Econ 103: Introduction to Econometrics
Week 5: Practice Questions

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Question 1

A study looked at whether there is a difference in hourly wages (measured in \$) between alumni of USC and UCLA, other things being equal. The model is given by

$$\text{Wage } = b_1 + b_2 * (\text{USC})$$

The variable USC is called an indicator variable, and it only has the value 0 or 1. The variable $USC = 1$ if the person is a USC alumni and $USC = 0$ if they are a $UCLA$ alumni.

Some of the regression output is given below:

- $\hat{b}_1 = 70.10, \text{se}(\hat{b}_1) = 2.10$
- $\hat{b}_2 = -20.51, \text{se}(\hat{b}_2) = 3.00$

(a) Interpret the coefficients of the model.

(b) Construct a 99% confidence interval (CI) for the slope of the model. Assume that t-critical=2.576 for a 99% CI.

(c) Test the hypothesis that the average hourly wage for UCLA alumni is \$65.00 at the 5% confidence level. Assume that t-critical = 1.96 for a 95% CI.

Question 2

Assume you estimate the simple regression equation below. The data are from a charity where the variable GIFT represents the gift amount (in \$) and MAILYR represents the number of mailings per year.

$$\text{GIFT} = b_1 + (2.65) * \text{MAILYR}$$

You are told the following:

- $se(\hat{b}_1) = 0.74$ with t.stat = 2.72
- $se(\hat{b}_2) =?$ with t.stat = 7.72

(a) What is the estimated equation intercept?

(b) What is the standard error of the estimated slope?

(c) Interpret the slope coefficient. If each mailing costs \$1.00, is the charity expected to make a net gain on each mailing? Explain.

(d) Construct a 95% confidence interval (CI) estimate of the slope of this relationship.

*Many thanks to all previous TAs for providing the notes. All mistakes are my own. Please get in touch with me at fdiazvaldes@g.ucla.edu if you spot any typos or mistakes.

Question 3

We are given the following model of home prices as a function of the square foot size of the house.

$$\text{price} = b_1 + b_2\text{sqrt}$$

where sqrt is measured in 100 sqft and price in \$1.000s. After running a regression, we see that $\hat{b}_2 = 13.40$ and $\text{se}(\hat{b}_2) = 0.449$.

Find the p-value associated with whether increasing the size of the house by 100sqft is associated with an increase in the price by \$13.000 versus the alternative hypothesis that it increases by more than \$13.000

Question 4

Let Y denote food expenditure, and let X denote household income. Our model is given by

$$Y = b_1 + b_2 * X$$

(a) After running a regression we are told that $\hat{b}_1 = 10$ and $\hat{b}_2 = 69.81$. Calculate the expected food expenditures for a household with $X = 10$.

(b) Building off part (a), suppose that $\mathbb{V}(\hat{b}_1) = 0.25$, $\mathbb{V}(\hat{b}_2) = 12.50$, and $\mathbb{C}(\hat{b}_1, \hat{b}_2) = 5.98$. Furthermore, suppose we are willing to assume that the residuals are homoskedastic, but we do not know the value of σ. Construct a 95% confidence interval of the expected value from part (a) using the critical value from the standard normal. Is your answer exact?

(c) Next, we want to test whether the expected food expenditures for a household with $X = 10$ equals 710 against the alternative that it does not equal 710. Calculate the $p - value$. Do you reject the null if $\alpha = 0.1$? What about $\alpha = 0.05$?

Question 5

Suppose we conduct an experiment where some individuals are treated with a medicine and others are not. Consider the model:

$$Y_i = \beta_1 + \beta_2 D_i + \varepsilon_i$$

Where D_i is equal to 1 if individual i was treated with the medicine and equal to 0 otherwise.

Y_i is the overall health of the individual 6 months after the experiment. Explain in 1 or 2 sentences how to interpret the parameter β_2. In other words, what does β_2 measure?

