FINM3123 Introduction to Econometrics
Quiz 1

Name: _____ Student ID: _____

Date: 10 October 2024
Time allowed: 60 minutes **Full mark: 50**

I. Multiple choice questions (8 points):

*Identify the letter of the choice that **best** completes the statement or answers the question. 2 points for each question.*

1. In the multiple linear regression model $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k + u$, the word **linear** in the term refers to the fact that
   a. $\beta_0, \beta_1, \ldots \beta_k$, all have exponents of 0
   b. $\beta_0, \beta_1, \ldots \beta_k$, all have exponents of 1
   c. $\beta_0, \beta_1, \ldots \beta_k$, all have exponents of at least 1
   d. $\beta_0, \beta_1, \ldots \beta_k$, all have exponents of less than 1

2. Larger values of R^2 imply that the observations are more closely grouped about the
   a. average value of the independent variables
   b. average value of the dependent variable
   c. fitted regression line
   d. origin

3. In a multiple regression problem $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$, if $\hat{\beta}_1$ is computed to be +2.0, it means that
   a. the relationship between x_1 and y is significant.
   b. the estimated average of y increases by 2 units for each increase of 1 unit of x_1, holding x_2 constant.
   c. the estimated average of y increases by 2 units for each increase of 1 unit of x_1, without regard to x_2.
   d. the estimated average of y is 2 when x_1 equals zero.

4. The variation attributable to factors other than the relationship between the independent variables and the explained variable in a regression analysis is represented by
   a. residual sum of squares.
   b. explained sum of squares.
   c. total sum of squares.
   d. R-squared.

II. Problems (42 points)

1. (24 points) The managers of a brokerage firm are interested in finding out if the number of new clients a broker brings into the firm affects the sales generated by the broker. They sample 12 brokers and determine the number of new clients they have enrolled in the last year and their sales amounts in thousands of dollars. These data are presented in the table that follows.

Broker (*i*)	**Clients (x_i)**	**Sales (y_i)**	$(x_i-\overline{x})(y_i-\overline{y})$	$(x_i-\overline{x})^2$	$(y_i-\overline{y})^2$
1	27	52	11.98	3.67	39.06
2	11	37	123.23	198.34	76.56
3	42	64	308.73	286.17	333.06
4	33	55	73.23	62.67	85.56
5	15	29	168.90	101.67	280.56
6	15	34	118.48	101.67	138.06
7	25	58	-1.02	0.01	150.06
8	36	59	144.65	119.17	175.56
9	28	44	-5.10	8.51	3.06
10	30	48	11.06	24.17	5.06
11	17	31	119.23	65.34	217.56
12	22	38	23.90	9.51	60.06
Sum	**301**	**549**	**1097.25**	**980.92**	**1564.25**
Average	**25.08**	**45.75**			

   a) (6 points) What is the fitted linear regression line?

   b) (4 points) Prove that $SSE=\hat{\beta}_1^2\sum_1^n(x_i-\overline{x})^2$.

   c) (5 points) What is the R^2? (*Hint*: use the result in (b))

   d) (5 points) What is the standard error of the regression, $\hat{\sigma}$?

   e) (4 points) What is the standard error of the estimated slop coefficient?

2. (10 points) Suppose that you have two independent unbiased estimators of the same parameter θ, say $\hat{\theta}_1$ and $\hat{\theta}_2$, with different variances v_1 and v_2. What linear combination $\hat{\theta}=c_1\hat{\theta}_1+c_2\hat{\theta}_2$ is the minimum variance unbiased estimator of θ?

3. (8 points) Consider the simple linear regression model $y = \beta_0 + \beta_1 x + u$. Suppose that the units of measurement of x are changed so that the new measure, x^*, is related to the original one by $x^* = \mu_1 x_i$, where μ_1 is a constant. Show that the new estimate of the slope coefficient is $\hat{\beta}_1/\mu_1$, where $\hat{\beta}_1$ is the estimated slope coefficient in the original regression.