Assignment 3

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Artificial Intelligence and Machine Learning (Evening Slot)

```
#Task 1
print("The dataset is downloaded and loaded in task 2")
```

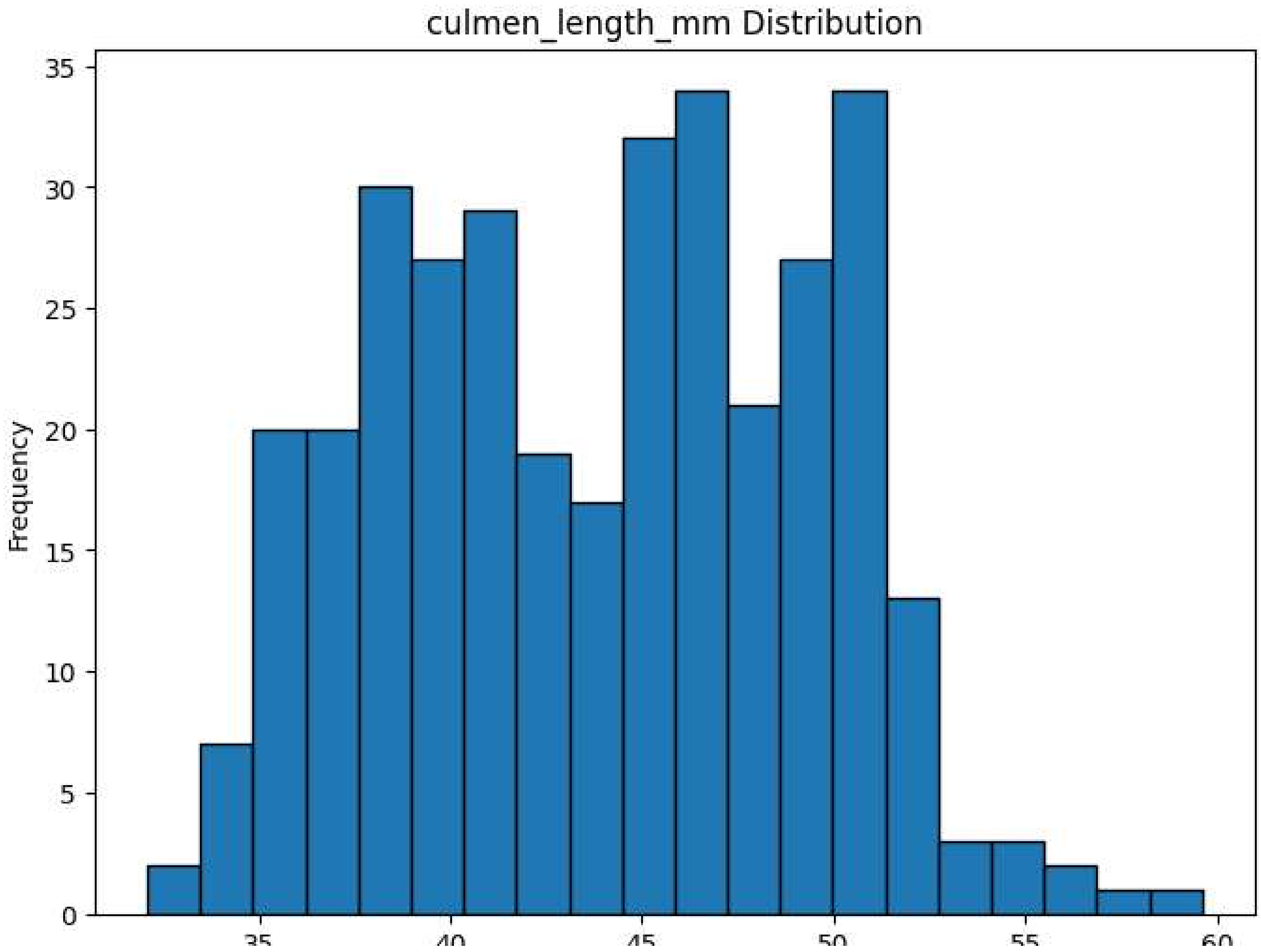
```
The dataset is downloaded and loaded in task 2
```

```
#Task 2
import pandas as pd
df = pd.read_csv('penguins_size.csv')
```

