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TAREA 1 Regresión lineal con Python

1) (4 Puntos) Modifica el código usando los datos del archivo adjunto y muestra los puntos junto con la recta de regresión usando el modelo de scikit-learn.

In [ ]:
```
import matplotlib.pyplot as plt
import numpy as np

from sklearn import datasets, linear_model
from sklearn.metrics import mean_squared_error, r2_score
```

Restaurantes	X	Y	XY
1	2	58	
2	6	105	
3	8	88	
4	8	118	
5	12	117	
6	16	137	
7	20	157	
8	20	169	
9	22	149	
10	26	202	

In [ ]:
```
X = np.array([2, 6, 8, 8, 12, 16, 20, 20, 22, 26])
Y= np.array([58, 105, 88, 118, 117, 137, 157, 169, 149, 202])
```

In [ ]:
```
X = X[:, np.newaxis]
```

In [ ]:
```
# Split the data into training/testing sets
X_train = X[:-2]
X_test = X[-8:]
```

In [ ]:
```
# Split the targets into training/testing sets
y_train = Y[:-2]
y_test = Y[-8:]
```

In [ ]:
```
# Create linear regression object
regr = linear_model.LinearRegression()
```

In [ ]:
```
# Train the model using the training sets
regr.fit(X_train, y_train)
```

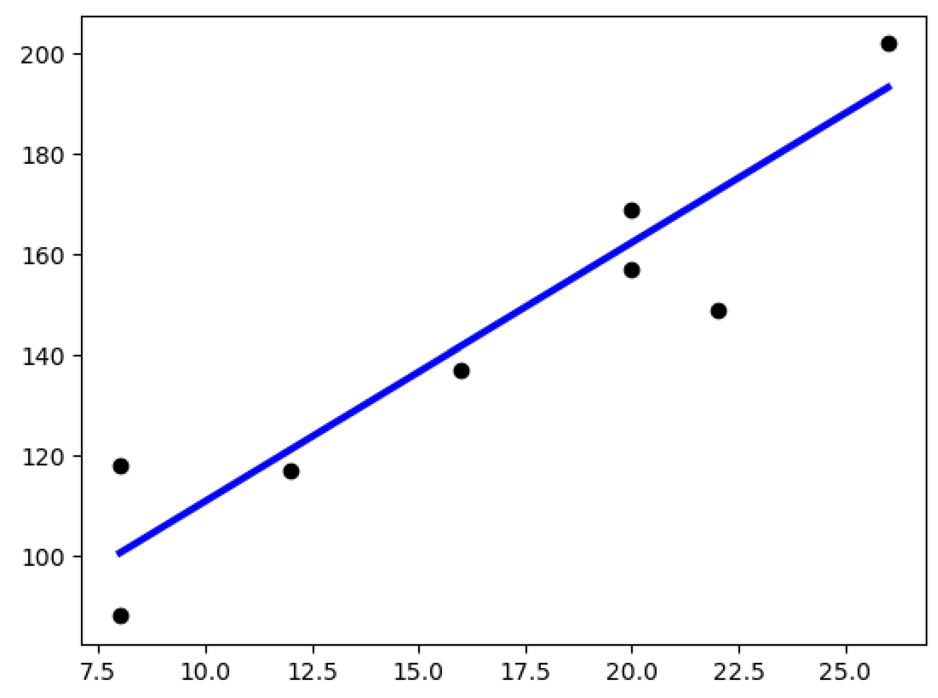
Out[ ]:
```
▾ LinearRegression
LinearRegression()
```

In [ ]:
```
# Make predictions using the testing set
y_pred = regr.predict(X_test)
```

In [ ]:
```
# The coefficients
print("Coefficients: \n", regr.coef_)
# The mean squared error
print("Mean squared error: %.2f" % mean_squared_error(y_test, y_pred))
# The coefficient of determination: 1 is perfect prediction
print("Coefficient of determination: %.2f" % r2_score(y_test, y_pred))
```

```
Coefficients:
 [5.15]
Mean squared error: 151.54
Coefficient of determination: 0.86
```

In [ ]:
```
# Plot outputs
plt.scatter(X_test, y_test, color="black")
plt.plot(X_test, y_pred, color="blue", linewidth=3)
plt.show()
```



2) (4 Puntos) Calcula la recta de regresión usando las fórmulas y dibújala con matplotlib:

In [ ]:
```
# Datos de ejemplo
x = np.array([2, 6, 8, 8, 12, 16, 20, 20, 22, 26])
y= np.array([58, 105, 88, 118, 117, 137, 157, 169, 149, 202])

# Número de datos
n = len(x)
```

$$b_1 = \frac{(\sum x_i y_i) - \frac{(\sum x_i)(\sum y_i)}{n}}{(\sum x_i^2) - \frac{(\sum x_i)^2}{n}} = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

