Take Test: Homework Assignment 1

Test Information

Description	Homework Assignment 1 Submission Deadline: 6:35pm on Monday, September 28
Instructions	You should submit all your answers BEFORE 6:35pm on Monday, September 28. Please, try to answer all questions. Note that different questions have different weights. I just need your answers. You do not need to show me your work.
Multiple Attempts	This test allows multiple attempts.
Force Completion	This test can be saved and resumed later. Your answers are saved automatically.

QUESTION 1

20 points Save Answer

Consider the following sample:

Observation	Hourly Earnings	Years of Education
1	30	20
2	20	16
3	22	12

(a) What is the sample size?
(b) Calculate the sample average hourly earnings.
(c) Calculate the sample median hourly earnings.
(d) Calculate the sample variance of hourly earnings. What is its unit of measurement?
(e) Calculate the sample standard deviation of hourly earnings. What is its unit of measurement?
(f) Calculate the sample covariance between hourly earnings and years of education. What is its unit of measurement?
(g) Calculate the sample correlation between hourly earnings and years of education.

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QUESTION 2

10 points Save Answer

Consider the following regression:

$$Y_i = \beta_0 + \beta_1 X_i + u_i, i = 1,...,10,000.$$

X has a sample average of 15 and a sample standard deviation of 2. Y has a sample average of 25 and a sample standard deviation of 5. The sample correlation between X and Y is 0.30.

(a) Calculate the OLS estimate of $\hat{\beta}_1$.
(b) Calculate the OLS estimate of $\hat{\beta}_0$.
(c) Assume the standard error of $\hat{\beta}_0$ is 6 and the standard error of $\hat{\beta}_1$ is 0.3.
(i) You want to test $H_0: \beta_1 = 1.5$ vs. $H_1: \beta_1 \neq 1.5$. Calculate the relevant t-statistic. Will you reject the null hypothesis at 1% significance level?
(ii) Calculate the lower limit and the upper limit of the 95% confidence interval for β_1.

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QUESTION 3

10 points Save Answer

The following regression is estimated for a sample of 150 countries:

$$\widehat{ChildMort}_i = 28.11 - 0.00082 \times GDPpC_i,$$
$$(6.02) \quad (0.0003)$$

where *ChildMort* is the number of deaths of children under 5 per 1,000 live births and *GDPpC* is GDP per capita. Let's denote the true value of the coefficient on *GDPpC* by β_1. We want to test $H_0: \beta_1 = 0$ vs. $H_1: \beta_1 < 0$.

(a) Calculate the actual value of the relevant t-statistic.
(b) What is the relevant critical value for the test statistic (use the large-sample normal approximation) at 5% significance level?
(c) Would you reject H_0 in favor of H_1 at 5% significance level?

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QUESTION 4

20 points Save Answer

You decide to estimate the following three regressions using the same sample of data (assume that sample size is 10,000):

$$wage_i = b_0 + b_1\, female_i + u_i \quad (1)$$
$$wage_i = c_0 + c_2\, male_i + v_i \quad (2)$$
$$wage_i = d_1\, female_i + d_2\, male_i + e_i \quad (3)$$

where wage refers to average hourly earnings, u, v, and e are the regressions' error terms, and
$female_i$ = 1 if observation i refers to a female, and = 0 if observation i refers to a male
$male_i$ = 1 if observation i refers to a male, and = 0 if observation i refers to a female

(a) How much is the expected wage of a female according to each regression?
(b) How much is the expected wage of a male according to each regression?
(c) Interpret the vertical intercept and the slope in regression (1).
(d) Interpret the vertical intercept and the slope in regression (2).
(e) Interpret the coefficients d_1 and d_2 in regression (3).

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QUESTION 5

10 points Save Answer

You estimate the linear regression:

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i, i = 1,...,350,$$

and find that the standard error of the regression, SER, equals 0.7. The total sum of squares, TSS, equals 200.

(a) Calculate the residual sum of squares (RSS), also referred to as the sum of squared residuals (SSR).
(b) Calculate R^2.

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QUESTION 6

30 points Save Answer

Consider the following regression output, where *ahe* refers to average hourly earnings and *yrseduc* refers to years of education.

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Call:
lm(formula = ahe ~ yrseduc, data = earn)

Residuals:
    Min      1Q  Median      3Q     Max
-30.517  -8.877  -2.527   4.750  62.290

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -10.9135     3.7147  -2.938  0.00347 **
yrseduc       2.4100     0.2444   9.862  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 13.81 on 466 degrees of freedom
Multiple R-squared:  0.1727,    Adjusted R-squared:  0.1709
F-statistic: 97.25 on 1 and 466 DF,  p-value: < 2.2e-16
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(a) What fraction of the sample variance of *ahe* is explained by *yrseduc*?
(b) How much is the standard error of the regression (SER)?
(c) What is the sample size? [Hint: Check the degrees of freedom of the SER and note that we have lost 2 degrees of freedom when estimating the two coefficients of the regression.]
(d) What is the OLS estimate of the slope?
(e) What is the standard error of the OLS estimator of the slope?
(f) What is the t-statistic corresponding to the two-sided test with null hypothesis that the slope equals 0.
(g) Will you reject the null hypothesis that the slope equals 0 in favor of the two-sided alternative at 5% significance level?
(h) Find the lower and the upper limit of the 95% confidence interval for the slope of the regression (use the normal approximation, which is justified since the sample size is large enough).
(i) Calculate the predicted wage (i.e., average hourly earnings) of a person with 16 years of education.
(j) What would be the predicted increase in the wage of a high-school graduate if he/she obtains a college degree? In answering this question assume that college takes 4 years.
(k) Give an example of a variable that can directly increase a person's wage and can be positive correlated with years of education.
(l) In view of (k), do you expect the OLS estimator of the slope to be unbiased? In particular, do you think that the expected value of the OLS estimator of the slope is greater, smaller, or equal to the true slope?

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