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

```
#Task 3
#Univariate
numerical_vars = ['culmen_length_mm']
for var in numerical_vars:
    summary_stats = df[var].describe()
    print(f"Summary Statistics for {var}:\n{summary_stats}\n")
    plt.figure(figsize=(8, 6))
    plt.hist(df[var], bins=20, edgecolor='k')
    plt.xlabel(var)
    plt.ylabel('Frequency')
    plt.title(f'{var} Distribution')
    plt.show()
```

```
Summary Statistics for culmen_length_mm:
count    342.000000
mean      43.921930
std        5.459584
min       32.100000
25%       39.225000
50%       44.450000
75%       48.500000
max       59.600000
Name: culmen_length_mm, dtype: float64
```



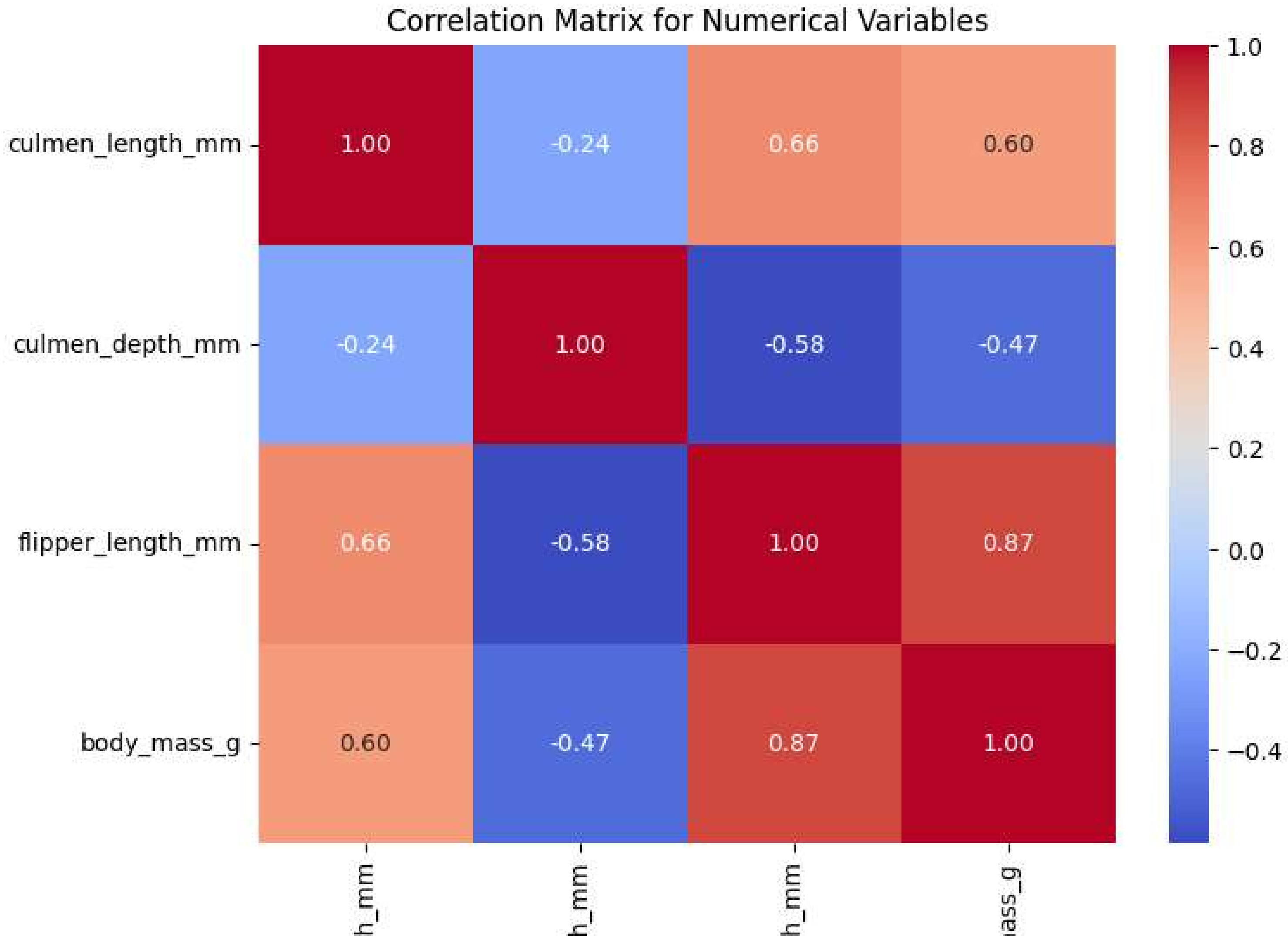
```
#Bi-variate
categorical_vars = ['species', 'island', 'sex']
for var1 in categorical_vars:
    for var2 in categorical_vars:
        if var1 != var2:
            cross_tab = pd.crosstab(df[var1], df[var2])
            print(f"Cross-tabulation between {var1} and {var2}:\n{cross_tab}\n")
```

```
Cross-tabulation between species and island:
island     Biscoe  Dream  Torgersen
species
Adelie         44     56         52
Chinstrap       0     68          0
Gentoo        124      0          0

Cross-tabulation between species and sex:
sex        .  FEMALE  MALE
species
Adelie     0      73    73
Chinstrap  0      34    34
Gentoo     1      58    61

Cross-tabulation between island and species:
species    Adelie  Chinstrap  Gentoo
island
Biscoe         44          0     124
Dream          56         68       0
Torgersen      52          0       0

Cross-tabulation between island and sex:
sex        .  FEMALE  MALE
island
Biscoe     1      80    83
Dream      0      61    62
Torgersen  0      24    23

Cross-tabulation between sex and species:
species  Adelie  Chinstrap  Gentoo
sex
.             0          0       1
FEMALE       73         34      58
MALE         73         34      61

Cross-tabulation between sex and island:
island  Biscoe  Dream  Torgersen
sex
.            1      0          0
FEMALE      80     61         24
MALE        83     62         23
```

```
import seaborn as sns
```

```
numerical_vars = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
```

```
#Multivariate
correlation_matrix = df[numerical_vars].corr()
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f")
plt.title('Correlation Matrix for Numerical Variables')
plt.show()
```



```
#Task 4
import pandas as p
numerical_vars = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
descriptive_stats = df[numerical_vars].describe()
print(descriptive_stats)
```

```
       culmen_length_mm  culmen_depth_mm  flipper_length_mm  body_mass_g
count        342.000000       342.000000         342.000000   342.000000
mean          43.921930        17.151170         200.915205  4201.754386
std            5.459584         1.974793          14.061714   801.954536
min           32.100000        13.100000         172.000000  2700.000000
25%           39.225000        15.600000         190.000000  3550.000000
50%           44.450000        17.300000         197.000000  4050.000000
75%           48.500000        18.700000         213.000000  4750.000000
