Université Libanaise
Faculté d'Information
Br I

الجامعة اللبنانية
كلية الاعلام
الفرع الاول

138

امتحان الفصل
للعام الجامعي 2025/2024

المرحلة:	المادة: إحصاء 3
السنة المنهجية: الثانية	المدة: دقيقة ٦٠
الاستاذ: عباس رمال	الدورة: الأولى

Exercise 1. (12 points)

The table below shows the impact of three advertising media (Instagram, Twitter, and Radio) on product sales. The data includes the advertising budget (in thousands of dollars) and sales (in thousands of units).

Instagram	Twitter	Radio	Sales
120.5	35.2	50.0	15.1
75.3	40.1	60.2	12.3
200.2	45.0	80.1	25.0
150.0	50.3	70.0	20.5
180.4	42.5	55.3	23.0
60.1	55.2	65.4	13.5

1. Identify the dependent variable (variable to be explained) and the independent variables (explanatory variables). Determine the multiple regression equation.
2. Test whether the residuals (ε_i) are normally distributed.
3. Calculate the estimator of the error variance.
4. Specify which variables are significant in the model using two different methods.
5. Indicate which statistic should be used to test the hypothesis $H_0: \beta_1 = \beta_2 = \beta_3 = 0$ against H_1: at least one $\beta_j \neq 0$ at a significance level $\alpha = 5\%$. Specify its value.
6. Estimate the range within which Sales can be expected to fall for Instagram = 130, Twitter = 45, and Radio = 60 using a 90% confidence level.

Exercise 2. (8 points)

A hosiery mill has recorded n=48 monthly observations of output and cost. The following summary statistics are available:

$\sum X_i = 1491.23$; $\sum X_i^2 = 54067.42$; $\sum Y_i = 3140.78$; $\sum Y_i^2 = 238424.46$;

$\sum X_i Y_i = 113095.80$

1) Estimate the parameters β_0 and β_1 of the linear regression model:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

using the least squares method. The regression sum of squares $SS_{Reg} = 31336.37$

2) Write the fitted regression equation.
3) Calculate the sum of squares of residuals SS_{Res} and the estimator of the error variance.
4) Construct a 95% confidence interval for β_1
5) Test the hypothesis:

$$H_0: \beta_0 = 3 \text{ against } H_1: \beta_0 \neq 3$$

at a significance level α=5%.

6) Calculate the coefficient of determination and interpret its meaning.