

Sociology 592 - Research Statistics I
Exam 2
November 3, 1995

1. (10 points each, 30 points total). You have been asked to serve as a statistical consultant for several proposed projects. For each 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. [NOTE: You must do three of the following, and you'll receive 5 points extra credit for each additional problem you get right.]

a. A prosecutor believes that black women will be harder on alleged criminals in domestic violence cases than will white women. A sample of 30 black women and 30 white women will be drawn. For each respondent, attitudes toward domestic violence will be measured on a scale that ranges from 0 (cares little about domestic violence) to 100 (feels very strongly about domestic violence).

b. Colin Powell wants to know whether he will have better luck running as a Republican or as an independent for President. Thirty respondents are asked to rate, on a scale ranging from 0 to 100, how likely it is they would support Powell if he ran as an independent. Using that same scale, they are also asked how likely it is they would support Powell if he ran as a Republican.

c. The new Provost wants to find out about gender disparities in the rank and tenure of Notre Dame faculty. A random sample of 100 faculty will be drawn. For each faculty member, the gender (male or female) and rank (assistant professor, associate professor, and full professor) will be recorded.

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 has collected data from 36 respondents on their religion (Catholic or nonCatholic), gender (male or female), and life satisfaction (measured on a scale ranging from 1 to 50). She computes

$$F_{(J-1)(K-1), N-JK} = \frac{SS \text{ Interaction}/(J - 1)(K - 1)}{SS \text{ Error}/(N - JK)} = 4$$

If she is using the .05 level of significance, she should conclude that neither religion nor gender has a significant effect on life satisfaction.

b. A researcher is interested in the relationship between race (3 categories), education (4 categories), and party affiliation (3 categories), where party affiliation is her dependent variable. She estimates the model of conditional independence. If $\alpha = .05$ and her Pearson chi-square statistic = 38, she should not reject the model of conditional independence.

c. The null and alternative hypotheses are

$$H_0: \mu_1 - \mu_2 = 10$$

$$H_A: \mu_1 - \mu_2 \neq 10$$

The 95% confidence interval ranges from 3 to 11. Ergo, the null hypothesis should not be rejected.

d. A political scientist believes that black males who participated in the Million Man March (group 1) are more liberal than black males who did not (group 2). She constructs a liberalism scale which ranges from 1 (very conservative) to 100 (very liberal). She draws a sample of 100 black males who attended and 100 black males who did not. She finds that

$$\hat{\mu}_1 = 57, \hat{\mu}_2 = 62, s_1 = 10, s_2 = 9$$

She should not reject the null hypothesis.

Answer two of the following three questions. You will get up to 10 points extra credit if you answer all three correctly.

3. (25 points or 10 points extra credit) Suppose that the body weight at birth of children within the United States is approximately normally distributed and has a mean of 7.2 pounds. A demographer believes that the birth weights of children born of mothers who are drug addicts may be lower on the average than for the population as a whole. In order to test this hypothesis, he secures records of the birth weights of a random sample of 25 children from mothers who are drug addicts. The mean of this sample is 7 pounds with $s = 0.5$. Evaluate the demographer's hunch, using our 5-step hypothesis testing procedure and $\alpha = .05$. Also compute the 95% confidence interval.

4. (25 points or 10 points extra credit) The University is concerned that not all of its students are "computer literate." It believes that computer literacy differs by College (Arts and Letters, Business, Other) and race (white, black, other). For each combination of College and race, 20 students are interviewed. Computer literacy is measured on a scale that ranges from 0 (knows nothing about computers) to 100 (computing genius). The University discovers that computing literacy has a mean of 50 and a standard deviation of 10. 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 (College)			80	
B (Race)	144			
AB (or 2-way interaction)				
A + B + AB (or explained)				
Error (or residual)	1368			
Total				

5. (25 points or 10 points extra credit) It is Summer, 1996. Democratic Presidential nominee Bill Clinton is set to do battle with his Republican opponent, Colin Powell. Ross Perot is now debating whether to enter the race as a third party candidate. Perot believes that he would draw more voters from Clinton than he would Powell. To test his idea, 100 voters are asked who they currently support (Clinton or Powell) and whether they would switch to Perot if he entered the race. The results are as follows:

CURRENT Current choice by SWITCH Switch to Perot?

CURRENT	Count	SWITCH		Row Total
		Yes	No	
	1.00	20	30	50
Clinton				50.0
	2.00	11	39	50
Powell				50.0
Column		31	69	100
Total		31.0	69.0	100.0

Using our 5-step hypothesis testing procedure and the .05 level of significance, determine whether the data support Perot's claim that he will steal more voters from Clinton than he will Powell.