Sociology 63993
Exam 2
March 30, 2007

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

1. A researcher hypothesizes that education positively affects the self-esteem of men but has no effect on the self-esteem of women. She gets

$$\hat{\beta}_{Education} = 5$$
$$\hat{\beta}_{Female} = 0$$
$$\hat{\beta}_{Education\ *\ Female} = -5$$

Female = 1 if female, 0 if male. The T values for Education and for the interaction term are both highly significant. The evidence supports the researcher's hypothesis.

2. A researcher believes that, for those older than 50, age has no effect on their attitudes toward working mothers. The following analysis confirms her hypothesis.

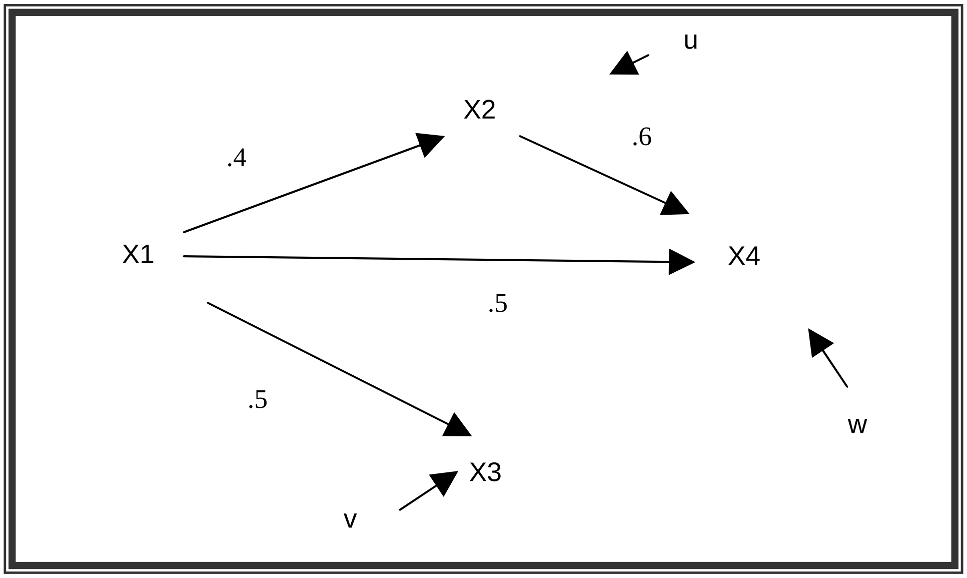
```
. mkspline age1 50 age2=age, marginal
. reg warm  age1 age2

      Source |       SS       df       MS              Number of obs =    2293
-------------+------------------------------           F(  2,  2290) =   51.83
       Model |  85.5158632     2  42.7579316           Prob > F      =  0.0000
    Residual |  1889.23512  2290  .824993501           R-squared     =  0.0433
-------------+------------------------------           Adj R-squared =  0.0425
       Total |  1974.75098  2292  .861584198           Root MSE      =  .90829

------------------------------------------------------------------------------
        warm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        age1 |  -.0106279   .0022345    -4.76   0.000    -.0150098    -.006246
        age2 |  -.0019757   .0043635    -0.45   0.651    -.0105326    .0065811
       _cons |   3.094973   .0844513    36.65   0.000     2.929364    3.260582
------------------------------------------------------------------------------
```

3. A researcher has collected data from respondents in both the United States and Canada. Her measures include a 100 point scale that measures socio-economic status (SES) and a 50 point scale that measures Ambition. She regresses SES on Ambition, but does NOT include dummy variables or interaction terms for nationality. If this model is correct, it implies that the average level of SES in both countries is the same.

4. One reason people sometimes prefer an incremental F test over a Wald test is that the incremental F test does not require that the constrained and unconstrained models have the same number of cases.

5. A researcher has included dummy variables called Catholic, Protestant and Jewish in her model. This likely means that members of Other religions are not included in her analysis.

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



a. (10 pts) Write out the structural equation for each endogenous variable, using both the names for the paths (e.g. β_{42}) and the estimated value of the path coefficient.