max           59.600000        21.500000         231.000000  6300.000000
```

```
#Task 5
import pandas as pd
import numpy as np
missing_values = df.isnull().sum()
columns_with_missing = missing_values[missing_values > 0]
print("Columns with missing values:")
print(columns_with_missing)
df_cleaned = df.dropna()
df['culmen_length_mm'].fillna(df['culmen_length_mm'].mean(), inplace=True)
df['culmen_depth_mm'].fillna(df['culmen_depth_mm'].mean(), inplace=True)
df['flipper_length_mm'].fillna(df['flipper_length_mm'].mean(), inplace=True)
df['body_mass_g'].fillna(df['body_mass_g'].mean(), inplace=True)
remaining_missing = df.isnull().sum().sum()
print("\nRemaining missing values:", remaining_missing)
```

```
Columns with missing values:
culmen_length_mm      2
culmen_depth_mm       2
flipper_length_mm     2
body_mass_g           2
sex                  10
dtype: int64

Remaining missing values: 10
```

```
#Task 6
import pandas as pd
import numpy as np
from scipy import stats
numerical_vars = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
z_threshold = 3
df_no_outliers = df.copy()
for var in numerical_vars:
    z_scores = np.abs(stats.zscore(df[var]))
    outliers = z_scores > z_threshold
    df_no_outliers[var][outliers] = np.nan
df_no_outliers_cleaned = df_no_outliers.dropna()
outliers_removed = df.shape[0] - df_no_outliers_cleaned.shape[0]
print("Number of outliers removed:", outliers_removed)
```

```
Number of outliers removed: 10
<ipython-input-14-1e66641b7f66>:11: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df_no_outliers[var][outliers] = np.nan
```

```
#Task 7
import pandas as pd
from scipy.stats import chi2_contingency
target_variable = 'species'
independent_variables = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
for var in independent_variables:
    contingency_table = pd.crosstab(df[target_variable], df[var])
    chi2, p, dof, expected = chi2_contingency(contingency_table)
    print(f"Chi-squared test results for {var}:")
    print(f"Chi-squared statistic: {chi2}")
    print(f"P-value: {p}")
    print()
```

```
Chi-squared test results for culmen_length_mm:
Chi-squared statistic: 470.5338593162223
P-value: 3.868884352428073e-07

Chi-squared test results for culmen_depth_mm:
```

```
Chi-squared statistic: 379.9739448241096
P-value: 6.137713516463007e-20

Chi-squared test results for flipper_length_mm:
Chi-squared statistic: 382.2373661501773
P-value: 9.294963538872332e-32

Chi-squared test results for body_mass_g:
Chi-squared statistic: 367.89770778147147
P-value: 9.265117412024159e-14
```

```
#Task 8
import pandas as pd
categorical_columns = ['island', 'sex']
df_encoded = pd.get_dummies(df, columns=categorical_columns, drop_first=True)
```

```
#Task 9
import pandas as pd
independent_variables = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
dependent_variable = 'species'
X = df[independent_variables]
y = df[dependent_variable]
```

```
#Task 10
import pandas as pd
from sklearn.preprocessing import StandardScaler
independent_variables = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
X = df[independent_variables]
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

