Chapter 3

A. Multiple Choice Questions

1. Consider the following regression equation: \( y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u \). What does \( \beta_1 \) imply?
   a. \( \beta_1 \) measures the ceteris paribus effect of \( x_1 \) on \( x_2 \).
   b. \( \beta_1 \) measures the ceteris paribus effect of \( y \) on \( x_1 \).
   c. \( \beta_1 \) measures the ceteris paribus effect of \( x_1 \) on \( y \).
   d. \( \beta_1 \) measures the ceteris paribus effect of \( x_1 \) on \( u \).

2. If the explained sum of squares is 35 and the total sum of squares is 49, what is the residual sum of squares?
   a. 10
   b. 12
   c. 18
   d. 14

3. Which of the following is true of \( R^2 \)?
   a. \( R^2 \) is also called the standard error of regression.
   b. A low \( R^2 \) indicates that the Ordinary Least Squares line fits the data well.
   c. \( R^2 \) usually decreases with an increase in the number of independent variables in a regression.
   d. \( R^2 \) shows what percentage of the total variation in the dependent variable, \( Y \), is explained by the explanatory variables.

4. The value of \( R^2 \) always _____.
   a. lies below 0
   b. lies above 1
   c. lies between 0 and 1
   d. lies between 1 and 1.5

5. If an independent variable in a multiple linear regression model is an exact linear combination of other independent variables, the model suffers from the problem of _____.
   a. perfect collinearity
   b. homoskedasticity
   c. heteroskedasticity
   d. omitted variable bias

6. Exclusion of a relevant variable from a multiple linear regression model leads to the problem of _____.
a. misspecification of the model  
b. multicollinearity  
c. perfect collinearity  
d. homoskedasticity

7. Suppose the variable $x_2$ has been omitted from the following regression equation, $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$.  
$\hat{\beta}_1$ is the estimator obtained when $x_2$ is omitted from the equation. The bias in $\hat{\beta}_1$ is positive if ______.
   a. $\beta_2 > 0$ and $x_1$ and $x_2$ are positively correlated  
   b. $\beta_2 < 0$ and $x_1$ and $x_2$ are positively correlated  
   c. $\beta_2 > 0$ and $x_1$ and $x_2$ are negatively correlated  
   d. $\beta_2 = 0$ and $x_1$ and $x_2$ are negatively correlated

8. Suppose the variable $x_2$ has been omitted from the following regression equation, $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$.  
$\hat{\beta}_1$ is the estimator obtained when $x_2$ is omitted from the equation. The bias in $\hat{\beta}_1$ is negative if ______.
   a. $\beta_2 > 0$ and $x_1$ and $x_2$ are positively correlated  
   b. $\beta_2 < 0$ and $x_1$ and $x_2$ are positively correlated  
   c. $\beta_2 = 0$ and $x_1$ and $x_2$ are negatively correlated  
   d. $\beta_2 = 0$ and $x_1$ and $x_2$ are negatively correlated

9. Suppose the variable $x_2$ has been omitted from the following regression equation, $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$.  
$\hat{\beta}_1$ is the estimator obtained when $x_2$ is omitted from the equation. If $E(\hat{\beta}_1) > \beta_1$, $\hat{\beta}_1$ is said to ______.
   a. have an upward bias  
   b. have a downward bias  
   c. be unbiased  
   d. be biased toward zero

10. High (but not perfect) correlation between two or more independent variables is called ______.
   a. heteroskedasticity  
   b. homoskedasticity  
   c. multicollinearity  
   d. micronumerosity

11. Find the degrees of freedom in a regression model that has 10 observations and 7 independent variables.
   a. 17  
   b. 2  
   c. 3  
   d. 4
12. The Gauss-Markov theorem will not hold if _____.
   a. the error term has the same variance given any values of the explanatory variables
   b. the error term has an expected value of zero given any values of the independent variables
   c. the independent variables have exact linear relationships among them
   d. the regression model relies on the method of random sampling for collection of data

B. True or False Questions
1. The term "linear" in a multiple linear regression model means that the equation is linear in parameters.
2. The key assumption for the general multiple regression model is that all factors in the unobserved error term be correlated with the explanatory variables.
3. The coefficient of determination (R^2) decreases when an independent variable is added to a multiple regression model.
4. An explanatory variable is said to be exogenous if it is correlated with the error term.
5. A larger error variance makes it difficult to estimate the partial effect of any of the independent variables on the dependent variable.

