1. As a result of complaints from both students and faculty about lateness, the registrar at a large university wants to determine whether the scheduled break between classes should be changed and, therefore, is ready to undertake a study. Until now, the registrar has believed that there should be 20 minutes between scheduled classes. what is the appropriate alternative hypothesis is

   A. $H_1: \mu \neq 20$
   B. $H_1: \bar{x} < 20$
   C. $H_1: \mu > 20$
   D. $H_1: \mu \leq 20$
   E. $H_1: \mu \geq 20$

Since the registrar has believed that there should be 20 minutes between scheduled classes, $H_1: \mu \neq 20$

2. If you reject H_0 when H_0 is correct, what type of error is this?

   A. Type I error
   B. Type II error
   C. May be type I or Type II
   D. No error
   E. We need more information to tell

   Type I error, reject H_0, when its true

3. The manager of a paint supply store wants to determine whether the mean amount of paint contained in 1-gallon cans purchased from a nationally known manufacturer is actually 1 gallon. You select a random sample of 25 cans, and the mean amount of paint per 1-gallon can is 0.995 gallon with standard deviation of the amount of paint is 0.02 gallon. To test that the mean amount of paint per 1-gallon is different from 1 gallon, the observed value of the test statistic was found to be – 1.25. The p-value for this test is equal to

   A. Between 0.2 and 0.30
   B. Between 0.1 and 0.15
   C. Between 0.85 and 0.9
   D. 0.1056
   E. Between 0.7 and 0.8

Since $H_1: \mu \neq 1$,

$$p - value = 2P(T_{24} > |-1.25|)$$

From the table

$$0.1 < P(T_{24} > 1.25) < 0.15$$

$$0.2 < p - value < 0.3$$

The quality-control manager at a light bulb factory needs to determine whether the mean life of a large shipment of light bulbs is more than 350 hours. The population standard deviation is 100 hours. A random sample of 25 light bulbs indicates a sample mean life of 375 hours

Based on this information, answer the next three questions

4. what distribution will you use to test your hypothesis?

   A. normal distribution
   B. t-student distribution with 24 degrees of freedom
   C. binomial distribution
   D. t-student distribution with 25 degrees of freedom
   E. Chi-square distribution

Since the population standard deviation is known, the point estimator follows normal.

5. what is the value of test statistic?

   A. 1.25
   B. –1.25
   C. – 6.25
   D. 6.25
   E. – 0.25

$$Z_0 = \frac{(\bar{x} - \mu_0)\sqrt{n}}{\sigma} = \frac{(375 - 350)\sqrt{25}}{100} = 1.25$$

6. we reject H_0 if the value of test statistic is _______ than _________

   A. more than 1.645
   B. more than 1.96
   C. less than – 1.645
   D. less than – 1.96
   E. We cannot tell what our decision will be from the information given.

Since $H_1: \mu > 350$, we reject H_0 if $Z_0 > Z_{0.05} = 1.645$

Ahmed wants to open a restaurant at KFUPM mall. He thinks that opening the restaurant will be profitable if mean food expenditure of the students is more than 100 Ryal. Of a random sample of size 16 students, the mean food expenditure is found to be 103 Ryal with variance 200 Ryal^2. At 5% level of significance, should Ahmed open the restaurant?

Based on this information, answer the next three questions

7. what distribution will you use to test your hypothesis?

   A. t-student distribution with 15 degrees of freedom
   B. normal distribution
   C. binomial distribution
   D. t-student distribution with 16 degrees of freedom
   E. Chi-square distribution

   Since the population standard deviation is unknown and n small, the point estimator follows t- student distribution with 15 degrees of freedom.

8. what is the value of test statistic?

   A. 0.85
   B. –0.85
   C. – 0.21
   D. 0.21
   E. 0.06

$$T_0 = \frac{(\bar{x} - \mu_0)\sqrt{n}}{s} = \frac{(103 - 100)\sqrt{16}}{\sqrt{200}} = 0.8485$$

9. which of the following is true

   A. since the test statistic is less than the critical value which is 1.753; don't reject the null hypothesis; there is no evidence that mean food expenditure of the students is more than 100 Ryal and Ahmed will not open the restaurant.
   B. since the test statistic is less than the critical value which is 1.753; reject the null hypothesis; there is evidence that mean food expenditure of the students is more than 100 Ryal and Ahmed will open the restaurant.
   C. since the test statistic is less than the critical value which is - 1.753; reject the null hypothesis; there is evidence that mean food expenditure of the students is more than 100 Ryal and Ahmed will open the restaurant.
   D. since the test statistic is more than the critical value which is - 1.753; don't reject the null hypothesis; there is no evidence that mean food expenditure of the students is more than 100 Ryal and Ahmed will not open the restaurant.
   E. May be Ahmed will open the restaurant may be not.