Question 6

Let WAGE denote wages and EDUC years of education, and consider the model.

$$\log(\text{WAGE}) = \beta_1 + \beta_2 * \text{EDUC} + \varepsilon$$

We estimate the regression in R and find the following output.

Table 1: Regression Coefficients

	Estimate	Std. Error	t value	$\Pr(>\|t\|)$
(Intercept)	0.4260866	0.0430064	9.908	$< 2 \times 10^{-16}$ ***
educ	0.1135814	0.0029442	38.577	$< 2 \times 10^{-16}$ ***

Note: Signif. codes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Assume that the degrees of freedom are 4,730. Mark each of the following statements either TRUE or FALSE

(a) These estimates suggest that, on average, one additional year of education is associated with an increase in wages of approximately 11.3%.

(b) The confidence interval for the estimate of β_2 will include the value 0.1135814, regardless of the confidence level.

(c) There are 4,733 observations in this sample.

(d) The p-value associated with $H_0 : \beta_2 = 0$ versus $H_1 : \beta_2 \neq 0$, is very close to 5%.

Question 7

We are given 500 observations of single family homes sold in Los Angeles during 2018-2020. The data includes PRICE (in thousands of dollars) and number of windows. The regression model is

$$\text{PRICE} = \beta_1 + \beta_2 * (\text{WINDOWS}^2) + \varepsilon$$

From the data we obtain the estimates

- $\hat{\beta}_1 = 93.56$
- $\hat{\beta}_2 = 0.186$

Compute the elasticity of PRICE with respect to WINDOWS for a home with 20 windows.

Question 8

Below we summarize the output from a regression of monthly sales (SALES are measured in $1,000s) on the price of their popular burger (PRICE is measured in dollars).

Table 2: OLS regression of *sales* on *price*

Source	SS	df	MS
Model	1219.09103	1	1219.09103
Residual	1896.39084	73	25.9779567
Total	3115.48187	74	42.1011063

Number of obs	75
F(1, 73)	46.93
Prob > F	0.0000
R-squared	0.3913
Adj R-squared	0.3830
Root MSE	5.0969

	Coef.	Std. Err.	t	P> $\|t\|$	[95% Conf. Interval]	
price	-7.829074	1.142865	-6.85	0.000	-10.1068	-5.551348
_cons	121.9002	6.526291	18.68	0.000	108.8933	134.9071

Which of the following statements provide the best interpretation of the slope?

(a) We expect monthly revenue to increase by $7,829 for a decrease in price of $1.

(b) An increase in price of $1 will lead to a fall in monthly revenue of $7,829.

(c) An increase in price of $1 will lead to a increase in monthly revenue of $7,829.

(d) None of the above because the confidence interval endpoints are both negative.

Question 9

To investigate the relationship between experience (measured in years) and wages (measured in dollars), we will fit a log-quadratic model, which contains 1,000 observations on hourly wage rates ($WAGE$) and experience ($EXPER$) from the 2018 Current Population Survey. Assume $\text{t}(0.975, 998) = 1.96$ and $\text{t}(0.95, 998) = 1.65$.

For this model we will first create a new variable $EXPER30 = EXPER - 30$, and then run our regression using $EXPER30$. The regression is

$$\ln(WAGE) = \beta_1 + \beta_2 * (EXPER30^2) + \varepsilon$$

The regression output is

- $\hat{\beta}_1 =?$
- $\hat{\beta}_2 = 0.00071$.
- $\mathbb{V}(\hat{\beta}_1) = (6.07)^2$, $t_1 = 12.58$ when $H_0 : \beta_1 = 0$.
- $\mathbb{V}(\hat{\beta}_2) = (0.0053)^2$, $t_2 = 8.07$ when $H_0 : \beta_2 = 0$.

Now,

(a) Compute the estimated intercept $\hat{\beta}_1$ and the standard error of β_2.

(b) Find the 95% confidence interval estimate for β_2.

(c) Compute the estimated marginal effect of experience upon wage for a person with 10 years of experience.