MAT 121 Statistics I
Weekly Exam #4

Problem 1.

To investigate the efficacy of a diet, a random sample of 16 male patients is drawn from a population of adult male volunteers is collected. The weight of everyone in the sample is taken at the start of the diet, and at a medical follow-up four weeks later. Assume that the population of differences in weight before versus after the diet follows a normal distribution. What would be the appropriate statistical test to conduct the hypothesis test?

A. Paired t-test
B. Normal test for the difference between two proportions
C. Pooled-Variance t-Test for the difference between two means
D. Normal test for the difference between two means

Answer: A
This is a typical paired experiment.

Problem 2

Which of the following definitions for a two-tailed test is correct?

A. P-value = sum of the areas of both tails.
B. P-value = average of left and right tail areas.
C. P-value = 2 times the smaller tail area.
D. P-value = difference of left tail area and right tail area.

Answer: C
By the definition of the p-value for a two-tailed test.

Problem 3.

For testing a normal population mean, in which of the following situation a t-test must be used?
A. when the sample size is small ($n<30$) and population variance are known.
B. when the sample size is small ($n<30$) and population variance are unknown.
C. when the sample size is small ($n>30$) and population variance are known.
D. When population variance is known regardless of sample size.

Answer B.

Problem 4.

The mean credit card debt among households in one state is $8400. A hypothesis test is to be performed to decide whether the mean credit card debt for households in the formerly affluent town of Rich-No-More differs from the mean credit card debt for the state.

A). Ho: $\mu = 8400$ vs Ha: $\mu \leq 8400$
B). Ho: $\mu > 8400$ vs Ha: $\mu < 8400$
C). Ho: $\mu = 8400$ vs Ha: $\mu \neq 8400$
D). Ho: $\mu < 8400$ vs Ha: $\mu = 8400$

Answer: C.
The claim is $\mu \neq 8400$

Problem 5.

A health insurer has determined that the "reasonable and customary" fee for a certain medical procedure is $1200 They suspect that the average fee charged by one particular clinic for this procedure is higher than $1200. The insurer wants to perform the following hypothesis test Ho: $\mu \leq 1200$ vs Ha: $\mu > 1200$.

The null hypothesis is rejected. State the appropriate conclusion.

A). The sample evidence supports the insurer's claim that the mean fee is higher than $1200.
B). The sample evidence does not support the insurer's claim that the mean fee is higher than $1200.
C). The mean fee is not $1200.
D). the mean fee is at least $1200.

Answer: A
Claim: " is higher than $1200 " is the alternative. Since the null hypothesis is rejected, we conclude with the alternative hypothesis. We support the claim.

Problem 6.

A psychologist has designed a test to measure stress levels in adults. The following hypothesis test is to be conducted to determine whether the mean score for trial lawyers exceeds the national mean score

Ho: $\mu = 27$ vs Ha: $\mu \neq 27$.

If the test concludes that $\mu = 27$ when, in fact, the true stress level is not 27.

A). correct conclusion
B). Type I error
C). Type II error
C). Type I and type II errors.

Answer C.
This is something like the patient has no disease but the doctor claimed a disease. This is a type II error.

Problem 7.

The recommended dietary allowance (RDA) of vitamin C for women is 75 milligrams per day. The hypothesis test is to be performed based on a large sample to decide whether adult women are, on average, getting less than the RDA of 75 milligrams per day.

Ho: μ ≥ 75 vs Ha: μ < 75

A). The rejection region is on the right tail of the standard normal density curve.
B). The rejection region is on the left tail of the standard normal density curve.
C). The rejection region is on both tails of the standard normal density curve.
D). The rejection region is around the mean of the standard normal density curve.

Answer B.

Problem 8.

We use the body temperature data collected by the researchers at the University of Maryland with characteristics: *n=36*, $\bar{x} = 98.20^o F$, *s=0.62*^{0}*F*. Find the value of the test statistic for the claim that the population mean is $\mu = 98.6^o F$. What is the value of the test statistic?

A). $\frac{98.2-98.6}{0.62/\sqrt{36}} = -3.87$

B). $\frac{98.6-98.2}{0.62/\sqrt{36}} = 3.87$

C). $\frac{98.2-98.6}{\sqrt{0.62/36}} = -3.05$

D). $\frac{98.6-98.2}{\sqrt{0.62/36}} = 3.05$

Answer A:

Problem 9.

In an advertisement, a pizza shop claims that its mean delivery time is less than 30 minutes. A random selection of **36** delivery times has a sample mean of 28.5 minutes and a standard deviation of 3.5 minutes. The shop performed the following test.

Ho: μ ≥ 30 vs Ha: μ < 30

The test statistic is given by

$$TS = \frac{28.5 - 30}{3.5/\sqrt{36}} = -2.57$$

What is the p-value?

A). 0.0051
B). 0.9950
C). 0.0102
D). 0.025

Answer A

Problem 10.

Which of the following statement is true?

A). The null hypothesis is rejected if the p-value is less than the significance level.
B). The claim is rejected if the p-value is less than the significance level.
C). The alternative is rejected if the p-value is less than the significance level.
D). The null hypothesis is rejected if the p-value is greater than the significance level.

