

STA 6934 – Fall 2002 – Quiz 2

Print Name:

SSN:

1) A government researcher is interested in studying people's attitudes toward Medicare. In particular, she wishes to compare the attitudes of Democrats and Republicans. She samples 1000 adults from each political party between the ages of 25 and 45, asking each to give their rating from 0 to 10 on a continuous visual analogue scale (where 0 represents strongly disfavor and 10 represents strongly favor). She obtains the following data from her survey:

$$\bar{Y}_D = 6.4 \quad S_D = 1.8 \quad \bar{Y}_R = 5.2 \quad S_R = 2.2$$

a) If she wishes to determine whether the population mean attitudes differ for the two parties, give the appropriate null and alternative hypotheses:

- i) $H_0 : \bar{Y}_D - \bar{Y}_R = 0$ $H_A : \bar{Y}_D - \bar{Y}_R > 0$
- ii) $H_0 : \bar{Y}_D - \bar{Y}_R = 0$ $H_A : \bar{Y}_D - \bar{Y}_R < 0$
- iii) $H_0 : \bar{Y}_D - \bar{Y}_R = 0$ $H_A : \bar{Y}_D - \bar{Y}_R \neq 0$
- iv) $H_0 : \mu_D - \mu_R = 0$ $H_A : \mu_D - \mu_R < 0$
- v) $H_0 : \mu_D - \mu_R = 0$ $H_A : \mu_D - \mu_R \neq 0$
- vi) $H_0 : \mu_D - \mu_R = 0$ $H_A : \mu_D - \mu_R > 0$

b) Give the appropriate test statistic.

c) Give the rejection region based on the $\alpha = 0.05$ significance level.

d) Sketch the p -value of your test statistic.

2) For each of the following scenarios, state which of the small-sample tests is appropriate (in each case they want to compare mean outcomes of a quantitative variable):

a) A group of researchers are studying the pharmacokinetics of two formulations of a drug. They take a sample of healthy volunteers, giving each volunteer each formulation in random order with a long washout period. One measurement of interest is the time to maximum concentration t_{max} . Due to the fact that blood samples are only taken at discrete points, this measurement cannot be observed as the continuous variable it truly is, but only as a discrete (non-normal) outcome.

b) A study is conducted to determine the effects thalidomide on weight gain in HIV^+ patients. One group has tuberculosis as well as being HIV^+ , the other group does not have tuberculosis. Experience has shown that weight gains/losses are not normally distributed as a few rare patients gain a great more weight than others in their group.

3) A study is conducted to determine whether the risk of a cardiac event (MI or heart related death) is effected by use of aspirin. A sample of 2000 doctors is taken, where 1000 are assigned at random to aspirin and the other 1000 receive a placebo. Of the 1000 doctors receiving aspirin, 50 suffer from a cardiac event within 8 years; of the 1000 receiving placebo, 125 do.

a) What is the estimated risk (probability) of suffering a cardiac event among doctors receiving placebo?

b) What is the estimated risk (probability) of suffering a cardiac event among doctors receiving aspirin?

c) What is the estimated relative risk of suffering a cardiac event for placebo takers vs aspirin takers?

d) Give a 95% confidence interval for the population relative risk (placebo/aspirin).

e) What statement best describes the studies results (based on $\alpha = 0.05$ significance level?)

i) Conclude higher risk for aspirin users than placebo users

ii) Cannot conclude any differences between aspirin and placebo users

iii) Conclude higher risk for placebo users than aspirin users

4) A study is conducted to determine whether a medication that is targeted at lowering cholesterol is effective. The researchers wish to test:

$$H_0 : \mu_1 - \mu_2 = 0 \quad vs H_A : \mu_1 - \mu_2 > 0$$

where μ_1 is true mean reduction for the medication and μ_2 is true mean reduction for placebo. If the researchers have made a Type II error they have:

i) Concluded that the medication has a higher mean than placebo, when it really does not.

ii) Concluded that the medication has a higher mean than placebo, when it really does.

iii) Concluded that the medication does not have a higher mean than placebo, when it really does.

iv) Concluded that the medication does not have a higher mean than placebo, when it really does.

5) A study was conducted to compare the times to complete two medical procedures by its surgical team. The team performed $n_1 = n_2 = 5$ procedures based on each procedure (in random order and plenty of rest time between operations). The hospital administrator times each of the 10 operations, obtaining the following times (in minutes):

Procedure	
1	2
219	124
378	234
471	98
871	203
198	102

a) Compute the test statistic based on Wilcoxon Rank-sum test (while it's the same team performing all procedures, it's the hospital's only team and the surgical patients are different, and were randomly assigned to treatment. They wish to test whether the mean surgical times differ for the two procedures (with $\alpha = 0.05$).

b) The critical value is $T = \min(T_1, T_2) \leq 18$ based on these sample sizes and $\alpha = 0.05$. What is your conclusion, based on this level of significance?

c) Which observation would have led the researchers to use the rank-sum test instead of the 2-sample t -test?

6) Which of the following statements are true, all else being equal?

a) As the sample size increases the power of a test increases when the alternative hypothesis is true.

b) As the sample size increases, the width of 95% confidence intervals for unknown parameters increase.

c) As the sample size increases, the probability of a Type I error increases when the null hypothesis is true.

7) A study is conducted as a crossover design in $n = 12$ patients to compare the delivery of nicotine into the bloodstream by two brands of transdermal nicotine patches. The authors report a 95% confidence interval for $\mu_d = \mu_1 - \mu_2$, the difference in mean AUC for the two brands as $(-76.0, -24.0)$.

a) What do you conclude with respect to the 2 brands true population means at the $\alpha = 0.05$ significance level?

i) The true mean is higher for brand 1

ii) Cannot conclude the true means differ for the two brands

iii) The true mean is higher for brand 2

b) What was the sample mean difference, \bar{d} ?

c) What can you say about the P -value of a 2-sided test of $H_0 : \mu_1 - \mu_2 = 0$ vs $H_A : \mu_1 - \mu_2 \neq 0$?

i) P -value > 0.05

ii) P -value < 0.05

iii) We need more information