

Key for First Spring Exam 2003

**Problem A:**

1. A:  $SCORE_i = \beta_0 + \beta_1 TIME_i + \beta_2 PROBLEMS_i + \varepsilon_i$   
C:  $SCORE_i = \beta_0 + \varepsilon_i$   
 $H_0: \beta_1 = \beta_2 = 0$   
pa = 3, pc = 1
  
2.  $INT = TIME_i \times PROBLEMS_i$   
A:  $SCORE_i = \beta_0 + \beta_1 TIME_i + \beta_2 PROBLEMS_i + \beta_3 INT + \varepsilon_i$   
C:  $SCORE_i = \beta_0 + \beta_1 TIME_i + \beta_2 PROBLEMS_i + \varepsilon_i$   
 $H_0: \beta_3 = 0$   
pa = 4, pc = 3
  
3.  $QUADRATIC = PROBLEMS_i \times PROBLEMS_i$   
A:  $SCORE_i = \beta_0 + \beta_1 TIME_i + \beta_2 PROBLEMS_i + \beta_3 QUADRATIC + \varepsilon_i$   
C:  $SCORE_i = \beta_0 + \beta_1 TIME_i + \beta_2 PROBLEMS_i + \varepsilon_i$   
 $H_0: \beta_3 = 0$   
pa = 4, pc = 3
  
4. TUTOR1 = 1 if Standard Cognitive Tutor & Explanation  
          -1 if Standard Cognitive Tutor  
TUTOR2 = -2 if Drill & Practice  
          1 if Standard Cognitive Tutor or Standard Cognitive Tutor & Explanation  
TYPE = -1 if Standard Problem  
          1 if Story Problem  
INT1 = TUTOR1 x TYPE  
INT2 = TUTOR2 x TYPE  
  
A:  $SCORE_i = \beta_0 + \beta_1 TUTOR1_i + \beta_2 TUTOR2_i + \beta_3 TYPE_i + \beta_4 INT1_i + \beta_5 INT2_i + \varepsilon_i$   
C:  $SCORE_i = \beta_0 + \beta_2 TUTOR2_i + \beta_3 TYPE_i + \beta_4 INT1_i + \beta_5 INT2_i + \varepsilon_i$   
 $H_0: \beta_1 = 0$   
pa = 6, pc = 5
  
5. A:  $SCORE_i = \beta_0 + \beta_1 TUTOR1_i + \beta_2 TUTOR2_i + \beta_3 TYPE_i + \beta_4 INT1_i + \beta_5 INT2_i + \varepsilon_i$   
C:  $SCORE_i = \beta_0 + \beta_1 TUTOR1_i + \beta_2 TUTOR2_i + \beta_3 TYPE_i + \beta_5 INT2_i + \varepsilon_i$   
 $H_0: \beta_4 = 0$   
pa = 6, pc = 5
  
6. A:  $PROBLEMS_i = \beta_0 + \beta_1 TUTOR1_i + \beta_2 TUTOR2_i + \beta_3 TYPE_i + \beta_4 INT1_i + \beta_5 INT2_i + \varepsilon_i$   
C:  $PROBLEMS_i = \beta_0 + \varepsilon_i$   
 $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$   
pa = 6, pc = 1
  
7. A:  
 $SCORE_i = \beta_0 + \beta_1 PROBLEMS_i + \beta_2 TUTOR1_i + \beta_3 TUTOR2_i + \beta_4 TYPE_i + \beta_5 INT1_i + \beta_6 INT2_i + \varepsilon_i$   
C:  
 $SCORE_i = \beta_0 + \beta_1 PROBLEMS_i + \beta_3 TUTOR2_i + \beta_4 TYPE_i + \beta_5 INT1_i + \beta_6 INT2_i + \varepsilon_i$   
 $H_0: \beta_2 = 0$   
pa = 7, pc = 6