Answer: A

Problem 11.

A study was set up to look at whether there was a difference in the mean arterial blood pressure between two groups of volunteers, after 6 weeks of following one of two treatment programs. One group of volunteers was given an exercise regimen to follow for the 6 weeks and the other group was given the same exercise regimen with the addition of an experimental tablet.
Which type of t-test should be used in this situation?

a) One sample t-test
b) independent samples t-test
c) Paired samples t-test
d) None of the t-tests would be suitable

Answer: B

Problem 12.

To see if there had been a significant change in reported alcohol consumption(units) in patients diagnosed with alcoholic liver disease before intervention and after the intervention has been completed. Which of the following t-tests should be used and for what reason?

a) One sample t-test because the “Before” data is normally distributed
b) independent samples t-test because the “Before” data is normally distributed
c) A paired samples t-test because the “Before” is normally distributed.
d) A paired samples t-test because the “Difference” is normally distributed.

Answer: D

Problem 13

The test-statistic $T = \frac{(\bar{x}-\mu_0)}{s/\sqrt{n}}$ has a t-distribution with the following degrees of freedom.

a) n
b) n - 1
c) n - 2
d) $n_1 + n_2 - 2$

Answer B.

Problem 14

Which of the following is not needed to calculate a t-score for a test?

A Sample mean
B Sample standard deviation
C Sample size
D Significance level

Answer: D

Problem 15

The proportion of defective items is not allowed to be over 15%. A buyer wants to test whether the proportion of defectives exceeds the allowable limit. The buyer takes a random sample of 100 items and finds that 19 are defective. State the null and alternative hypotheses for this test.

A) Ho: $p \leq .15$, Ha: $p > .15$

B) Ho: $p < .15$, Ha: $p > .15$

C) Ho: $p = .15$, Ha: $p > .15$

D) Ho: $p < .15$, Ha: $p > .15$

E) none of the above

Answer - A:
Claim 'is not allowed to be over 15%'. p <= 0.15.

Problem 16.

Conduct a test to determine whether or not the population proportion of voters in favor of proposal A is greater than 50%. In a random sample of 200 voters, 140 said that they were in favor of this proposal. Compute the test statistic.

A) z = 6.17
B) z = 19.80
C) z = 5.66
D) z = 7.07
E) none of the above

Answer - C:

Use the phat = 0.7, p0 = 0.5, n = 200.

Problem 17.

The proportion of defective items is not allowed to be over 15%. A buyer wants to test whether the proportion of defectives exceeds the allowable limit. The buyer takes a random sample of 100 items and finds that 19 are defective. Find the p-value.

A) 0.3686
B) 0.1314
C) 0.2628
D) 0.8686
E) none of the above

Answer - B:
Claim "not allowed to be over 15%" ➔ p <= 0.15. ➔ Ho: p <= 0.15 vs Ha: p> 0.15
This is a right-tailed test. The test statistic TS = 1.12. p-value = P(Z> 1.12) = 0.1314

Problem 18.

In the past, the mean running time for a certain type of radio battery has been 9.6 hours. The manufacturer has introduced a change in the production method and wants to perform a hypothesis test to determine whether the mean running time has changed as a result. The null (H_0) and alternative (H_a) hypotheses are

a. H0: $\mu \geq 9.6$ hours; H1: $\mu = 9.6$ hours
b. H0: $\mu > 9.6$ hours; H1: $\mu > 9.6$ hours
c. H0: $\mu \neq 9.6$ hours; H1: $\mu = 9.6$ hours
d. H0: $\mu = 9.6$ hours; H1: $\mu \neq 9.6$ hours

Answer: D
Claim: "whether the mean running time has changed as a result", $\mu \neq 9.6$ hours

Problem 19.
The death rate from a particular form of cancer is 23% during the first year. When treated with an experimental drug, only 15 out of 84 patients die during the initial year. Is this strong evidence to claim that the new medication reduces the mortality rate?

(A) Yes, because the P-value is .0459.
(B) Yes, because the P-value is .1314.
(C) No, because the P-value is only .0459.
(D) No, because the P-value is above .10.
(E) An answer cannot be given without first knowing if a placebo was also used and what the results were.

Answer: B

Claim "reduces the mortality rate", ➔ $p < 0.23$. This is a left-tailed test. TS = -1.12
p-value = $P(Z < -1.12) = 0.1314$.

Problem 20.

A bottling company produces bottles that hold 12 ounces of liquid. Periodically, the company gets complaints that their bottles are not holding enough liquid. To test this claim, the bottling company randomly samples 64 bottles and finds the average amount of liquid held by the bottles is 11.9155 ounces with a standard deviation of 0.40 ounces. *Suppose the p-value of this test is 0.0455*. State the proper conclusion.

A) At $\alpha = 0.025$, reject the null hypothesis.
B) At $\alpha = 0.05$, accept the null hypothesis.
C) At $\alpha = 0.05$, reject the null hypothesis.
D) At $\alpha = 0.10$, fail to reject the null hypothesis.

Answer: C

The rejection rule of p-value method.