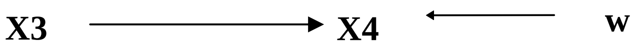
b. (10 pts) Part of the correlation matrix is shown below. Determine the complete correlation matrix. (Remember, variables are standardized. You can use either normal equations or Sewell Wright, but you might want to use both as a double-check.)

```
             |       x1       x2       x3       x4
-------------+------------------------------------
          x1 |   1.0000
          x2 |   0.4000   1.0000
          x3 |      ?        ?     1.0000
          x4 |      ?        ?        ?     1.0000
```

c. (5 pts) Decompose the correlation between X2 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 is interested in the relationship between self-reported health and weight. In particular, she suspects that men feel their weight has relatively little effect on their health (indeed, being heavier might even make them feel healthier). Women, on the other hand, may be more likely to feel that being heavier hurts their health. To test her hypotheses, she uses the NHANES2F data, available from Stata's web site. The data includes information on the following:

Variable	Description
health	Self-reported health. Values range from 1 (poor health) to 5 (excellent health)
female	Coded 1 if female, 0 otherwise
weight	Weight, in kilograms
femweight	Computed variable; equals female * weight

[NOTE: These data are weighted and proper analysis should take that into account. In addition, the dependent variable is ordinal and would probably be better analyzed by ordinal regression methods that we will talk about later. For simplicity, we will ignore such details for now.]

An analysis of the data yields the following results.

```
. webuse nhanes2f, clear
. * Estimate models 1-3
. nestreg: reg health weight female  femweight

Block  1: weight

      Source |       SS       df       MS              Number of obs =   10335
-------------+------------------------------           F(  1, 10333) =   18.08
       Model |  26.2659433     1  26.2659433           Prob > F      =  0.0000
    Residual |  15008.7554 10333  1.45250706           R-squared     =  0.0017
-------------+------------------------------           Adj R-squared =  0.0017
       Total |  15035.0214 10334   1.4549082           Root MSE      =  1.2052

------------------------------------------------------------------------------
      health |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      weight |  -.0032831   .0007721    -4.25   0.000    -.0047965   -.0017698
       _cons |   3.649905   .0567655    64.30   0.000     3.538634    3.761176
------------------------------------------------------------------------------
```

```
Block  2: female

      Source |       SS       df       MS              Number of obs =   10335
-------------+------------------------------           F(  2, 10332) =   22.89
       Model |  66.3199383     2  33.1599691           Prob > F      =  0.0000
    Residual |  14968.7014 10332  1.44877095           R-squared     =  0.0044
-------------+------------------------------           Adj R-squared =  0.0042
       Total |  15035.0214 10334   1.4549082           Root MSE      =  1.2036

------------------------------------------------------------------------------
      health |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      weight |  -.0049337   .0008325    -5.93   0.000    -.0065656   -.0033018
      female |  -.1345989   .0255987    -5.26   0.000    -.1847774   -.0844205
       _cons |    3.83925   .0671624    57.16   0.000     3.707598    3.970901
------------------------------------------------------------------------------

Block  3: femweight

      Source |       SS       df       MS              Number of obs =   10335
-------------+------------------------------           F(  3, 10331) =   41.75
       Model |  180.099242     3  60.0330806           Prob > F      =  0.0000
    Residual |  14854.9221 10331   1.4378978           R-squared     =  0.0120
-------------+------------------------------           Adj R-squared =  0.0117
       Total |  15035.0214 10334   1.4549082           Root MSE      =  1.1991

------------------------------------------------------------------------------
      health |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      weight |   .0034455   .0012551     2.75   0.006     .0009853    .0059057
      female |    .950207   .1245888     7.63   0.000     .7059889    1.194425
   femweight |  -.0148752   .0016722    -8.90   0.000    -.0181531   -.0115973
       _cons |   3.185756   .0993674    32.06   0.000     2.990977    3.380535
------------------------------------------------------------------------------


  +-------------------------------------------------------------+
  |       |          Block  Residual                     Change |
  | Block |       F     df        df     Pr > F       R2    in R2 |
  |-------+-----------------------------------------------------|
  |     1 |   18.08      1     10333   0.0000   0.0017          |
  |     2 |   27.65      1     10332   0.0000   0.0044   0.0027 |
  |     3 |   79.13      1     10331   0.0000   0.0120   0.0076 |
  +-------------------------------------------------------------+

. * Test whether the effect of weight is significant for women
. lincom weight + femweight

 ( 1)  weight + femweight = 0

------------------------------------------------------------------------------
      health |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |  -.0114297   .0011051   -10.34   0.000    -.0135959   -.0092636
------------------------------------------------------------------------------

. * Now estimate Model 4
. egen meanweight = mean(weight) if e(sample)
(2 missing values generated)
. gen xweight = weight - meanweight
(2 missing values generated)
. gen femxweight = female * xweight
(2 missing values generated)
```

```
. reg health xweight female femxweight

      Source |       SS       df       MS              Number of obs =   10335
-------------+------------------------------           F(  3, 10331) =   41.75
       Model |  180.099242     3  60.0330806           Prob > F      =  0.0000
    Residual |  14854.9221 10331   1.4378978           R-squared     =  0.0120
-------------+------------------------------           Adj R-squared =  0.0117
       Total |  15035.0214 10334   1.4549082           Root MSE      =  1.1991

------------------------------------------------------------------------------
      health |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     xweight |   .0034455   .0012551     2.75   0.006     .0009853    .0059057
      female |  -.1193687   .0255599    -4.67   0.000    -.1694711   -.0692664
  femxweight |  -.0148752   .0016722    -8.90   0.000    -.0181531   -.0115973
       _cons |   3.433499   .0187423   183.20   0.000      3.39676    3.470237
------------------------------------------------------------------------------
```

