68	75	78	76	74	77
After	73	80	79	76	76	80	74	77	75	74	76	78

State the hypothesis, and your conclusion in context using 5% significance level.
p-value: 0.086

18. **The table shows the gas mileage (in miles per gallon) of 10 cars with and without using a fuel additive. At the 5% significance level, is there enough evidence to conclude that the fuel additive improved gas mileage?**

Gas mileage without additive	35.8	37.7	39.4	36.8	36.6	33.7	38.4	37.3	35.7	36.7	37.1	38.3
Gas mileage with additive	36.2	39.8	40.1	39.3	36.9	34.5	38.8	37.3	36.1	37.9	37.0	38.6

p-value = 0.0036

19. **A medical research team conducted a study to test the effect of a cholesterol-reducing medication. At the end of the study, the researchers found that of the 4700 subjects who took the medication, 301 died of heart disease. Of the 4300 subjects who took the placebo, 357 died of heart disease.** At the 1% significance level, can you conclude that the death rate is lower for those who took the medication than for those who took the placebo?
State the hypotheses, find the test statistic (z), and the p-value. State your conclusion in context.

20. **In a random survey of 1500 adults in California and 1000 adults in Oregon, you find that the percentages of smokers are 16.4% and 22.4%, respectively.** At the 5% significance level, is there enough evidence to conclude that the proportion of adults who are smokers is lower in California than in Oregon?
State the hypotheses, find the test statistic (z), and the p-value. State your conclusion in context.