

Name ID

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Stat 201 Quiz 5

Instructor: Dr. Bensmail

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Problem 1 (total 2, 0.5 for each (a),(b),(c),(d))

Suppose that building specifications in a certain city require that the average breaking strength of residential sewer pipe be more than 2400 pounds per foot of length. Each manufacturer who wants to sell pipe in this city must demonstrate that its products meets the specification.

Suppose that we test 50 sections of sewer pipe and find the mean of these 50 measurements to be $\bar{X} = 2460$ pounds per linear foot

We suppose that the population standard deviation $\sigma = 200$ pounds per linear foot

We want to decide whether the mean breaking strength of the pipe exceeds 2400 pounds per linear foot. Conduct the test at a level of significance $\alpha = 0.05$ and interpret the result.

(a) $\mu = 2400$ versus $\mu > 2400$

(b) $t = \frac{2460-2400}{200/\sqrt{50}} = 2.1213$

(c) $P_{value} = P(Z > 2.12) = 1 - 0.9830 = 0.017$,

(d) Using $\alpha = 0.05$, we conclude that the null hypothesis is not valid

Problem 2: (Total=2, 0.5 for each (a), (b), (c), (d))

During the National Football League (NFL) season, Las Vegas oddsmakers establish a point spread on each game for betting purposes. For example, the St Louis Rams were established as 7-point favorites over the Tennessee Titans in the 2000 Super Bowl. The final scores of NFL games were compared against the final point spreads established by the oddsmakers in Chance (Fall 1998). The difference between the game outcome and point spread (called a point-spread error) was calculated for 240 NFL games. The mean of the point spread-spread errors is $\bar{X} = -1.6$. We suppose that standard deviation of the point-spread error for all NFL is $\sigma = 13.3$

Use this information to test the hypothesis that the true mean point-spread error for all NFL games is 0 or different than 0. Conduct the test at a level of significance $\alpha = 0.01$ and interpret the result.

(a) $\mu = 0$ versus $\mu \neq 0$

$$(b) t = \frac{-1.6}{13.3/\sqrt{240}} = -1.8637$$

$$(c) P_{value} = 2 \times P(Z > 1.86) = 2 \times (1 - 0.9686) = 0.0628,$$

(d) Using $\alpha = 0.01$, we conclude that the null hypothesis is valid

Problem 3: Total 3points, one point for each (1), (2), (3)

Information Resources Inc., a Chicago-based research organization, tracks supermarket sales in 28 metropolitan markets in the United states. They convert their data for specific products to an index that measures products usage relative to the national average usage. For example, Green Bay, Wisconsin’s ketchup index is 143, the highest in the nation. This means that that Green Bay residents consume 43% more ketchup , on average, than the mean national consumption rate. The table lists the salad dressings index for each in a sample of seven Southeastern cities

Salad Dressings Index (U.S. mean =100)	
Charlotte, N.C.	124
Birmingham, Al	99
Raleigh, N.C.	124
Knoxville, TN	99
Memphis, TN	90
Atlanta, Ga	111
Nashville, TN	89

1. Specify the appropriate null and alternative hypotheses for testing whether the true mean consumption rate of salad dressings in the Southeastern United States is different than the mean national consumption rate of 100.
2. What assumptions about the sample and population must hold in order for it to be appropriate to use a t statistic in conducting the hypothesis test using $\alpha = 0.05$
3. Calculate the p-value and make your decision

1. $\mu = 100$ versus $\mu \neq 100$
2. Normality of the population and unknown standard deviation
3. $\bar{X} = 105.14, s = 14.78$

$$t = \frac{105.14 - 100}{14.78 / \sqrt{7}} = 0.92011$$

$P_{value} = 2 \times P(T_6 > 0.92) \approx 2 \times 0.20 = 0.4$, so with $\alpha = 0.05$, we conclude that the null hypothesis is valid

Problem 4:(Total =3 points, one for (2) and two points for (1))

A product that Walgreen makes has a list price of \$12.95, but each store that sells this product is allowed to set the price as it wishes. Walgreen has just completed a quick survey, and the marked prices at a random sample of stores that sell the product were as follows:

12.95	9.95	8.95	12.95	12.95	9.95	9.95	9.98	13.00	9.95
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The Walgreen marketing department believes that this product generally sells at a mean discount of 12% from the list price (in this case it would be \$11.40).

1. Perform a hypothesis test to see whether the Walgreen marketing department's belief holds true.
2. Provide a 95% confidence interval for the listed price

1. $\mu = 12.95$ versus $\mu < 12.95$

$$\bar{X} = 11.058$$

$$s = 1.667$$

$$n = 10$$

$$t = \frac{11.058 - 12.95}{1.667/\sqrt{10}} = -3.6042$$

$P_{value} = P(T_9 < -3.60) = 0.0025$, so we conclude that the null hypothesis is not valid with $\alpha = 5\%$ or $\alpha = 10\%$

2. 95% CI for the population mean is $= [\bar{X} - t^* \times \frac{s}{\sqrt{n}}, \bar{X} + t^* \frac{s}{\sqrt{n}}]$, with a $t^* = 2.26$
 $= [11.058 - 2.26 \times \frac{1.667}{\sqrt{10}}; 11.058 + 2.26 \times \frac{1.667}{\sqrt{10}}] = [9.8666; 12.249]$