8.  $X1 = \text{PROBLEMS}_i \times \text{TUTOR1}_i$   
 $X2 = \text{PROBLEMS}_i \times \text{TUTOR2}_i$   
 $X3 = \text{PROBLEMS}_i \times \text{TYPE}_i$   
 $X4 = \text{PROBLEMS}_i \times \text{INT1}_i$   
 $X5 = \text{PROBLEMS}_i \times \text{INT2}_i$

A:  $\text{SCORE}_i = \beta_0 + \beta_1 \text{PROBLEMS}_i + \beta_2 \text{TUTOR1}_i + \beta_3 \text{TUTOR2}_i + \beta_4 \text{TYPE}_i + \beta_5 \text{INT1}_i + \beta_6 \text{INT2}_i + \beta_7 X1_i + \beta_8 X2_i + \beta_9 X3_i + \beta_{10} X4_i + \beta_{11} X5_i + \epsilon_i$

C:  $\text{SCORE}_i = \beta_0 + \beta_1 \text{PROBLEMS}_i + \beta_2 \text{TUTOR1}_i + \beta_3 \text{TUTOR2}_i + \beta_4 \text{TYPE}_i + \beta_5 \text{INT1}_i + \beta_6 \text{INT2}_i + \epsilon_i$

$H_0: \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = 0$

$pa = 12, pc = 7$

9. If we choose the unit of analysis to be students, then there is a possible violation of the independence of errors assumption because scores within a school are likely to be more similar. A possible solution to this problem would be to change the unit of analysis to school, assuming that each school was randomly assigned to each condition.

**Problem B:**

1. Overall, there were no group differences in the extent to which the NRA and its members are viewed in a stereotypical way,  $F_{5,94} = 1.38$ ,  $PRE = .0684$ ,  $p = .24$ . The type of news story read did not seem to influence how NRA members are perceived,  $F_{1,94} = .078$ ,  $PRE = .0008$ ,  $p = .78$ . Furthermore, education did not seem to influence perceived stereotypicality: neither the linear trend,  $F_{1,94} = .15$ ,  $PRE = .002$ ,  $p = .70$ , nor the quadratic trend,  $F_{1,94} = .17$ ,  $PRE = .002$ ,  $p = .69$ , were reliable. However, the linear effect of education on perceived stereotypicality depended on the type of news story read,  $F_{1,94} = 6.64$ ,  $PRE = .066$ ,  $p = .01$ . Specifically, for those who read a story indicating the NRA was losing influence, increasing education was associated with decreasing stereotypical views of NRA members, whereas for those who read a story indicating the NRA was gaining influence, increasing education was associated with increasing stereotypical views of NRA members. The regression coefficient associated with this interaction is 2.14, which represents half the difference in the slope of the linear trend in education for the participants who viewed a positive news story regarding the NRA and for the participants who viewed a negative news story regarding the NRA.

2.

<i>Type of story</i>	Positive	Positive	Positive	Negative	Negative	Negative
<i>Education</i>	HS	Some College	Degree	HS	Some College	Degree
	-1	0	1	0	0	0

$$SSR = \frac{[-1(69.01) + 1(73.94)]^2}{(-1)^2/17 + (1)^2/23} = 237.65$$

$$SSEa = 5246.95$$

$$SSEc = SSR + SSEa = 237.65 + 5246.95 = 5484.6$$

$$PRE = SSR/SSEc = 237.65/5484.6 = .043$$

$$F_{1,94} = \frac{(PRE/pa-pc)}{(1-PRE)/(n-pa)} = 4.22$$

$$p < .05$$

For those who read stories indicating the NRA is gaining influence, the linear trend in education is significant, such that increasing education is associated with increasing stereotypical views of NRA members.

$$3. A: STER_i = \beta_0 + \beta_1NEWS_i + \beta_2ED1_i + \beta_3ED2_i + \beta_4NED1_i + \beta_5NED2_i + \beta_6ATT_i + \epsilon_i$$

$$C: STER_i = \beta_0 + \beta_1NEWS_i + \beta_2ED1_i + \beta_3ED2_i + \beta_4NED1_i + \beta_5NED2_i + \epsilon_i$$

$$PRE = .187$$

$$F_{1,93} = 21.45$$

$$p < .0001$$

Within education levels and the news factor, there is a relationship between attitudes on gun control and the perceived stereotypicality of NRA members, such that as support for gun control increases, the perceived stereotypicality of NRA members increases. The coefficient associated with the attitude variable is 1.6516, which indicates that for each point increase on the gun control attitude scale, stereotypical views increase by 1.6516 points.

