※ 注意：全部題目均請作答於試卷內之「非選擇題作答區」，請標明題號依序作答。

注意：本試卷共有三頁。請考生答題前，務必閱讀每大題的注意事項說明！

第一大題：填空題（每格 5 分，共 50 分）

（1）第一大題為填空題，請依空格號 (1)~(10) 之順序作答，每一空格 5 分；此部分不須計算過程。

（2）如果沒有特別指示，請將答案約分至「最簡分數」表示，否則不予計分。

A. Let Y denote a **geometric** random variable with probability of success $p = 3/4$. The probability $P(Y > 2) =$ **(1)** ; the probability $P(Y > 8|Y > 5) =$ **(2)** ; the standard deviation of Y is **(3)** ; the moment-generating function (MGF) of Y, $m_Y(t) \equiv E(e^{tY}) =$ **(4)** ; the probability-generating function of Y, $P_Y(t) \equiv E(t^Y) =$ **(5)** .

B. Suppose that, for $-1 \leq \alpha \leq 1$, the joint probability density function of Y_1 and Y_2 is given by:

$$f(y_1, y_2) = \begin{cases} [1 - \alpha\{(1 - 2\exp(-y_1))(1 - 2\exp(-y_2))\}]\exp(-y_1 - y_2), 0 \leq y_1, 0 \leq y_2, \\ 0, \quad \text{elsewhere.} \end{cases}$$

The expected value of Y_2, $E(Y_2) =$ **(6)** ; the expected value $E(4Y_1 - 3Y_2) =$ **(7)** ; the variance of Y_2, $V(Y_2) =$ **(8)** ; the variance $V(4Y_1 - 3Y_2) =$ **(9)** ; the condition for Y_1 and Y_2 to be independent is **(10)** .

見背面

第二大題：計算問答說明題（50 分）

注意：(1) 第二大題有四題計算問答說明題。

(2) 請標示清楚，並將所有過程、步驟交代清楚；沒有說明過程者，甚者只給簡單回答如 Yes、No 等，不給分。每大題之下的小題分數，如括號內所示。

Note: You should carefully state the reasons or calculations in the following questions in order to get the points. A short answer, such as "Yes" or "No" will NOT receive any point.

1. (20 points) A researcher studies the relationship between the daily supply quantity of egg y and its unit selling price x. Using data collected over 8 days, the following summary statistics are obtained:

$$\sum x = 64, \sum y = 176, \sum x^2 = 560, \sum y^2 = 4{,}208, \sum xy = 1{,}504.$$

Assume the classical linear regression assumptions hold.

a. (5 points) Using the least squares method, estimate the regression line of y on x (state intercept and coefficient).

b. (5 points) Compute the coefficient of determination, R^2. Briefly explain what this value means in this context.

c. (10 points) Test whether the unit selling price has a statistically significant effect on daily supply quantity. Specifically, test the following hypotheses at the 5% significance level:

$$H_0: \beta_1 = 0 \quad \text{vs.} \quad H_1: \beta_1 \neq 0$$

You are given that the estimated variance of the error term is:

$$\sigma^2 = \frac{SSE}{n-2} = 14$$

Clearly state the test statistic, the rejection rule, and your conclusion (Use the t-table with upper-tail probabilities).

2. (10 points) A researcher estimates the following regression equation:

$$Y=0.5+0.006X$$

where Y is the number of asthma hospitalizations, and X is the concentration of sulfur dioxide (SO_2) measured in parts per million (PPM).

Suppose the researcher changes the unit of measurement of X from PPM (10^{-6}) to parts per ten thousand (‰), where 1‰ = 10^{-3}, and re-estimates the regression.

Answer the following questions:

a. (5 points) Write down the new regression equation after the unit change.

b. (5 points) Does the coefficient of determination R^2 change? Explain briefly.

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3. (5 points) The dataset contains 9 observations. Based on the regression of the dependent variable y on the explanatory variable x, the following estimation results are obtained:

Predictor	Coefficient	Standard Error
Constant	18.600	6.200
x	1.050	0.300

Source	SS	df	MS	F
Regression	210.000	?	?	?
Error	120.000	?	?	
Total	330.000			

What is the value of the F statistic for testing the overall significance of the regression?

4. (15 points) Answer the following true or false question with brief explanation of the reason.

a. **(5 points)** In a multiple regression model, if an explanatory variable has a statistically insignificant coefficient, then removing that variable from the model will not change the estimated coefficients of the remaining variables.

b. **(5 points)** In a multiple regression model, the presence of severe multicollinearity causes the OLS estimators to be biased and the R^2 of the regression to be low.

c. **(5 points)** When estimating a regression of agricultural commodity prices on seasonal effects, if there are four seasons in a year (Spring, Summer, Fall, Winter), four seasonal dummy variables should be included in the regression model.

Student's t critical values table (upper-tail probabilities)

df	0.25	0.1	0.05	0.025	0.01	0.005
5	0.7267	1.4759	2.0150	2.5706	3.3649	4.0321
6	0.7176	1.4398	1.9432	2.4469	3.1427	3.7074
7	0.7111	1.4149	1.8946	2.3646	2.9980	3.4995
8	0.7064	1.3968	1.8595	2.3060	2.8965	3.3554
9	0.7027	1.3830	1.8331	2.2622	2.8214	3.2498
10	0.6998	1.3722	1.8125	2.2281	2.7638	3.1693
11	0.6974	1.3634	1.7959	2.2010	2.7181	3.1058

試題隨卷繳回