In [ ]:
```
# Calcula los coeficientes de la regresión
b1 = (n * np.sum(x * y) - np.sum(x) * np.sum(y)) / (n * np.sum(x**2) - (np.sum(x))**2)
print("b1 = ",  b1)
```

```
b1 =  5.0
```

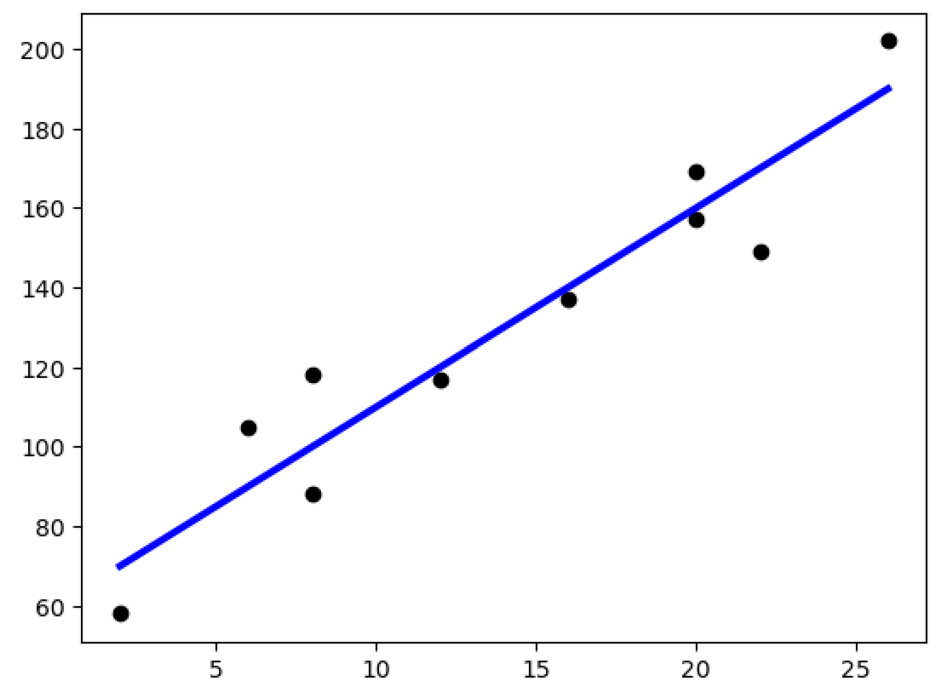
$$b_0 = (\sum \bar{y}) - (b_1 \sum \bar{x}) = \frac{(\sum y) - (b_1 \sum x)}{n}$$

In [ ]:
```
b0 = (np.sum(y) - b1 * np.sum(x)) / n
print("b0 = ",  b0)
```

```
b0 =  60.0
```

In [ ]:
```
# Genera puntos para la línea de regresión
x_line = np.linspace(min(x), max(x), 100)
y_line = b0 + b1 * x_line

# Grafica los puntos y la línea de regresión
plt.scatter(x, y, color="black")
plt.plot(x_line, y_line, color="blue", linewidth=3)
plt.show()
```



3) (2 Puntos) Calcula los coeficientes de determinación r2 y r.

$\hat{y} = b_0 + b_1 x$

In [ ]:
```
# Calcula los valores estimados
y_hat = b0 + b1 * x

print("y_hat = ", y_hat)
```

```
y_hat =  [ 70.  90. 100. 100. 120. 140. 160. 160. 170. 190.]
```

$SCE = \sum (y_i - \hat{y}_i)^2$

In [ ]:
```
SCE = np.sum((y - y_hat)**2)

print("SCE = ", SCE)
```

```
SCE =  1530.0
```

$SCT = \sum (y_i - \bar{y}_i)^2$

In [ ]:
```
# Coeficiente de determinación (r^2)
mean_y = np.mean(y) # np.sum(y)/n
SCT = np.sum((y - mean_y)**2)

print("SCT = ", SCT)
```

```
SCT =  15730.0
```

$r^2 = 1 - \frac{SCE}{SCT}$

In [ ]:
```
r_squared =  1 - (SCE / SCT)

print("Coeficiente de determinación (r_squared):", r_squared)
```

```
Coeficiente de determinación (r_squared): 0.9027336300063573
```

$r = (\text{ Signo de } b_1)\sqrt{r^2}$

In [ ]:
```
# Coeficiente de correlación (r)
r =  np.sign(b1) * np.sqrt(r_squared)

print("Coeficiente de correlación (r):", r)
```

```
Coeficiente de correlación (r): 0.9501229552044079
```