4. For the group that read the positive new story about the NRA and have a college degree:  
 $STER = 73.93 - 1.65(.65 - .209) = 73.2$

5. A:  $ATT_i = \beta_0 + \beta_1 NEWS_i + \beta_2 ED1_i + \beta_3 ED2_i + \beta_4 NED1_i + \beta_5 NED2_i + \varepsilon_i$   
 C:  $ATT_i = \beta_0 + \varepsilon_i$   
 $pa = 6$   
 $pc = 1$   
 $pa - pc = 5$

$$PRE = 1 - TOLERANCE = 1 - .932 = .068$$

$$F_{5,94} = \frac{(PRE/pa-pc)}{(1-PRE)/(n-pa)} = 1.37$$

$$p > .05$$

There is no evidence that attitudes towards gun control vary as a function of education level and type of news story read (and their interaction).

6. A:  $STER_i = \beta_0 + \beta_1 NEWS_i + \beta_2 ED1_i + \beta_3 ED2_i + \beta_4 NED1_i + \beta_5 NED2_i + \beta_6 ATT_i + \beta_7 NATT_i + \beta_8 AED1_i + \beta_9 AED2_i + \beta_{10} NAED1_i + \beta_{11} NAED2_i + \varepsilon_i$   
 C:  $STER_i = \beta_0 + \beta_1 NEWS_i + \beta_2 ED1_i + \beta_3 ED2_i + \beta_4 NED1_i + \beta_5 NED2_i + \beta_6 ATT_i + \varepsilon_i$   
 $pa = 12$   
 $pc = 7$

$$SSEa = 3152.49$$

$$SSEc = 4263.69$$

$$PRE = \frac{SSEc - SSEa}{SSEc} = .261$$

$$F_{5,88} = \frac{(PRE/pa-pc)}{(1-PRE)/(n-pa)} = 6.22$$

$$p < .05$$

There is evidence that the slope relating attitudes towards gun control and stereotype scores differ between the 6 groups. Thus, the homogeneity of regression assumption has been violated.

$$7. A: \text{STER}_i = \beta_0 + \beta_1 \text{NEWS}_i + \beta_2 \text{ED1}_i + \beta_3 \text{ED2}_i + \beta_4 \text{NED1}_i + \beta_5 \text{NED2}_i + \beta_6 \text{ATT}_i + \beta_7 \text{NATT}_i + \beta_8 \text{AED1}_i + \beta_9 \text{AED2}_i + \beta_{10} \text{NAED1}_i + \beta_{11} \text{NAED2}_i + \varepsilon_i$$

$$A: \text{STER}_i = \beta_0 + \beta_1 \text{NEWS}_i + \beta_2 \text{ED1}_i + \beta_3 \text{ED2}_i + \beta_4 \text{NED1}_i + \beta_5 \text{NED2}_i + \beta_6 \text{ATT}_i + \beta_8 \text{AED1}_i + \beta_9 \text{AED2}_i + \beta_{10} \text{NAED1}_i + \beta_{11} \text{NAED2}_i + \varepsilon_i$$

$$\text{PRE} = .203$$

$$F_{1,88} = 22.46$$

1.707; At average levels of education, 1.707 is half the difference in the simple slope relating attitudes on gun control to stereotypical views of NRA members between those who read a positive news story and those who read a negative news story. In particular, the simple slope is more strongly positive for those who read a positive news story than for those who read a negative news story. This result reflects the fact that more influence leads to stronger stereotypes among those supporting gun control, but weaker stereotypes among those who oppose gun control, which is congruent with the original hypothesis.