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Since $H_1: \mu > 100$,we reject H_0 if $T_0 > T_{0.05,15} = 1.7531$
Since $T_0 = 0.85 < T_{0.05,15} = 1.7531$, don't reject H_0 and there is no evidence that mean food expenditure of the students is more than 100 Ryal and Ahmed will not open the restaurant.

The U.S. Department of Education reports that 46% of full-time college students are employed while attending college. A recent survey of 60 full-time students at Miami University found that 34 were employed. At 5% level of significance, if you need to prove that the proportion of full-time students at Miami University is different from the national norm of 0.46

Based on this information, answer the next three questions

10. The estimator of the proportion of the full-time students at Miami University are not employed is

    A. 0.43
    B. 0.57
    C. 0.46
    D. 0.05
    E. 0.10

$$\hat{p} = \frac{number\ of\ not\ employes}{total} = \frac{60-34}{60} = 0.4333$$

11. what is the value of test statistic?

    A. 1.66
    B. −1.66
    C. − 0.12
    D. 0.12
    E. 0.3

$$H_0: \pi = 0.46 \quad H_1: \pi \neq 0.46$$

Since $\pi p_0 > 5\ and\ \pi(1-p_0) > 5$

$$Z_0 = \frac{(\hat{p}-p_0)}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{\left(\frac{34}{60}-0.46\right)}{\sqrt{\frac{0.46(1-0.46)}{60}}} = 1.6577$$

12. The observed level of significance of the test is equal to

    A. 0.0970
    B. 0.0485
    C. 0.9515
    D. 0.0966
    E. 0.0601

Since $H_1: \pi \neq 0.46$,

$$p - value = 2P(Z > |1.66|) = 2P(Z > 1.66) = 2P(Z - 1.66) = 2(0.0485) = 0.0970$$

A bank has the business objective of developing an improved process for serving customers during the noon-to-1 P.M. lunch period. Management decides to first study the waiting time in the current process for two branches. The first branches is located in located in a commercial district of a city they took a sample of 15 customers and found that the mean waiting for this sample to be $\bar{X}_1 = 4.29\, min$, and standard deviation $S_1 = 1.638\, min$. And they took another sample of 15 customers from the other branch, located in a residential area and found that the mean waiting for this sample to be $\bar{X}_2 = 7.11\, min$, and standard deviation of $S_2 = 2.082\, min$.

Based on this information, answer the next five questions

13. What distribution will you use to test the claim that there is no difference between the variances of the waiting time of customers in both branches,

    A. F distribution with 14 and 14 degrees of freedom
    B. t student distribution with 28 degrees of freedom
    C. normal distribution
    D. F distribution with 15and 15 degrees of freedom
    E. t student distribution with 29 degrees of freedom

    since $H_1: \sigma_1^2 \neq \sigma_2^2$,
    the distribution will be F distribution with $df_1 = n_2 - 1 = 14\ and\ \ df_2 = n_1 - 1 = 14$

14. To test the claim that there is no difference between the variances of the waiting time of customers in both branches, the test statistic equal to

    A. 1.615
    B. 1.271
    C. 0.618
    D. 0.786
    E. 1.368

$$F_0 = \frac{S_2^2}{S_1^2} = \left(\frac{2.082}{1.638}\right)^2 = 1.615$$

15. At 5% level of significance, which of the following statements is true:

    A. The critical value is 2.949 which is more than the test statistic; the variances are equal.
    B. The critical value is 2.949 which is less than the test statistic; the variances are not equal.
    C. The critical value is 2.463 which is less than the test statistic; the variances are not equal.
    D. The critical value is 2.463 which is more than the test statistic; the variances are equal.
    E. we cannot tell

    since $H_1: \sigma_1^2 \neq \sigma_2^2$, we reject we reject H_0 if $F_0 > F_{0.025,14,14} = 2.949$

    since $F_0 = 1.615 < F_{0.025,14,14} = 2.949$, don't reject H_0, the variances are equal

16. At 0.02 level of significance, if we want to test whether the mean waiting time for the first branch is different to that of the second. What is the pooled variance:

    A. 3.5089
    B. 3.2750
    C. 17.4092
    D. 1.0091
    E. 0.9112

$$S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} = \frac{(14)(1.638)^2 + (14)(2.082)^2}{15 + 15 - 2} = 3.5089$$

17. After analyzing the samples, you state that you have a 98% confidence that the difference between the two means of waiting time is between – 4.507 and – 1.132, you conclude that

    A. Reject H_o; and conclude that the mean waiting time for the two branches are not equal.
    B. Don't reject H_o; and conclude that the mean waiting time for the two branches are not equal.
    C. Reject H_o; and conclude that the mean waiting time for the two branches are equal.
    D. Don't reject H_o; and conclude that the mean waiting time for the two branches are equal.
    E. Don't Reject H_o; and conclude that the mean waiting time for the first branch is less than the second branch.

