Practice Exam 1, Econ 311

Total points are 100. But it counts 20% toward your final grade. So the effective total points are 20

Note: (i) show me your work in details in order to get partial credits; (ii) round your answer to 2 decimal spaces

Last Name First Name

You may use the following facts to answer some questions. Let $Z \sim N(0,1)$ then

$$P(Z < 1.96) = 0.975 \quad P(Z < 1.645) = 0.950 \quad P(Z < 1.28) = 0.900$$

Q1, 2, 3, 4, 5, 6 and 7 are based on the following result of a simple regression

```
> summary(lm(y~x))$coef
            Estimate  Std. Error   t value      Pr(>|t|)
(Intercept) 7.115328   ?           ?            ?
x           -2.517987 .3048        ?            ?
```

Q1 (5 points). How to interpret the intercept term 7.115328

Q2 (5 points). Please draw a graph showing how y and x are related.

Q3 (5 points). Suppose we multiply x by 10. How does this affect the slope coefficient?

Q4 (10 points). Let β be the true slope coefficient of x. Consider the null hypothesis $H_0 : \beta = -2$ versus the alternative hypothesis $H_a : \beta \neq -2$. Please find the T test and draw a conclusion using the 5% significance level.

Q5 (5 points). Find the 90% confidence interval for the slope coefficient

Q6 (5 points). Find the fitted value when $x = 3$

Q7 (5 points). Can you guess the p-value for β_1 is less than or greater than 0.05? Why?

Q8 (5 points). What are the first order conditions of OLS? What do they imply?

Q9 (5 points) Please prove that $\sum_{i=1}^{n}(y_i - \bar{y}) = 0$

Q10 (5 points). What are the differences between error term u and residual $\hat{u}$?

Q11 (10 points). Suppose you use a student's SAT score as y, use the student's family income as x, and run a simple regression. Write down the two conditions for omitted variables. Focus on a variable called VE that measures how a family values education. Suppose VE rises if the family puts higher value on education. Discuss in detail the sign of the omitted variable bias caused by VE.

Q12 (5 points). Consider a strange regression without x

$$y = \beta_0 + u$$

Please apply the first order condition (FOC) of OLS, and find the OLS estimate $\hat{\beta}_0$

Q13 (5 points). What is spurious causality? How to design a Monte Carlo study to show spurious causality?

Q14 (5 points). Explain the two-step procedure implied by the FW Theorem

Q15, 16, and 17 are based on the following multiple regression using the House data

```
> summary(lm(rprice~baths+area+age))$coef
              Estimate  Std. Error   t value     Pr(>|t|)
(Intercept)  9959.9862 4484.126479  2.221165 2.704600e-02
baths       13641.5988 2298.852799  5.934090 7.740657e-09
area           21.5844    2.383401  9.056134 1.415320e-17
age          -201.3679   40.770001 -4.939118 1.272098e-06
```

Q15 (5 points). Please interpret -201.3679, the coefficient of age

Q16 (10 points). Please describe in detail how to apply F test for the null hypothesis that neither area nor baths matters for rprice. You need to formulate that hypothesis mathematically, write down the formula for F test, and specify the unrestricted and restricted regressions.

Q17 (5 points). Please convert the p value 1.272098e-06 of age from scientific notation into a decimal