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1 Problema

A study was conducted at Virginia Tech to determine if certain static arm-strength measures have an influence on the "dynamic lift" characteristics of an individual. Twenty-five individuals were subjected to strength tests and then were asked to perform a weightlifting test in which weight was dynamically lifted overhead. The data are given here.

Individual	Arm Strength x	Dynamic Lift y
1	17.3	71.7
2	19.3	71.7
3	19.5	88.3
4	19.7	75.0
5	22.9	91.7
6	23.1	100.0
7	26.4	73.3
8	26.8	65.0
9	27.6	75.0
10	28.1	88.3
11	28.2	68.3
12	28.7	96.7
13	29.0	76.7
14	29.6	78.3
15	29.9	60.0
16	29.9	71.7
17	30.3	85.0
18	31.3	85.0
19	36.0	88.3
20	39.5	100.0
21	40.4	100.0
22	44.3	100.0
23	44.6	91.7
24	50.4	100.0
25	55.9	71.7

Table 1:

Then:
(a) Estimate β_0 and β_1 for the linear regression curve $\mu_{y|x} = \beta_0 + \beta_1 x$
(b) Find a point estimate of $\mu_{y|30}$.
(c) Plot the residuals versus the $x's$ (arm strength). Comment.

2 Solución

Para encontrar b_0 se realizó lo siguiente con los datos de la tabla 1:

$$b_1 = \frac{n\sum_{i=1}^{n} x_i y_i - \left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)}{n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2} = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(x_i-\bar{x})^2} \text{ and}$$

$$b_0 = \frac{\sum_{i=1}^{n} y_i - b_1 \sum_{i=1}^{n} x_i}{n} = \bar{y} - b_1\bar{x}.$$

Figure 1: Fórmulas para encontrar b_0 y b_1

El ejercicio se realizó en Python,el cual el código quedó de la siguiente manera, en donde calculamos b_0 y b_1, el punto de estimación de $\mu_{Y|30}$, y graficar el residual de x.

tarea2.py

```
import numpy as np
import matplotlib.pyplot as plt
import math
import csv
import time
x = np.array([17.3,19.3,19.5,19.7,22.9,23.1,26.4,26.8,27.6,28.1,28.2,28.7,29,29.6,
29.9,29.9,30.3,31.3,36,39.5,40.4,44.3,44.6,50.4,55.9])

y = np.array([71.7,48.3,88.3,75,91.7,100,73.3,65,75,88.3,68.3,96.7,76.7,78.3,
60,71.7,85,85,88.3,100,100,100,91.7,100,71.7])

xy= x*y
x2= x**2
a=sum(x)
b=sum(y)
c=sum(xy)
d=sum(x2)
print a,b,c,d
b0 = ((25*c)-(a*b))/((25*d)-(a*a))
b1 = ((d*b)-(a*c))/((25*d)-(a**2))

ygorrito = b1 + (b0*30)
print b0
print b1
print ygorrito
fig, ax = plt.subplots()
linea=[b1,105]
ax.scatter(x,y)
ax.plot(linea)
#plt.plot(x,y)
fig.show()
time.sleep(5.5)
```

Figure 2: Código en Python

Una vez realizada las operaciones se obtuvo lo siguiente:
En donde:
$\sum_{i=1}^{n} x_i = 778.7$
$\sum_{i=1}^{n} y_i = 2050.0$

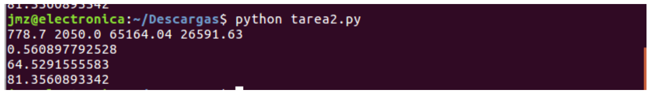

Figure 3: Resultados

$\sum_{i=1}^{n} xy_i = 65164.04$
$\sum_{i=1}^{n} x_i^2 = 26591.63$

(a) Los valores de $b_0 = 64.52915$ y $b_1 = 0.5608$ (b) Estimando el valor $\mu_{Y|30}$ esto es igual a 81.356

(c) Por ultimo graficamos el residual quedando de la siguiente manera

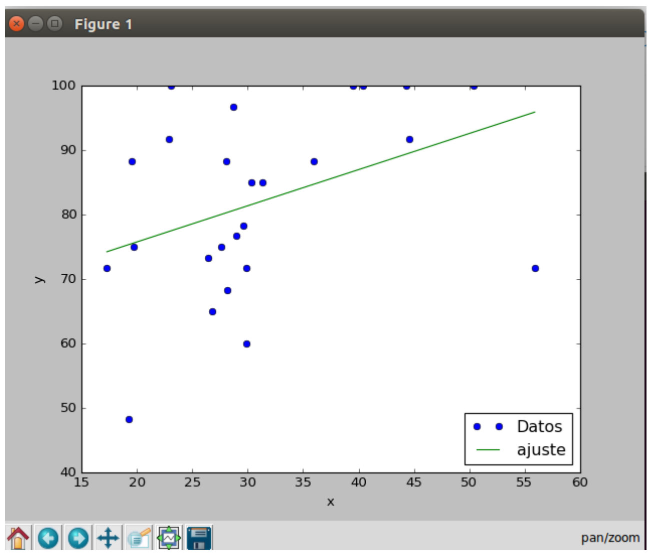

Figure 4: Gráfica