Sociology 593
Exam 2
April 1, 2005

I. True-False. (20 points) Indicate whether the following statements are true or false. If false, briefly explain why.

1. A researcher regresses political liberalism on age and income. If the effect of age is 0, this means that as people get older, their political liberalism does not change.

2. In order to use a Wald test, you need to estimate both the constrained and unconstrained models.

3. A Chow test can be used to test whether coefficients differ across groups, e.g. men and women.

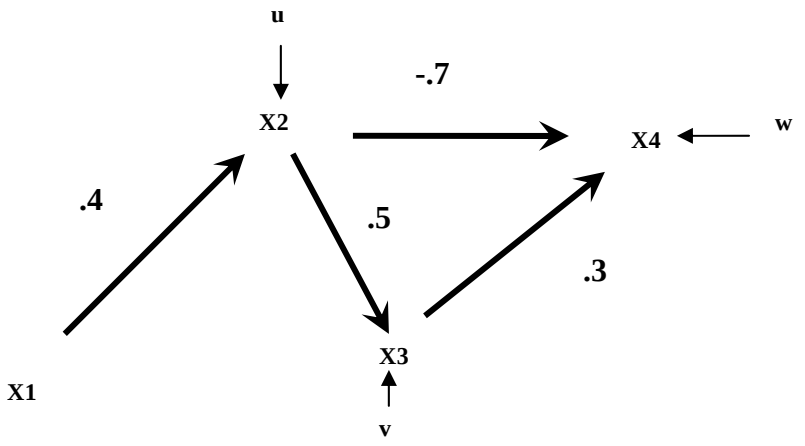
4. A researcher believes that years in the labor force has a stronger (more positive) effect on the occupational prestige of women than it does for men. If she is right, and if all other variables have the same effect on men and women, this means that women have higher occupational prestige than do men.

5. A researcher hypothesizes that Parental Socio-Economic Status (PSES) has a stronger effect on the educational achievement of blacks than it does for whites (White = 1 if white, 0 if black). She finds that

   $\beta_{PSES} = 4$
   $\beta_{White} = 0$
   $\beta_{White*PSES} = 1$

   The results are consistent with her hypothesis.

II. Path Analysis/Model specification (30 pts). A sociologist believes that the following model describes the relationships between X1, X2, X3 and X4. All variables are in standardized form. The hypothesized value of each path is included in the diagram.



a. (10 pts) Write out the structural equation for each endogenous variable.

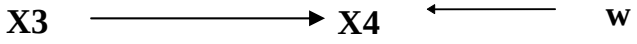
b. (10 pts) Part of the correlation matrix is shown below. Determine the complete correlation matrix. (Remember, variables are standardized. You can use either normal equations or Sewell Wright, but you might want to use both as a double-check.)

	x1	x2	x3	x4
x1	1.0000			
x2	0.4000	1.0000		
x3	?	?	1.0000	
x4	-0.2200	?	?	1.0000

c. (5 pts) Decompose the correlation between X3 and X4 into

- Correlation due to direct effects
- Correlation due to indirect effects
- Correlation due to common causes

d. (5 pts) Suppose the above model is correct, but instead the researcher believed in and estimated the following model:



What conclusions would the researcher likely draw? In particular, what would the researcher conclude about the effect of changes in X3 on X4? Why would he make these mistakes? Discuss the consequences of this mis-specification.