```
#Task 11
import pandas as pd
from sklearn.model_selection import train_test_split
independent_variables = ['culmen_length_mm', 'culmen_depth_mm', 'flipper_length_mm', 'body_mass_g']
dependent_variable = 'species'
X = df[independent_variables]
y = df[dependent_variable]
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
#Task 12
import numpy as np
print("Training data - Features shape:", X_train.shape)
print("Testing data - Features shape:", X_test.shape)
print("Training data - Target shape:", y_train.shape)
print("Testing data - Target shape:", y_test.shape)
```

```
Training data - Features shape: (275, 4)
Testing data - Features shape: (69, 4)
Training data - Target shape: (275,)
Testing data - Target shape: (69,)
```

```
#Accuracy Predictions
#Accuracy Values Generation
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_s
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
model = LogisticRegression(random_state=42)
model.fit(X_train_scaled, y_train)
y_train_pred = model.predict(X_train_scaled)
y_test_pred = model.predict(X_test_scaled)
train_accuracy = accuracy_score(y_train, y_train_pred)
print("Training Accuracy:", train_accuracy)
test_accuracy = accuracy_score(y_test, y_test_pred)
print("Testing Accuracy:", test_accuracy)
```

```
Training Accuracy: 0.9890909090909091
Testing Accuracy: 0.9710144927536232
```

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