**✈️ Module 1: Flight Data Analysis – Full Python Code**

**🔧 Step 1: Import Libraries and Load Dataset**

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

# Load dataset

df = pd.read\_csv("air\_arabia\_flight\_operations\_data.csv")

# Show first few rows

print(df.head())

**📊 Step 2: Clean & Inspect Data**

# Check for null values and data types

print(df.info())

# Describe numeric columns

print(df.describe())

**📌 Step 3: Insight 1 - Average Fuel Consumption Per Route**

# Calculate average actual fuel per route

route\_fuel = df.groupby('Route')['ActualFuel\_kg'].mean().reset\_index().sort\_values(by='ActualFuel\_kg', ascending=False)

# Plot

plt.figure(figsize=(10,6))

sns.barplot(data=route\_fuel, x='ActualFuel\_kg', y='Route', palette='viridis')

plt.title('Average Fuel Consumption per Route')

plt.xlabel('Avg Fuel Burn (kg)')

plt.ylabel('Route')

plt.tight\_layout()

plt.show()

**✈️ Step 4: Insight 2 - Fuel Burn per Aircraft Type**

# Compare actual fuel burned per aircraft type

aircraft\_fuel = df.groupby('AircraftType')['ActualFuel\_kg'].mean().reset\_index()

# Plot

plt.figure(figsize=(6,4))

sns.barplot(data=aircraft\_fuel, x='AircraftType', y='ActualFuel\_kg', palette='Set2')

plt.title('Fuel Burn by Aircraft Type (A320 vs A321)')

plt.xlabel('Aircraft Type')

plt.ylabel('Avg Fuel Burn (kg)')

plt.tight\_layout()

plt.show()

**📦 Step 5: Insight 3 - Fuel Consumption vs Payload**

# Scatter plot: Payload vs Actual Fuel

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

sns.scatterplot(data=df, x='Payload\_kg', y='ActualFuel\_kg', hue='AircraftType', alpha=0.7)

plt.title('Fuel Consumption vs Payload')

plt.xlabel('Payload (kg)')

plt.ylabel('Fuel Burn (kg)')

plt.tight\_layout()

plt.show()

**👥 Step 6: Fuel Consumption vs Passenger Load**

# Scatter plot: Passenger Count vs Actual Fuel

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

sns.scatterplot(data=df, x='PassengerCount', y='ActualFuel\_kg', hue='AircraftType', alpha=0.7)

plt.title('Fuel Consumption vs Passenger Count')

plt.xlabel('Passenger Count')

plt.ylabel('Fuel Burn (kg)')

plt.tight\_layout()

plt.show()

**📈 Correlation Check**

# Check correlations

correlation = df[['ActualFuel\_kg', 'Payload\_kg', 'PassengerCount']].corr()

print(correlation)

# Heatmap

plt.figure(figsize=(6,4))

sns.heatmap(correlation, annot=True, cmap='coolwarm')

plt.title('Correlation between Fuel, Payload, and Passenger Load')

plt.tight\_layout()

plt.show()

**✅ Summary of Insights:**

* Routes with the highest average fuel burn
* A321 generally burns more fuel than A320
* Fuel burn increases with payload and passenger count