    We need to test $H_0: \mu_1 - \mu_2 = 0 \quad H_1: \mu_1 - \mu_2 \neq 0$
    Since $0 \notin (-4.507, -1.132)$, we reject H_0, and conclude that the mean waiting time for the two branches are not equal.

18. A bank branch located in a commercial district of a city has developed an improved process for serving customers during the noon – to 1:00 p.m. lunch period. The waiting time (defined as the time the customer enters the line until he reaches the teller window) of all customers during this hour is recorded over a period of one week. A random sample of fifteen customers is selected, and the results are as follows:

    The sample mean: 4.3 and the sample standard deviation: 1.633

    To test that there is evidence that the population standard deviation is more than 2 minutes, which of the following is true

    A. The test statistic equal to 9.34 which is less than the critical value 23.69; don't reject the null hypothesis; there is no evidence that the population standard deviation is more than 2 minutes.
    B. The test statistic equal to 9.34 which is less than the critical value 23.69; reject the null hypothesis; there is no evidence that the population standard deviation is more than 2 minutes.
    C. The test statistic equal to 9.34 which is less than the critical value 23.69; don't reject the null hypothesis; there is strong evidence that the population standard deviation is more than 2 minutes.
    D. The test statistic equal to 9.34 which is less than the critical value 23.69; reject the null hypothesis; there is strong evidence that the population standard deviation is more than 2 minutes.
    E. The test statistic equal to 9.34 which is less than the critical value 23.69; maybe we reject the null hypothesis maybe not.

    We need to test $H_0: \sigma \leq 2 \quad H_1: \sigma > 2$

$$\chi_0^2 = \frac{(n-1)s^2}{\sigma_0^2} = \frac{(14)1.633^2}{4} = 9.3$$

    Reject H_0 if $\chi_0^2 > \chi_{0.05,14}^2 = 23.6848$ and since $\chi_0^2 = 9.3 < \chi_{0.05,14}^2 = 23.6848$, don't reject H_0 and we conclude that there is no evidence that the population standard deviation is more than 2 minutes

A study was conducted on the use of cell phones for accessing news. The study reported that 47% of users under age 50 accessed news on their cell phones (population 1) and 15% of users age 50 and over accessed news on their cell phones (population 2). Suppose that the survey consisted of 1,000 users under age 50, of whom 470 accessed news on their cell phones, and 1000 users age 50 and over, of whom 420 accessed news on their cell phones.

From the data above answer the following two questions:

19. At 0.05 level of significance, if we want to test whether the proportion of users age 50 and above who access news on their cell phones is different from the proportion of users under the age 50 who access news on their cell phones. Then, null hypothesis is:

A. $H_o: \pi_1 = \pi_2$
B. $H_o: \pi_1 \geq \pi_2$
C. $H_o: \pi_1 - \pi_2 \neq 0$
D. $H_o: p_1 \neq p_2$
E. $H_o: p_1 - p_2 < 0$

We want to see if the proportion of users age 50 and above who access news on their cell phones is different from the proportion of users under the age 50 who access news on their cell phones. So,

$$H_o: \pi_1 = \pi_2 \quad vs \quad H_1: \pi_1 \neq \pi_2$$

20. At 0.05 level of significance, if we want to test whether the proportion of users age 50 and above who access news on their cell phones is different from the proportion of users under the age 50 who access news on their cell phones. Then, the test statistic is:

A. 2.25
B. 7.30
C. -2.25
D. -7.30
E. 1.3110

$$p_1 = \frac{X_1}{n_1} = \frac{470}{1000} = 0.47, \qquad p_2 = \frac{X_2}{n_2} = \frac{420}{1000} = 0.42$$

$$\bar{p} = \frac{X_1 + X_2}{n_1 + n_2} = \frac{470 + 420}{1000 + 1000} = 0.445$$

Now,

$$Z_0 = \frac{(0.47 - 0.42) - (0)}{\sqrt{0.445(1 - 0.445)(\frac{1}{1000} + \frac{1}{1000})}} = +2.25$$