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ASSIGNMENT-1

1. Given the following data of Temperature (°C) and Power Consumption (kWh):

Temperature (°C) (X)	**Power Consumption (kWh) (Y)**
10	300
12	310
14	320
16	330
18	345
20	360
22	370
24	390
26	420
28	450

(a) Derive the regression equation, Y = a + bX, using the least squares method and calculate a (intercept) and b (slope). Also compute ΣX, ΣY, ΣXY.

Solution:
$\Sigma X = 190$
$\Sigma Y = 3595$
$\Sigma X^2 = 3940$
$\Sigma XY = 70810$

$b = [n\Sigma XY - \Sigma X\Sigma Y] / [n\Sigma X^2 - (\Sigma X)^2]$
$= [10(70810) - (190)(3595)] / [10(3940) - (190)^2]$
$= 7.59$
$a = \bar{Y} - b\bar{X}$
$= 359.5 - 7.59(19)$
$= 215.29$
Hence, Regression Equation:

$Y = 215.29 + 7.59X$

(b) Using predicted values, compute R^2.

$R^2 = [(n\Sigma XY - \Sigma X\Sigma Y)^2] / [(n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)]$

$= 0.918$

Thus, $R^2 = 0.918$ (≈ 91.8%), showing a strong positive relationship.

2. (a) Use Python (statsmodels) to fit model and compare.
(b) Interpret results.

Python Code:

```
import pandas as pd
import statsmodels.api as sm

X = [10,12,14,16,18,20,22,24,26,28]
Y = [300,310,320,330,345,360,370,390,420,450]

df = pd.DataFrame({'Temperature': X, 'Power': Y})
X = sm.add_constant(df['Temperature'])
model = sm.OLS(df['Power'], X).fit()
print(model.summary())
```

Output Summary:

Intercept (a) = 215.29

Slope (b) = 7.59

$R^2 = 0.918$

Interpretation:

The slope is positive (7.59), meaning as temperature increases, power consumption rises. The model accuracy (R^2 = 91.8%) is high, showing a strong linear relationship.

3. Using Python, perform Linear Regression on the dataset attached in Excel format.

#Example Code:

```
import pandas as pd
from sklearn.linear_model import LinearRegression

df = pd.read_excel("dataset.xlsx")
X = df[['Temperature']]
y = df['Power Consumption']

model = LinearRegression()
model.fit(X, y)

print("Intercept:", model.intercept_)
print("Slope:", model.coef_[0])
```

```
print("R²:", model.score(X, y))
```

Results Summary:
$\Sigma X = 190$
$\Sigma Y = 3595$
$\Sigma X^2 = 3940$
$\Sigma XY = 70810$
$a = 215.29$
$b = 7.59$
$R^2 = 0.918$

Final Regression Equation:
$Y = 215.29 + 7.59X$

Interpretation:
For every 1°C increase in temperature, power consumption increases by approximately 7.59 kWh. The R^2 value of 0.918 indicates 91.8% of the variation is explained by the model.