**Chapter 4**

A. Multiple Choice Questions

1. The normality assumption implies that:
   a. the population error $u$ is dependent on the explanatory variables and is normally distributed with mean equal to one and variance $\sigma^2$.
   b. the population error $u$ is independent of the explanatory variables and is normally distributed with mean equal to one and variance $\sigma$.
   c. the population error $u$ is dependent on the explanatory variables and is normally distributed with mean zero and variance $\sigma$.
   d. the population error $u$ is independent of the explanatory variables and is normally distributed with mean zero and variance $\sigma^2$.

2. A normal variable is standardized by:
   a. subtracting off its mean from it and multiplying by its standard deviation.
   b. adding its mean to it and multiplying by its standard deviation.
c. subtracting off its mean from it and dividing by its standard deviation.
d. adding its mean to it and dividing by its standard deviation.

3. Which of the following is a statistic that can be used to test hypotheses about a single population parameter?
   a. F statistic
   b. t statistic
   c. χ² statistic
   d. Durbin Watson statistic

4. Consider the equation, \( Y = \beta_1 + \beta_2 X_2 + u \). A null hypothesis, \( H_0: \beta_2 = 0 \) states that:
   a. \( X_2 \) has no effect on the expected value of \( \beta_2 \).
   b. \( X_2 \) has no effect on the expected value of \( Y \).
   c. \( \beta_2 \) has no effect on the expected value of \( Y \).
   d. \( Y \) has no effect on the expected value of \( X_2 \).

5. The significance level of a test is:
   a. the probability of rejecting the null hypothesis when it is false.
   b. one minus the probability of rejecting the null hypothesis when it is false.
   c. the probability of rejecting the null hypothesis when it is true.
   d. one minus the probability of rejecting the null hypothesis when it is true.

6. The general t statistic can be written as:
   a. \( t = \frac{\text{Hypothesized value}}{\text{Standard error}} \)
   b. \( t = (\text{estimate} - \text{hypothesized value}) \)
   c. \( t = \frac{(\text{estimate} - \text{hypothesized value})}{\text{variance}} \)
   d. \( t = \frac{(\text{estimate} - \text{hypothesized value})}{\text{standard error}} \)

7. Which of the following statements is true of hypothesis testing?
   a. The t test can be used to test multiple linear restrictions.
   b. A test of single restriction is also referred to as a joint hypotheses test.
   c. A restricted model will always have fewer parameters than its unrestricted model.
   d. OLS estimates maximize the sum of squared residuals.
8. Which of the following correctly defines $F$ statistic if $SSR_r$ represents sum of squared residuals from the restricted model of hypothesis testing, $SSR_u$ represents sum of squared residuals of the unrestricted model, and $q$ is the number of restrictions placed?

a. $F = \frac{(SSR_u - SSR_r)/q}{SSR_r/(n-k-1)}$

b. $F = \frac{(SSR_r - SSR_u)/q}{SSR_u/(n-k-1)}$

c. $F = \frac{(SSR_u - SSR_r)/q}{SSR_r/(n-k-1)}$

d. $F = \frac{(SSR_u - SSR_r)/(n-k-1)}{SSR_r/q}$

9. Which of the following statements is true?

a. If the calculated value of $F$ statistic is higher than the critical value, we reject the alternative hypothesis in favor of the null hypothesis.

b. The $F$ statistic is always nonnegative as $SSR_r$ is never smaller than $SSR_u$.

c. Degrees of freedom of a restricted model is always less than the degrees of freedom of an unrestricted model.

d. The $F$ statistic is more flexible than the $t$ statistic to test a hypothesis with a single restriction.

10. If $R^2_u = 0.6873$, $R^2_r = 0.5377$, number of restrictions = 3, and $n - k - 1 = 229$, $F$ statistic equals:

a. 21.2

b. 28.6

c. 36.5

d. 42.1

B. True or False Questions

1. If the calculated value of the $t$ statistic is greater than the critical value, the null hypothesis, $H_0$, is rejected in favor of the alternative hypothesis, $H_1$.

2. $H_1$: $\beta_i \neq 0$, where $\beta_i$ is a regression coefficient associated with an explanatory variable, represents a one-sided alternative hypothesis.

3. If $\hat{\beta}_1$ and $\hat{\beta}_2$ are estimated values of regression coefficients associated with two explanatory variables in a regression equation, then the standard error $(\hat{\beta}_1 - \hat{\beta}_2) = \text{standard error} (\hat{\beta}_1) - \text{standard error} (\hat{\beta}_2)$.

4. Standard errors must always be positive.