

AP Statistics – Chapter 11 Practice FR Test

1. Does the use of fancy type fonts slow down the reading of text on a computer screen? Adults can read four paragraphs of text in an average time of 22 seconds in the common Times New Roman font. Ask 25 adults to read this text in the ornate font named Gigi. Here are their times:

23.2 21.2 28.9 27.7 29.1 27.3 16.1 22.6 25.6

34.2 23.9 26.8 20.5 34.3 21.4 32.6 26.2 34.1

31.5 24.6 23.0 28.6 24.4 28.1 41.3

Suppose that reading times are Normal with $\sigma = 6$ seconds. Is there good evidence that the mean reading time for Gigi is greater than 22 seconds? Carry out an appropriate test to help you answer this question.

2. Read the brief newspaper article on using a depression pill to help smokers quit.

Depression Pill Seems to Help Smokers Quit

BOSTON — Taking an antidepressant medicine appears to double smokers' chances of kicking the habit, a study found. The Food and Drug Administration approved the marketing of this medicine, called Zyban or bupropion, to help smokers in May. The results of several studies with the drug, including one published in today's issue of the *New England Journal of Medicine*, were made public then.

The newly published study was conducted on 615 volunteers who wanted to give up smoking and were not outwardly depressed. They took either Zyban or dummy pills for 6 weeks. A year later, 23 percent of those getting Zyban were still off cigarettes, compared with 12 percent in the comparison group.

- a. The results of this experiment were significant at the $\alpha = 0.05$ significance level. In your opinion, are the results practically significant? Justify your position.
- b. To what population can the results of this study be generalized? Explain.
- c. Can we conclude that taking Zyban *causes* people to quit smoking? Justify your answer.
3. There was a great deal of publicity a few years ago about allegations that gravel companies delivered less gravel than contracts demanded. After a lengthy investigation, the city managers concluded that the allegations were unfounded. However, they also claimed that it was too expensive to measure every load and were forced to rely upon the honesty of the contractor! Having successfully completed an introductory statistics course and having been just hired by the city, you point out that it is not necessary to weigh every truck; why not just weigh a sample? Your supervisor is not convinced and asks for a demonstration.
- A current contract for a 1 kilometer stretch of road requires gravel fill for a width of 10 meters and a depth of 1 meter. The successful bidder estimated it will take 500 tandem-truck loads of gravel. The total amount of gravel required is $10,000 \text{ m}^3$. So the mean volume of gravel in the 500 trucks must be at least 20 m^3 .
- a. What hypotheses should you test in this situation? Explain.
- b. Describe a Type I error and a Type II error in this setting, and give the consequences of each.

AP Statistics – Chapter 11 Practice FR Answers

1.

1. **Step 1:** We want to see if the use of fancy type fonts slows down the reading of text on a computer. Our hypotheses are $H_0: \mu = 22$ vs. $H_a: \mu > 22$, where μ = the mean reading time for Gigi font. **Step 2:** Since we know σ , we can perform a one sample z test. SRS—We have to assume that the sample is representative of the population of interest. Normality—We are told that the reading times are Normal. Note that there is one high outlier (41.3) in the sample data. Independence—We assume that these 25 times represent independent measurements. **Step 3:** $z = (27.088 - 22) / (6 / \sqrt{25}) = 4.24$; P -value ≈ 0 . Without the outlier, $z = 3.75$ and P -value ≈ 0 . **Step 4:** A mean time as large as 27.088 seconds would almost never occur if Gigi did not affect the reading time. This is very strong evidence that it takes more than a mean of 22 seconds to read text printed in Gigi font. 10. (a) From the table; $z < -1.645$.

2.

1. Although there was significant evidence that the proportion of those taking Zyban who successfully quit smoking was higher than the proportion of those taking the placebo, and although approximately twice as many taking Zyban quit as compared with those taking the placebo, it is also true that more than three-quarters of those taking the new drug were not successful in quitting smoking. That's a 77% failure rate. Accordingly, the argument can be made that the results are not practically important.

On the other hand, other smoking cessation programs have had very poor success rates (few better than 5%), and the evidence here does suggest that Zyban will help about 1 in 4 who want to quit. Consequently, these results are practically important. (NOTE: Grade this item primarily on how the student supports his/her position, regardless of the position taken.)

2. Because this study used volunteers who wanted to give up smoking and who were not outwardly depressed, no generalization can be made to a population. Ideally, a randomly selected sample should be used. 3. Despite being volunteers, as long as the subjects were randomly assigned to the treatment or the placebo group, a cause and effect conclusion can be made. 4. Typically a fixed significance level α is adopted when a decision must be made. Examples: When a company must make a decision about an expensive upgrade of equipment, or when gathering evidence to present in a court case where the accepted significance level is $\alpha = 0.05$. A P -value is calculated when one wants to assess the strength of the evidence provided by a sample against a null hypothesis, H_0 .

3.

1. $H_0: \mu = 20$ vs. $H_a: \mu < 20$, where μ is the mean volume (in m^3) of gravel in each truck. 2. A Type I error would occur if you concluded that the trucks were carrying less than a mean of $20 m^3$ each when they really weren't and the bidder unfairly lost the contract. A Type II error would occur if you failed to detect that the trucks were carrying less than the required mean volume and the bidder kept the contract, when they actually were delivering less gravel than promised.