III. Group comparisons (30 points).

A researcher has constructed a 100 point scale (workmom) that measures the level of support for a mother of young children being in the labor force. She believes that education (ed, measured in years) will affect the level of support. She also believes that there may be differences in the model for men and women (male = 1 if male, 0 if female), but she is not sure what those differences will be. She estimates the following models.

```
. * Model 1
. reg  workmom  ed

      Source |       SS       df       MS              Number of obs =    2293
-------------+------------------------------           F(  1,  2291) =   89.55
       Model |  80897.1481     1  80897.1481           Prob > F      =  0.0000
    Residual |  2069606.67  2291  903.363889           R-squared     =  0.0376
-------------+------------------------------           Adj R-squared =  0.0372
       Total |  2150503.82  2292  938.265191           Root MSE      =  30.056

------------------------------------------------------------------------------
     workmom |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ed |    1.87957   .1986202     9.46   0.000     1.490076    2.269065
       _cons |   30.08284    2.50661    12.00   0.000     25.16738     34.9983
------------------------------------------------------------------------------

. * Model 2
. reg  workmom  ed male

      Source |       SS       df       MS              Number of obs =    2293
-------------+------------------------------           F(  2,  2290) =   86.63
       Model |  151260.364     2  75630.1821           Prob > F      =  0.0000
    Residual |  1999243.45  2290  873.032076           R-squared     =  0.0703
-------------+------------------------------           Adj R-squared =  0.0695
       Total |  2150503.82  2292  938.265191           Root MSE      =  29.547

------------------------------------------------------------------------------
     workmom |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ed |   1.941475   .1953789     9.94   0.000     1.558337    2.324613
        male |  -11.11334   1.237904    -8.98   0.000    -13.54087   -8.685811
       _cons |   34.49301   2.512658    13.73   0.000     29.56568    39.42033
------------------------------------------------------------------------------

. test male

 ( 1)  male = 0

       F(  1,  2290) =   80.60
            Prob > F =    0.0000
```

```
. * Model 3
. gen edmale = ed * male
. reg  workmom  ed male  edmale

      Source |       SS       df       MS              Number of obs =    2293
-------------+------------------------------           F(  3,  2289) =   60.35
       Model |  157638.208     3  52546.0693           Prob > F      =  0.0000
    Residual |  1992865.61  2289  870.627178           R-squared     =  0.0733
-------------+------------------------------           Adj R-squared =  0.0721
       Total |  2150503.82  2292  938.265191           Root MSE      =  29.506

------------------------------------------------------------------------------
     workmom |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ed |   2.561016   .3007722     8.51   0.000     1.971202    3.150831
        male |   1.945303   4.980628     0.39   0.696    -7.821713    11.71232
      edmale |  -1.069662    .395208    -2.71   0.007    -1.844665   -.2946587
       _cons |   26.98782   3.739688     7.22   0.000     19.65429    34.32135
------------------------------------------------------------------------------

. test edmale

 ( 1)  edmale = 0

       F(  1,  2289) =    7.33
            Prob > F =    0.0068

. test male edmale

 ( 1)  male = 0
 ( 2)  edmale = 0

       F(  2,  2289) =   44.07
            Prob > F =    0.0000

. * Model 4 - alternate model suggested by smart (?) graduate student
. egen edmean = mean(ed)
. gen xed = ed - edmean
. gen xedmale = xed * male
. reg  workmom xed male xedmale

      Source |       SS       df       MS              Number of obs =    2293
-------------+------------------------------           F(  3,  2289) =   60.35
       Model |  157638.208     3  52546.0693           Prob > F      =  0.0000
    Residual |  1992865.61  2289  870.627178           R-squared     =  0.0733
-------------+------------------------------           Adj R-squared =  0.0721
       Total |  2150503.82  2292  938.265191           Root MSE      =  29.506

------------------------------------------------------------------------------
     workmom |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         xed |   2.561016   .3007722     8.51   0.000     1.971202    3.150831
        male |  -11.12389   1.236204    -9.00   0.000    -13.54808   -8.699689
     xedmale |  -1.069662    .395208    -2.71   0.007    -1.844665   -.2946587
       _cons |   58.27846   .8429325    69.14   0.000     56.62546    59.93145
------------------------------------------------------------------------------
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. * ttest – why did my student think I might want this???
. ttest ed, by(male)

Two-sample t test with equal variances

------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   Women |    1227     12.1141    .0799854    2.801774    11.95718    12.27102
     Men |    1066    12.33771    .1080179    3.526749    12.12576    12.54966
---------+--------------------------------------------------------------------
combined |    2293    12.21805    .0660083    3.160827    12.08861     12.3475
---------+--------------------------------------------------------------------
    diff |           -.2236116    .1322897               -.4830317    .0358084
------------------------------------------------------------------------------
Degrees of freedom: 2291

                 Ho: mean(Women) - mean(Men) = diff = 0

     Ha: diff < 0               Ha: diff != 0                 Ha: diff > 0
       t =  -1.6903               t =  -1.6903                  t =  -1.6903
   P < t =   0.0456           P > |t| =   0.0911              P > t =   0.9544
```

Based on the above results, answer the following questions:

a) (15 pts) The researcher begins by estimating three models. Which of these three models do you think is best, and why? Summarize what your preferred model says about the effect of education on feelings toward working mothers, and what it tells you about differences between men and women. Be sure to make clear whether the effect of education differs by gender, and if so what do those differences tell us?

b) (10 pts) Based on model 3, the researcher had concluded that gender had no effect once other variables were controlled for. However, her graduate student then gave her model 4. Now she does not know what to think. Explain to her why the effect of male seems to differ so much between the two models and how the effects should be interpreted. In particular, what do these results tell us about how the "average" (average on education, that is) man and woman differ in their support for working mothers?

c) The researcher's assistant also ran a t-test. Why do you think she did that, i.e. how does it add to our understanding of gender differences in support for working mothers? Do you think that differences in the amount of education men and women have plays a major role in determining male/female differences in support for working mothers?

IV. Short answer. Answer *one* of the following two questions. (20 points; up to 10 points extra credit if you do both).

1. Both of the following describe a nonlinear or nonadditive relationship between variables. Draw a scatterplot that illustrates each relationship. Describe the harms that might result if you simply regressed Y on X, e.g. would values be over-estimated, under-estimated, or what? Indicate the model you think should be estimated, e.g. $E(Y) = \alpha + \beta_1 X + \beta_2 X^2$. Explain what variables you would need to compute in order to actually estimate the model, e.g. logs of variables, interaction terms.

a. At first, each additional hour spent studying gradually increases your exam score. However, after 6 hours, each additional hour spent studying actually results in a gradual decrease in your score.

b. Workers are paid an hourly wage, which depends, in part, on their seniority and past job performance. After working 40 hours in a week, the workers receive overtime pay and the hourly wage goes up 50%.

2. President Bush has been speaking to large audiences across the country, trying to build support for his plan to reform Social Security. He is therefore dismayed by polls which show that support for the plan is eroding. Even worse, the polls show that people who have heard the President speak are less supportive of the plan than people who have not heard him speak. Some of his advisors are urging him to discontinue his talks because they are doing more harm than good, while others maintain that the talks are helping to achieve their intended purpose and should be continued.

The President has therefore called on you, a professionally trained social scientist, to explain why these relationships might exist. Drawing on your knowledge of <u>the logic of causal order</u>, present different models that could account for the observed relationships. Indicate what implications the different models have for what should be done about the program. To be fair, you will want to present one or more models that suggest that the talks actually build support for his plan, one or more models which imply that the talks do more harm than good, and one or two models which suggest that the talks are not achieving what the President wants but the problems are correctable (i.e. you don't have to completely scrap the talks to solve the problem). When presenting your answer, keep in mind that the President was only a C student in college, so you will have to make things very clear for him. Don't just draw diagrams; explain substantively what the models mean and why they might be plausible.