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 weight on self-reported health, and what it tells you about differences between men and women. Be sure to make clear whether the effect of weight differs by gender, and if so what do those differences tell us?

b) (10 pts) The researcher then estimates a fourth model. What is the rationale for doing this? While most results are the same between models 3 and 4, the constant and the coefficient for female change. Explain how the interpretation of these two coefficient differs between the two models. Does Model 4 change your decision about what model is best?

c) (5 pts) The researcher is now going to analyze men separately. Do you think it is wise for her to continue simply regressing health on weight, i.e. do you think her models and results will be plausible if she does this? If not, what might she try instead?

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 suggest or 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. $E(Y) = \alpha + \beta_1X + \beta_2X^2$. Explain what variables you would need to compute in order to actually estimate the model, e.g. logs of variables, interaction terms.

a. A researcher believes that Socio-Economic Status (SES) affects political liberalism, but she is unclear as to what the relationship is. A study of lower-income working class families found that the higher the SES, the more liberal individuals tended to be. But, a study of upper-income individuals found just the opposite: the higher the income, the less liberal people tended to be. To give her some additional insights into how to model the relationship, she runs the following analysis:

```
. quietly reg liberalism ses

. estat ovtest

Ramsey RESET test using powers of the fitted values of warm
       Ho:  model has no omitted variables
                F(3, 2288) =      13.81
                  Prob > F =      0.0000
```

b. A government investigator is researching complaints that a company discriminates against its women employees. She finds that, for both men and women, each year the person is employed by the company his or her salary goes up an average of $2,500. However, on average, women make $5,000 less than men who have been at the company the same length of time.

2. A supporter of Presidential candidate Barack Obama has created a video that has become a sensation on YouTube, with millions of people viewing it. The video uses clips from a famous 1984 Apple Macintosh ad and video from her own website to attack Hillary Clinton. (Go to http://www.slate.com/id/2162286/ if you'd like to see it.) Although it did not authorize the video, the Obama campaign has commissioned a nationwide survey to determine what effect it is having on popular opinion. It wants to know whether it should encourage or discourage the creation of such videos in the future. Much to its surprise, it finds that people who have viewed the video are more supportive of Hillary Clinton than those who have not.

Drawing on your knowledge of the logic of causal order, present different models that could account for the observed relationships. Indicate what implications the different models have for encouraging or discouraging such efforts in the future. To be fair, you will want to present one or more models that suggest that such videos actually lessen support for Clinton, one or more models which imply that such videos do more harm than good for Obama (i.e. they increase support for Clinton), and one or two models which suggest that such videos do not achieve what Obama wants but the problems are correctable (i.e. you don't have to completely do away with such videos to solve the problem). When presenting your answer, keep in mind that, while the Obama campaign may have some very smart people working for it, they aren't that familiar with the logic of causal order, so you will have to make things very clear for them. Don't just draw diagrams; explain substantively what the models mean and why they might be plausible.