# Econometrics

Econ 3341 - 01: Mock Exam 2

Diego Escobari

Name: _____

*Total Points: 22 (plus 1 extra point)* *Show your work*

The following equation describes how the number of Facebook friends depends on your gender and on how long you have been having a Facebook account (measured in weeks):

$$\texttt{fbfriends} = \beta_0 + \beta_1 \texttt{weekold} + \beta_2 \texttt{weekoldsq} + \delta_0 \texttt{female} + u. \quad (1)$$

The variable `fbfriends` denotes the number of Facebook friends, `weekold` is the number of weeks old your Facebook account is, while `weekoldsq` is `weekold` squared. Finally, `female` is equal to one if the account holder is female, zero otherwise. The estimation output from Gretl is the following:

```
Model 2: OLS, using observations 1-2060
Dependent variable: fbfriends

              coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       336.938       12.1349      27.77     2.29e-144 ***
  female       -7.77756      7.50715     -1.036    0.3003
  weekold       4.88149      0.754399     6.471    1.22e-010 ***
  weekoldsq     0.0561077    0.0103873    5.402    7.37e-08  ***

Mean dependent var   253.5602   S.D. dependent var   172.4297
Sum squared resid    59621754   S.E. of regression   170.2907
R-squared            0.026078   Adjusted R-squared   0.024657
F(3, 2056)           18.35041   P-value(F)           9.49e-12
Log-likelihood      -13504.28   Akaike criterion     27016.55
Schwarz criterion    27039.07   Hannan-Quinn         27024.81
```

1) Write down the estimated equation for females. (*2 points*)

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2) Write down the estimated equation for males. (*2 points*)

3) What is the interpretation of the coefficient on `female`? Explain the statistical significance of the coefficient. (*2 points*)

4) What is the equation that characterizes the marginal effect of weeks old on the number of Facebook friends? (*2 points*)

5) What is the predicted number of Facebook friends for someone who lives in Texas and opened his account exactly one year ago? (*2 points*)

6) What proportion of the variation in `fbfriends` is explained by this model? (*2 points*)

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7) Graph the regression equations that describes `fbfriends` as a function of `weekold`. Make sure you label your axes. (*2 points*)

Consider the following specification, where the variable `college` is a dummy variable equal to one if the account holder is in college, zero otherwise:

$$\log(\texttt{fbfriends}) = \beta_1 + \beta_2\,\texttt{college} + u \qquad (2)$$

```
Model 5: OLS, using observations 1-2060
Dependent variable: lfbfriends

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       4.83436      0.0437680    110.5     0.0000    ***
  college     0.819652     0.0697909     11.74    7.12e-031 ***

Mean dependent var   5.320973   S.D. dependent var   0.660987
Sum squared resid    843.0798   S.E. of regression   0.640047
R-squared            0.062812   Adjusted R-squared   0.062357
F(1, 2058)           137.9308   P-value(F)           7.12e-31
Log-likelihood      -2002.812   Akaike criterion     4009.624
Schwarz criterion    4020.884   Hannan-Quinn         4013.752
```

8) What is the interpretation of $\beta_2$? (1 *points*)

a. One more year in college increases your Facebook friends by 81.97%.
b. One more year in college increases you Facebook friends by 81.97
c. It is not statistically significant, so it is not correct to interpret the magnitude of the coefficient.
d If the person is in college, he/she is expected to have 81.97 more Facebook friends.
e. If the person is in college, he/she is expected to have 81.97% more Facebook friends.
f. None of the above.

9) What is the main constraint of the simple regression model in Equation (2)? (*1 point*)

a. The ceteris paribus assumption holds.
b. It is not keeping other factors constant.
c. Other variables have a positive effect on `fbfriends`.
d. The variable `college` has a linear effect on log(`fbfriends`).
e. The coefficient on the variable `college` is not statistically significant.
f. The coefficient on the variable `college` is not economically significant.

