Homework Handout K

In the following problems, use the 5-step method for tests of significance that I discussed in class.

1. A type of plastic has an average breaking strength of 27 lbs. per square inch. A new (more expensive) process is developed that will replace the old only if there is substantial evidence that it improves the strength of the product. A random sample of 64 pieces of the product made with the new process is obtained. For this sample, the average breaking strength was 32 lbs. per square inch and the sample SD was 10 lbs. per square inch. Is there significant evidence that the strength of the product has been increased with the new process?

1. Null: AVG breaking strength is still 27 lbs. sq. inch
2. Alternative: AVG breaking strength is now greater than 27
3. Test Statistic: \( Z = \frac{\text{obs} - \text{HN}}{\text{SE}} = \frac{32-27}{10/\sqrt{64}} = \frac{5}{1.25} = 4 \)
4. P-value: \( 100 - 99.9937 = .0063 \)
5. Conclusion: (a) Since .0063 < .05, the results are highly statistically significant.

(b) The evidence indicates that AVG breaking strength has been increased using the new process.

2. The "9-Minute Oil Change" Company advertises that the average wait for an oil change at their stations is 9 minutes. A consumer advocate group has had reports from customers that they usually have to wait longer than 9 minutes. In order to test the company's claims, 40 customers were randomly selected and the time required for their oil change was recorded. For this sample, the average wait for an oil change was 11 minutes with an SD of 5 minutes. Is there significant evidence that the average wait for all customers is greater than 9 minutes?

1. Null: AVG time is 9 minutes
2. Alternative: AVG time is greater than 9 minutes
3. Test Statistic: \( Z = \frac{11 - 9}{5/\sqrt{40}} = \frac{2}{1.79} = 2.53 \) (use 2.55)
4. P-value: \( 100 - 98.92 = .0108 \)
5. Conclusion: (a) Since .0108 < .05, the results are highly statistically significant.

(b) The evidence indicates that it does take on the average longer than 9 minutes for an oil change.
3. A certain package of cereal is designed to have a net weight of 16 ounces. The quality-control department is concerned that the packages are being underfilled due to some kind of problem with the machinery, so they take a simple random sample of 20 packages and find that the sample average weight is 15.3 ounces and the standard deviation is 2.5 ounces. Is this sufficient evidence to indicate that the true average weight of the packages has decreased?

1. **Null**: Population AVG is 16 ounces
2. **Alternative**: Population AVG is less than 16 ounces
3. **Test Statistic**: \[ Z = \frac{15.3 - 16}{2.5/\sqrt{20}} = \frac{-.7}{.56} = -1.25 \]
4. **P-value**: \[ 100 - \frac{78.87}{2} = 10.565\% \]

5. **Conclusions**:
   
   (a) Since 10.565% > 5%, the results are not significant.
   
   (b) We do not have evidence that the AVG is less than 16 ounces, i.e., we do not have evidence that they are being underfilled.

**Note**: It would not be correct to say that the evidence shows the AVG is 16 ounces like it supposed to be.