Name _____   ID_____

Midterm 3 –60 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 they must not be graphing calculators. 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

The decision to attend college is a very important one, and family characteristics are considered a major factor in educational attainment. To begin our study of educational attainment, we evaluate the impact of the number of siblings, *sibs*, and the order of birth, *brthord* (1 for first, 2 for second…), on the years of education attained, *educ*.

$$\log(educ) = \beta_0 + \beta_1 brthord + \beta_2 sibs + u$$

```
     Source |       SS           df       MS              Number of obs =      659
------------+----------------------------------           F( 2,   656) =    14.22
      Model |  .702496954        2   .351248477           Prob > F      =   0.0000
   Residual |  16.2065079      656   .024705042           R-squared     =   0.0415
------------+----------------------------------           Adj R-squared =   0.0386
      Total |  16.9090048      658   .025697576           Root MSE      =   .15718


------------------------------------------------------------------------------
     logeduc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
    brthord |  -.0096447    .005067     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       sibs |  -.0101424   .0034227     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      _cons |   2.652929   .0113445     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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```

a.) Please interpret the coefficient on *sibs*. Using the 99% confidence level, please test whether it is significantly different from zero. **(10 Points)**

b.) In part (a), I forget about parental education, which is probably quite important. Specifically, I include mother's education, *meduc*, and father's education, *feduc*, as follows:

$$\log(educ) = \beta_0 + \beta_1 brthord + \beta_2 sibs + \beta_3 \log(meduc) + \beta_4 \log(feduc) + u$$

The results from estimating this equation are below:

```
      Source |       SS       df       MS                  Number of obs =     659
-------------+------------------------------              F(  4,    654) =   36.58
       Model |  3.09146926      4   .772867314            Prob > F       =  0.0000
    Residual |  13.8175355    654   .02112773             R-squared      =  0.1828
-------------+------------------------------              Adj R-squared  =  0.1778
       Total |  16.9090048    658   .025697576            Root MSE       =  .14535


------------------------------------------------------------------------------
     logeduc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     brthord |  -.0009342    .0047804 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
        sibs |  -.0061294    .0031935 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     logmeduc |   .0752445    .0214354 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     logfeduc |   .1299058    .017919 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
        _cons |   2.150804    .0520578 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Is this model preferred to the model in 'a'? Please test this at the 95% level, stating your null and alternative hypotheses. Show your work!!! **(10 Points)**

c.) Using the regression in 'b', suppose I claim that birth order has a significant effect on education levels. What is the probability that I'm wrong? **(10 Points)**

d.) Please construct a 90% confidence interval for the coefficient on mother's education. Please interpret this confidence interval. **(10 Points)**

e.) Please **derive** an equation that allows me to test whether the effect of mother's education is the same as father's education. Along with the derivation, please state the null and alternative hypothesis, and write down any Stata commands required to generate new variables and run the regression. **(10 Points)**

Problem 2

Using the same dataset as before, I estimate the following equation predicting wage outcomes:

$$wage = \beta_0 + \beta_1(educ - 16) + \beta_2(meduc - 12) + \beta_3(feduc - 12) + u$$

where *wage* is the monthly wage of the respondent.   The results from estimating this equation are below:

```
      Source |       SS           df       MS              Number of obs =      722
-------------+------------------------------             F(  3,    718) =    32.61
       Model |  14399607.2        3  4799869.07           Prob > F       =   0.0000
    Residual |   105675187      718  147179.926           R-squared      =   0.1199
-------------+------------------------------             Adj R-squared =    0.1162
       Total |   120074794      721  166539.243           Root MSE       =   383.64


------------------------------------------------------------------------------
        wage |      Coef.   Std. Err.      t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     educ-16 |   46.60749   7.168573    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    meduc-12 |   10.67185   6.272866    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    feduc-12 |   11.04096   5.510691    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
       _cons |   1118.009   20.69534    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
------------------------------------------------------------------------------
```

Please construct a 92% confidence interval for the constant. Please interpret this confidence interval. Show your work!!! **(10 Points)**

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