Assignment: Gym Protein Predictor

1. The Story

I am Maharaju and I have started going to the gym. I want to build muscle, but I need a clear measure of the protein I should consume daily. Instead of guessing or calculating it manually every time my weight changes, I want to use Machine Learning to predict the exact amount of protein required based on body weight.

2. What You Have (Data)

You have a dataset of standard body weights and their corresponding recommended protein intake:

- **Body Weight (kg):** The independent variable (Input)
- **Protein Intake (g):** The dependent variable (Target)

Body Weight (kg)	Protein Intake (g)
40	72
45	81
50	90
55	99
60	108
65	117
70	126

3. What You Need to Build

You need to build a **Linear Regression Model** that learns the relationship between weight and protein. Once built, the model should answer the question:

- **Question:** If Maharaju's current weight is **57 kg**, exactly how much protein should he take?

4. Your Task

1. **Load the data** using NumPy arrays.
2. **Visualize the relationship** (Create a scatter plot to see if weight and protein are related).
3. **Train a Linear Regression model** using Scikit-Learn.
4. **Visualize the Model Fit** (Draw the regression line over the data).
5. **Make a prediction** for the specific weight of 57kg.

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5. Solution Code

Python

```python
# Step 1: Import Libraries
import numpy as np
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression

# Step 2: Create the Dataset (Using NumPy Arrays)
# We use numpy arrays directly as requested
body_weight = np.array([40, 45, 50, 55, 60, 65, 70])
protein = np.array([72, 81, 90, 99, 108, 117, 126])

# Reshape X because sklearn requires a 2D array for features
X = body_weight.reshape(-1, 1)
y = protein

# Step 3: Train the Model
model = LinearRegression()
model.fit(X, y)

# Step 4: Visualize the Data
plt.figure(figsize=(8, 5))
plt.scatter(X, y, color='green', s=100, label='Actual Data')
plt.title('Body Weight vs Protein Intake (NumPy Data)', fontsize=14)
plt.xlabel('Body Weight (kg)', fontsize=12)
plt.ylabel('Protein Intake (g)', fontsize=12)
plt.grid(True, linestyle='--', alpha=0.6)
plt.show()
```
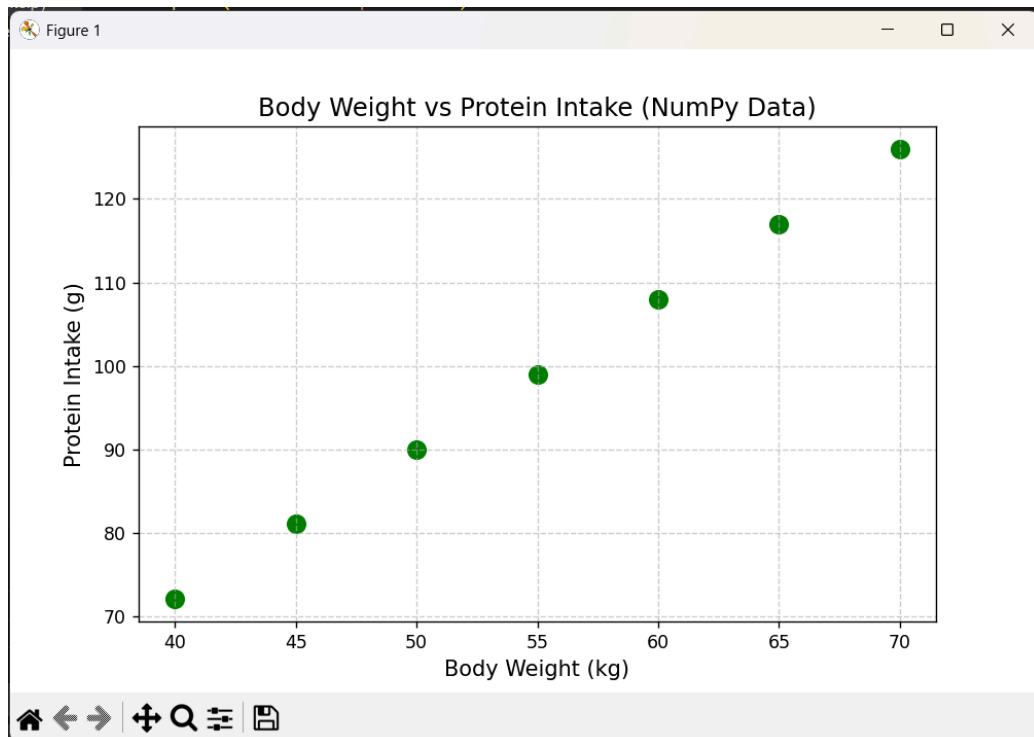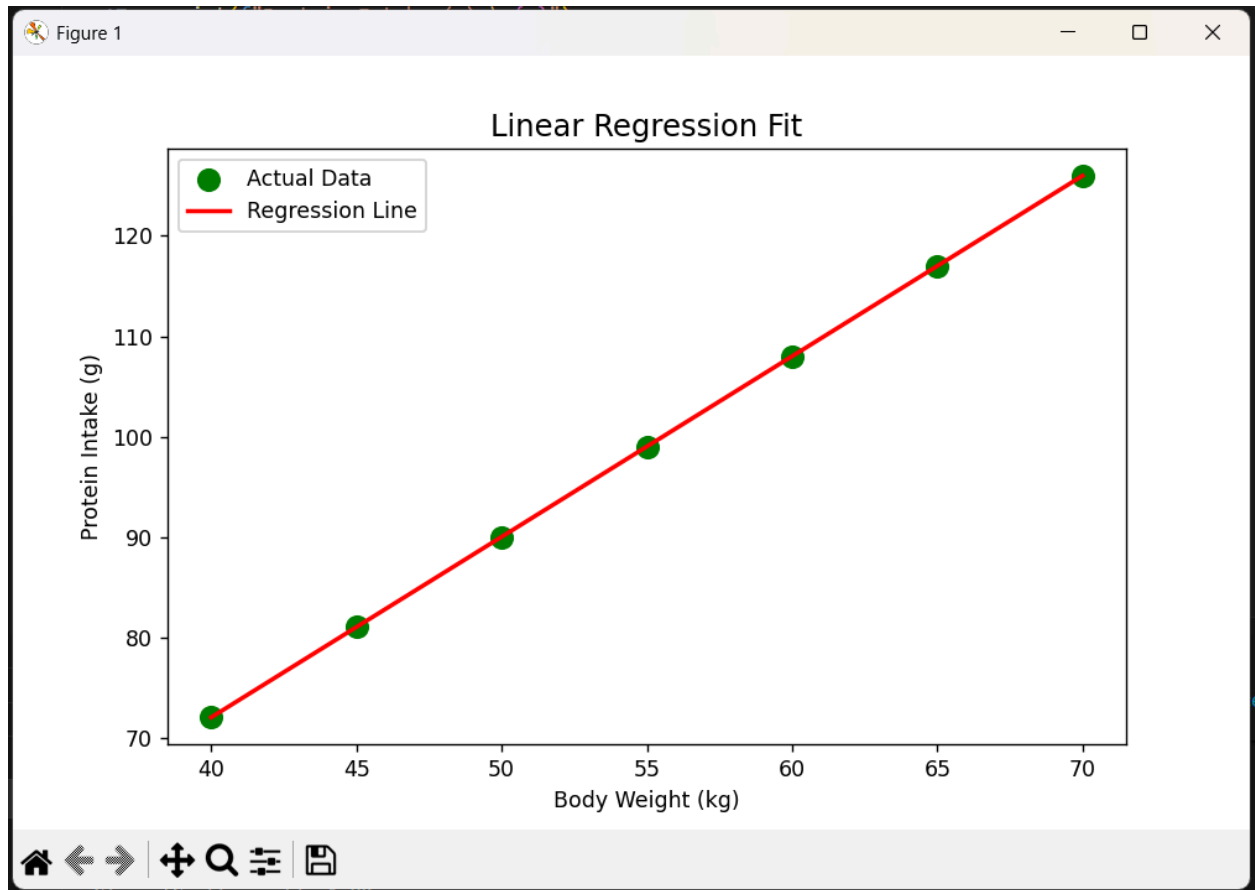
```python
# Step 5: Visualize the Regression Fit
plt.figure(figsize=(8, 5))
plt.scatter(X, y, color='green', s=100, label='Actual Data')
plt.plot(X, model.predict(X), color='red', linewidth=2, label='Regression Line')
plt.title('Linear Regression Fit', fontsize=14)
plt.xlabel('Body Weight (kg)')
plt.ylabel('Protein Intake (g)')
plt.legend()
plt.show()

# Step 6: Answer the Question (Predict for Maharaju)
new_weight = 57
predicted_protein = model.predict([[new_weight]])

print(f"\n--- Result for Maharaju ---")
print(f"Current Body Weight: {new_weight} kg")
print(f"Required Protein Intake: {predicted_protein[0]:.2f} grams")
```

6. Output Visualizations

Linear Regression Fit

7. Final Prediction

--- Result for Maharaju ---
Current Body Weight: 57 kg
Required Protein Intake: 102.60 grams