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# -*- coding: utf-8 -*-
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Robert Cocker - 1441
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DATA 3461 - Machine Learning
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Dr. Jawad
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2/14/2025
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Quiz 4
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# Quiz 4
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```
import numpy as np
```

```
import pandas as pd
```

```
import matplotlib.pyplot as plt
```

```
import statsmodels.api as sm
```

```
# Load input data
```

```
df = pd.read_csv("C:/Users/Robert/Desktop/longley.csv", index_col=0)
```

```
print(df)
```

```
# Correlation
```

```
print("Correlation Coefficient\n", np.corrcoef(df.Employed, df.GNP)[0,1])
```

```
x = df.Employed # predictor (independent variable)
```

```
y = df.GNP # response (dependent variable)
```

```
x = sm.add_constant(x) # adds constant term to predictor
```

```
# Linear Regression Model
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```
lr_model = sm.OLS(y,x).fit()
```

```
print(lr_model.summary())
```

```
# Predictions
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```
y_pred = lr_model.predict(x)
```

```
# Plot the data points and regression line
```

```
plt.figure(figsize=(8,6))
```

```
plt.scatter(df.Employed, df.GNP, color='blue', label='Actual Data') # Scatter plot of actual data
```

```
plt.plot(df.Employed, y_pred, color='red', linewidth=2, label='Regression Line') # Regression line
```

```
plt.xlabel("Employed Population")
```

```
plt.ylabel("Gross National Product (GNP)")
```

```
plt.title("Linear Regression: Employed vs. GNP")
```

```
plt.legend()
```

```
plt.grid(True)
```

```
plt.show()
```

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Inference:

We built a linear regression model with various Python libraries to predict gross national product based on the Employed feature/variable. The model outputs summary statistics and plots utilizing matplotlib

etc. About 97% of the model's variation is explained (via  $R^2$ , Adjusted  $R^2$ ) and there is statistical significance.

Based on initial observations, we can conclude that increasing employment leads to an increase in GNP based

on historical data. Further statistical inference and modeling can be done for a more robust model and conclusion.

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# References
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- Lecture, course materials

- ChatGPT

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