Université Libanaise
Faculté d'Information

Br I

الجامعة اللبنانية
كلية الاعلام
الفرع الاول

الامتحانات النهائية للفصل الأول

Course: Statistics 3

Final Exam 2022-2023

Instructor: Dr. Abbas Rammal

Duration: 120 minutes

$\hat{y} = 17,82 + 0,141x$

Problem 1.

An article in the *Journal of Environmental Engineering* (Vol. 115, No. 3, 1989, pp. 608–619) reported the results of a study on the occurrence of sodium and chloride in surface streams in central Rhode Island. The following data are chloride concentration y (in milligrams per liter) and roadway area in the watershed x (in percentage).

y	4.4	6.6	9.7	10.6	10.8	10.9
x	0.19	0.15	0.57	0.70	0.67	0.63
y	11.8	12.1	14.3	14.7	15.0	17.3
x	0.47	0.70	0.60	0.78	0.81	0.78
y	19.2	23.1	27.4	27.7	31.8	39.5
x	0.69	1.30	1.05	1.06	1.74	1.62

(a) Draw a scatter diagram of the data. Does a simple linear regression model seem appropriate here?

(b) Fit the simple linear regression model using the method of least squares. Find an estimate of σ^2.

$r = 0,923$

(c) Estimate the mean chloride concentration for a watershed that has 1% roadway area.

(d) Find the fitted value corresponding to $x = 0.47$ and the associated residual.

e)

Test the hypothesis H_0: $\beta_1 = 0$ versus H_1: $\beta_1 \neq 0$ using the analysis of variance procedure with $\alpha = 0.01$.

f)

Estimate the standard errors of $\hat{\beta}_1$ and $\hat{\beta}_0$.
Test H_0: $\beta_0 = 0$ versus H_1: $\beta_0 \neq 0$ using $\alpha = 0.01$. What conclusions can you draw? Does it seem that the model might be a better fit to the data if the intercept were removed?

g)

Find a 99% confidence interval on each of the following:

(a) β_1 (b) β_0

(c) Mean chloride concentration when roadway area $x = 1.0\%$

(d) Find a 99% prediction interval on chloride concentration when roadway area $x = 1.0\%$.