

Sociology 592 - Research Statistics I

Exam 2

November 8, 1996

1. (10 points each, 30 points total, up to 10 points extra credit). You have been asked to serve as a statistical consultant for several proposed projects. For *three* of the following, your employers want you to tell them:

- (i) Which of the cases we have studied their problem falls under (e.g. one sample tests, case I, σ known; nonparametric tests, case II, tests of association). Briefly explain why.
- (ii) the null and alternative hypotheses
- (iii) whether a Z, T, chi-square, or F test is appropriate; where applicable, also tell what the degrees of freedom for the test are. You DO NOT have to give the formula for the test statistic, nor do you need to specify the acceptance region.

If values for population parameters are not specified (e.g. σ) assume they are unknown; and if two or more unknown σ 's are involved, assume they are equal. You will get up to 5 points extra credit for each additional problem you do.

a. Al Gore wants to make sure he is ready for his year 2000 presidential campaign. He first wants to see whether his popularity varies across different economic groups. Twenty wealthy voters, twenty middle-class voters, and twenty low-income voters are asked to rate, on a scale ranging from 1 to 100, how much they like Al Gore.

b. Now that South Bend Mayor Joe Kernan has been elected lieutenant governor, the city needs a new top administrator. Democratic party leaders will officially make the choice, but Kernan's endorsement of a successor will be very influential. Kernan has three people in mind, whom he believes are equally popular with Democratic leaders. To test his theory, a random sample of 30 party leaders will be asked which of the three candidates they like best.

c. O.J. Simpson's lawyers are worried that recent charges of sexual harassment against their client will further turn public opinion against him. Before the charges, a random sample of 200 people showed that 60% thought Simpson was guilty. Another random sample of 200 people will now be asked what they think.

d. A researcher believes that individuals want fewer children after they have been married for a while than they do when they are first married. Twelve newlyweds are asked how many children they want to have. Twelve individuals who have been married for five years are also asked how many children they want.

e. Management claims that 2/3 of workers are at least somewhat satisfied with company policies. Union leaders disagree. A random sample of 240 employees is drawn. Employees are asked to rank their satisfaction with company policies on a seven point scale, where 1 = very dissatisfied, 2 = dissatisfied, 3 = somewhat dissatisfied, 4 = neutral, 5 = somewhat satisfied, 6 = satisfied, 7 = very satisfied.

2. (5 points each, 20 points total). For each of the following, indicate whether the statement is true or false. If you think the statement is false, indicate how the statement could be corrected.

NOTE: These are all pretty easy, but you could waste a great deal of time on some of them or make stupid mistakes if you don't happen to see what the easiest way to approach each problem is.

a. A researcher is interested in the relationship between race (2 categories), father's occupation (4 categories), and son's occupation (4 categories), where son's occupation is the dependent variable. She estimates the model of conditional independence. If she is using the .01 level of significance and her test statistic equals 35, she should reject the null hypothesis.

b. A Notre Dame finance professor believes that faculty in the College of Business (Group 1) are more intelligent than faculty in the College of Arts and Letters (Group 2). The IQ's of 15 faculty in each College are measured (where the higher the IQ score, the more intelligent the person is). She finds that

$$\hat{\mu}_1 = 119, \hat{\mu}_2 = 139, s_1 = 6, s_2 = 5$$

The null hypothesis should not be rejected.

c. A researcher believes that younger people are more likely to support welfare reform than are older people. She therefore collects data on age (2 categories) and support for welfare reform (also 2 categories). To test her hypothesis, she can either use Nonparametric tests, case II, tests of association, or else 2 sample tests, case V, test of $p_1 = p_2$.

d. A researcher has collected data from 36 respondents on their race (white, black, other), region of country (North, South, East, West) and the number of hours they spend watching TV every day. She computes

$$F_{J+K-2, N-JK} = \frac{SS \text{ Main}/(J + K - 2)}{SS \text{ Error}/(N - JK)} = 140$$

She should therefore conclude that both race and region significantly affect the amount of TV watched.

3. (25 points) Lou Holtz thinks his football players need to be in better shape. Sixty players are combined into 30 pairs of "near-twins." In each pair, one person takes part in an experimental conditioning program (A) while the other person continues under the old program (B). Holtz is unsure which program will be more effective. The individual percentage increases in strength are recorded. For each pair, the researcher computes $D_i = X_{Ai} - X_{Bi}$. The researcher finds that $\sum D_i = 120$ and $\sum D_i^2 = 3960$.

- a. Compute the mean and standard deviation for D.
- b. Using our 5-step hypothesis testing procedure, determine whether the two approaches significantly differ in their effectiveness. Use $\alpha = .05$.
- c. Construct the 95% confidence interval for μ_D . According to the confidence interval, do the two approaches significantly differ in their effectiveness?

4. (25 points) The NRA (National Rifle Association) is concerned about public opinion on gun control laws. Subjects were asked (on a scale ranging from 1 to 100) whether they supported stronger gun control laws. They were also asked whether they owned a gun (yes or no) and their party affiliation (Republican, Democrat, Reform Party, Other). For each combination of gun ownership and party affiliation, 12 subjects were interviewed. The NRA finds that the mean score is 70 with a standard deviation of 5. Complete the following ANOVA table. You do NOT need to indicate whether or not the F values are statistically significant.

Source	SS	D.F.	M. S.	F
A + B (or Main Effects)				
A (Gun Ownership)	485			
B (Party)				
AB (or 2-way interaction)				2.0
A + B + AB (or explained)	1055			
Error (or residual)				
Total				