Consider the existence of four different groups: females that attend college (`collegefemale`), females that do not attend college (`nocollegefemale`), males that attend college (`collegemale`), and males that do not attend college (`nocollegemale`). We want to test if there are differences across these groups in terms of their number of Facebook friends. One possible specification is:

$$\log(\texttt{fbfriends}) = \beta_0 + \beta_1 \texttt{collegefemale} + \beta_2 \texttt{collegemale} + \beta_3 \texttt{nocollegefemale} + u \quad (3)$$

where the omitted category (base group) is `nocollegemale`. We obtain the following output from Gretl:

```
Model 6: OLS, using observations 1-2060
Dependent variable: lfbfriends

                   coefficient   std. error   t-ratio    p-value
  ------------------------------------------------------------------
  const              4.84723      0.0623222    77.78     0.0000    ***
  collegefemale      0.807449     0.0777252    10.39     1.13e-024 ***
  collegemale        0.805680     0.0975339     8.261    2.57e-016 ***
  nocollegefemale   -0.0243846    0.0877099   -0.2780    0.7810

Mean dependent var   5.320973   S.D. dependent var   0.660987
Sum squared resid    843.0251   S.E. of regression   0.640337
R-squared            0.062873   Adjusted R-squared   0.061505
F(3, 2056)           45.97968   P-value(F)           9.33e-29
Log-likelihood      -2002.745   Akaike criterion     4013.490
Schwarz criterion    4036.012   Hannan-Quinn         4021.747
```

10) Why we should not include `nocollegemale` in the estimated regression? (*1 point*)

a. Because we will not have the dummy variable trap.
b. It is fine to include it because Gretl will drop it anyway.
c. Because `nocollegemale` contains the same information as the other three dummy variables.
d. Because it will have a negative effect on `fbfriends`.
e. Because the sample of 2060 observations does not have any males that did not attend college.
f. None of the above.

11) What is the interpretation of $\beta_2$? (*1 point*)

a. College males have 80.57% more Facebook friends than college females.
b. For every additional college male, the number of Facebook friends increases by 80.57.
c. For every additional college male, the number of Facebook friends increases by 80.57%,
d. College males have 80.57% more Facebook friends than college females.
e. College males have 80.57 more Facebook friends than college females.
f. College males have 80.57% more Facebook friends than males who do not attend college.

Consider the alternative model:

$$\log(\texttt{fbfriends}) = \beta_0 + \beta_1\texttt{college} + \beta_2\texttt{weekold} + \beta_3\texttt{weekoldcollege} + u \qquad (4)$$

where `weekoldcollege` is the interaction term (`weekold` times `college`). The Gretl output is:

```
Model 7: OLS, using observations 1-2060
Dependent variable: lfbfriends

                  coefficient   std. error   t-ratio    p-value
  ------------------------------------------------------------
  const            4.34658      0.109505     39.69     2.78e-256 ***
  college          1.48060      0.145897     10.15     1.20e-023 ***
  weekold         -0.0121392    0.00234802   -5.170     2.57e-07  ***
  weekoldcollege   0.0179934    0.00363260    4.953     7.89e-07  ***

Mean dependent var   5.320973   S.D. dependent var   0.660987
Sum squared resid    832.1932   S.E. of regression   0.636210
R-squared            0.074914   Adjusted R-squared   0.073564
F(3, 2056)           55.49854   P-value(F)           1.71e-34
```

12) The null hypothesis to test if the number of Facebook friends follows the same model for college and non-college students is: (*1 point*)

a. $H_0$: college = non-college
b. $H_0$: college = weekoldcollege = 0

c. $H_0: \beta_1 = \beta_3 = 0$
d. $H_0: \beta_2 = \beta_3 = 0$
e. $H_0: \beta_1 = 0$
f. None of the above

13) Can you claim that the effect of `weekold` is the same for college and non college students? (*1 points*)

a. No, because the coefficient is not significant.
b. No, because even thought the coefficient is significant, it has the wrong sign.
c. No, because the p-value is below 5%.
d. Yes, because the coefficient is not statistically significant.
e. Yes, because the coefficient is statistically significant.
f. None of the above.

14) Graph the regression equations that describes log(`fbfriends`) as a function of `weekold` for both, college and non college students. (*2 points + 1 extra point*)

Record your responses for the multiple choice section here:

| | Response |
|---|---|
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |