Economics 113 Professor Spearot — Introduction to Econometrics
Fall 2014 – Exam 3
Name _____ ID_____

Exam 3 – 80 Points

You must answer all questions. Please write your name on every page. The exam is closed book and closed notes. You may use calculators, but no cell phones. Do not use your own scratch paper.

You must show your work to receive full credit

I have neither given nor received unauthorized aid on this examination, nor have I concealed any similar misconduct by others.

*Signature*_____

Problem 1 (40 Points)

We wish to predict college outcomes using the following regression:

$$college = \beta_0 + \beta_1 mom\_college + \beta_2 dad\_college + u$$

Here, *college* is a dummy variable taking on a value of 1 for respondents with 16 or more years of education, and zero otherwise. The dummy variables *mom_college* and *dad_college* take on a value of 1 if the mom and dad went to college, respectively, and zero otherwise.

```
      Source |       SS       df       MS              Number of obs =     722
-------------+------------------------------           F(  2,   719) =   33.13
       Model |  XXXXXXXXXX     2  6.40338444           Prob > F      =  0.0000
    Residual |  XXXXXXXXXX   719  .193286522           R-squared     =  0.0844
-------------+------------------------------           Adj R-squared =  0.0818
       Total |  XXXXXXXXXX   721  .210512869           Root MSE      =  .43964
------------------------------------------------------------------------------
     college |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 mom_college |    .331223   .0724886    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 dad_college |   .2727932   .0654208    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   .2558639   .0172718    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

a.) Please construct and interpret a 90% confidence interval for the intercept. Show your work! **(10 Points)**

b.) Please interpret the coefficient on *mom_college*. At the 99% confidence level, please test whether it is greater than zero using a one-sided test, and briefly interpret your result. Show your work!! **(10 Points)**

c.) It appears that having a mother who went to college has a larger effect on college outcomes than having a father who went to college. Please derive an equation that allows me to test whether the effect of the mother's college outcome is the same as the father's college outcome. Along with the derivation, please state the null and alternative hypotheses, and write down any Stata commands required to generate new variables and run the regression. Show your work! **(10 Points)**

d.) For the next few regressions, we add an effect of siblings, *sibs,* which is the number of siblings of the respondent. Specifically, we estimate the following:

$$college = \beta_0 + \beta_1 mom\_college + \beta_2 dad\_college + \beta_3 sibs + u$$

The results are the following:

```
      Source |       SS       df       MS              Number of obs =     722
-------------+------------------------------           F(  3,   718) =   29.43
       Model |  16.6200171     3   5.5400057           Prob > F      =  0.0000
    Residual |  135.159761   718  .188244793           R-squared     =  0.1095
-------------+------------------------------           Adj R-squared =  0.1058
       Total |  151.779778   721  .210512869           Root MSE      =  .43387

------------------------------------------------------------------------------
     college |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 mom_college |   .3245219   .0715525    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 dad_college |   .2621026   .0646056    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
        sibs |  -.0323631   .0071906    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   .3497149   .0269324    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Which regression is preferred, the regression in '1a' or '1d'? Please test this hypothesis at the 95% level, stating your null and alternative hypotheses. Briefly interpret your result, and show your work!! **(10 points)**
(I know this is different and that I X'd out something that you want to use. But think about it and you will get it!)

e.) You're unhappy with the regression in 'd', and produce an interaction between *sibs* and parental education.

$$college = \beta_0 + \beta_1 mom\_college + \beta_2 dad\_college + \beta_3 sibs + \beta_4 mom\_college \cdot sibs + \beta_5 dad\_college \cdot sibs + u$$

where *urban* is a dummy variable identifying respondents from metropolitan areas.

```
      Source |       SS       df       MS              Number of obs =     722
-------------+------------------------------           F(  5,   716) =   18.43
       Model |   17.305119     5  3.46102379           Prob > F      =  0.0000
    Residual |  134.474659   716   .18781377           R-squared     =  0.1140
-------------+------------------------------           Adj R-squared =  0.1078
       Total |  151.779778   721  .210512869           Root MSE      =  .43337

------------------------------------------------------------------------------
         college |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------+------------------------------------------------------------
     mom_college |    .112594   .1339742    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     dad_college |   .3460208   .1252459    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
mom_college_sibs |   .0951133   .0523259    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
dad_college_sibs |  -.0467353   .0497364    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
            sibs |  -.0343139   .0073956    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
           _cons |   .3561122   .0274761    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Which regression is preferred, the regression in '1d' or '1e'? Please test this hypothesis at the 95% level, stating your null and alternative hypotheses. Briefly interpret your result, and show your work!! **(10 Points)**

f.) Suppose I claim that having mother who attended college affects the relationship between siblings and the respondent's college outcome. What is the probability that I'm wrong? **(10 Points)**

Problem 2 (25 Points)

a.) For this problem, we wish to associate wages with education, location, and age:

$$\ln(wage) = \beta_0 + \beta_1 educ + \beta_2 urban + \beta_3 age + \beta_4 age^2 + u$$

Here, *wage* is the monthly wage in dollars, *urban* is a dummy variable identifying respondents that live in metropolitan areas, *educ* is years of schooling, and *age* is the age of the respondent. Results:

```
      Source |       SS       df       MS              Number of obs =     935
-------------+------------------------------           F(  4,   930) =   43.71
       Model |  26.2161887     4  6.55404717           Prob > F      =  0.0000
    Residual |  139.440095   930  .149935586           R-squared     =  0.1583
-------------+------------------------------           Adj R-squared =  0.1546
       Total |  165.656283   934  .177362188           Root MSE      =  .38722
------------------------------------------------------------------------------
     ln_wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |     .05774   .0058051     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       urban |   .1714169   .0282304     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
         age |   .0137273   .1028383     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
        age2 |   .0001333   .0015446     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   5.277044    1.69378     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Is there an age at which wages are maximized? If so, solve for this age. If not, tell me why. Show your work!! **(10 Points)**

b.) Please precisely interpret the coefficient on urban. Show your work! (**5 Points)**

c.) What is the precise effect of going from 12 years of education (HS) to 22 years of education (PhD!)? Show your work! **(5 Points)**

Have a great weekend!

Normal Distribution from -oo to Z

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

TABLE G.3b

5% Critical Values of the *F* Distribution

	Numerator Degrees of Freedom:									
	1	2	3	4	5	6	7	8	9	10
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83

Example: The 5% critical value for numerator $df = 4$ and large denominator df (∞) is 2.37.

Source: This table was generated using the Stata® function invFtail.