

**College of Sciences**

**Department of**

**Statistics and Operations Research**

**كلية العلوم**

**قسم الإحصاء وبحوث العمليات**

**Midterm Exam**

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| **Wednesday, 03 / 07 / 1444 H** | **STAT 332** | **Academic year 1444 H** |
| **7:00 – 09:00 pm** | **Regression Analysis** | **Second Semester** |

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| Student’s Name |  | اسم الطالب |
| ID number |  | الرقم الجامعي |
| Section No. |  | رقم الشعبة |
| Classroom No. |  | رقم قاعة الاختبار |
| Teacher’s Name |  | اسم أستاذ المقرر |
| Roll Number |  | رقم التحضير |

Important Notices: Answer the following questions (3 questions, two pages) Answer a new question in a new page.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Question One (8 Marks)** |

Suppose that $(y\_{1},x\_{1}),(y\_{2},x\_{2}),.....,(y\_{n},x\_{n})$ is a data set to which we fit a simple regression model,

$$Y\_{i}=β\_{0}+β\_{1}X\_{i}+ε\_{i},i=1,2,...n.$$

1. If $β\_{0}=0$, find the least squared estimate of the of $β\_{1}$, next, discuss the unbiasedness and derive its variance.
2. Ifprove that:
3. The sum of residuals is equal to zero.
4. The total sum of square error is equal to the sum the regression square error of the plus the sum of square error.

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| **Question Two (12 Marks)** |

A fire insurance company wants to relate the amount of fire damage (Y in SR1000) in major residential fires (الحرائق السكنية الكبرى) to the distance between the residence and the nearest fire station (X in mile). The study is to be conducted in a large suburb of a major city, a sample of 15 recent fires in this suburb is selected. The 15 values and the printout follow:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X** | **3.4** | **1.8** | **4.6** | **2.3** | **3.1** | **5.5** | **0.7** | **3.0** | **2.6** | **4.3** | **2.1** | **1.1** | **6.1** | **4.8** | **3.8** |
| **Y** | **26.2** | **17.8** | **31.3** | **23.1** | **27.5** | **36.0** | **14.1** | **22.3** | **19.6** | **31.3** | **24.0** | **17.3** | **43.2** | **36.4** | **26.1** |

1. Estimate the regression line and interpret the coefficients.
2. Calculate the estimate of the standard deviation of fire damage for all homes the same distance from the fire station is (in SR1000)
3. Construct 90% confidence intervals for the model coefficients and explain the results.
4. Test the linearity by using ANOVA.
5. Find 95% confidence interval for the mean fire damage for all house 3.5 miles from the fire station is (in SR1000).
6. Calculate the residual corresponding to the of the damage at the house of 5.5 miles (in SR1000).

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| **Question Three (10 Marks)** |

1. In the following example, data are available on the effect of dietary supplement on the growth rates of rats. Let

X=dose of dietary supplement and Y= growth rate.

The following table presents the data in a form suitable for the analysis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| X | 10 | 15 | 20 | 25 | 30 | 35 |
| Y | 7378 | 8588 | 9091 | 878691 | 75 | 6563 |

1. Fit the model $Y=β\_{0}+β\_{1} X+ε$
2. Test the linearity using t-test.
3. Discuss the lack of fit test.

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1. A linear regression was run on a set of data. You are given only the following partial information from R:

Coefficients:

 Estimate Std. Error t value

Intercept 293.89 5.62 52.2

X (1)…. 0.13 -13.13

Analysis of Variance Table

Response: y

 Df Sum Sq Mean Sq F value

x 1 7621.667 (2)…. (4)….

Residuals 5 (3)…. 44.21

Complete the table (1, 2, 3, 4)

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**With Our Best Wishes and Regards ..**

 **Dr. Walid Emam & Dr. Mahmoud Bakr**