```
#import necessary libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

#Load the dataset
df = pd.read_csv('Credit Score Classification Dataset.csv')
df.head()
```

```
   Age  Gender  Income            Education Marital Status  \
0   25  Female   50000    Bachelor's Degree         Single
1   30    Male  100000      Master's Degree        Married
2   35  Female   75000            Doctorate        Married
3   40    Male  125000  High School Diploma         Single
4   45  Female  100000    Bachelor's Degree        Married

   Number of Children Home Ownership Credit Score
0                   0         Rented         High
1                   2          Owned         High
2                   1          Owned         High
3                   0          Owned         High
4                   3          Owned         High
```

Exploratory Data Analysis (EDA)

```
df.isnull().sum()
```

```
Age                   0
Gender                0
Income                0
Education             0
Marital Status        0
Number of Children    0
Home Ownership        0
Credit Score          0
dtype: int64
```

```
df.shape
```

```
(164, 8)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 164 entries, 0 to 163
Data columns (total 8 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
```

```
 0   Age                  164 non-null    int64
 1   Gender               164 non-null    object
 2   Income               164 non-null    int64
 3   Education            164 non-null    object
 4   Marital Status       164 non-null    object
 5   Number of Children   164 non-null    int64
 6   Home Ownership       164 non-null    object
 7   Credit Score         164 non-null    object
dtypes: int64(3), object(5)
memory usage: 10.4+ KB
```

```
df.describe()
```

```
               Age         Income  Number of Children
count  164.000000     164.000000          164.000000
mean    37.975610   83765.243902            0.652439
std      8.477289   32457.306728            0.883346
min     25.000000   25000.000000            0.000000
25%     30.750000   57500.000000            0.000000
50%     37.000000   83750.000000            0.000000
75%     45.000000  105000.000000            1.000000
max     53.000000  162500.000000            3.000000
```

```
df.columns
```

```
Index(['Age', 'Gender', 'Income', 'Education', 'Marital Status',
       'Number of Children', 'Home Ownership', 'Credit Score'],
      dtype='object')
```

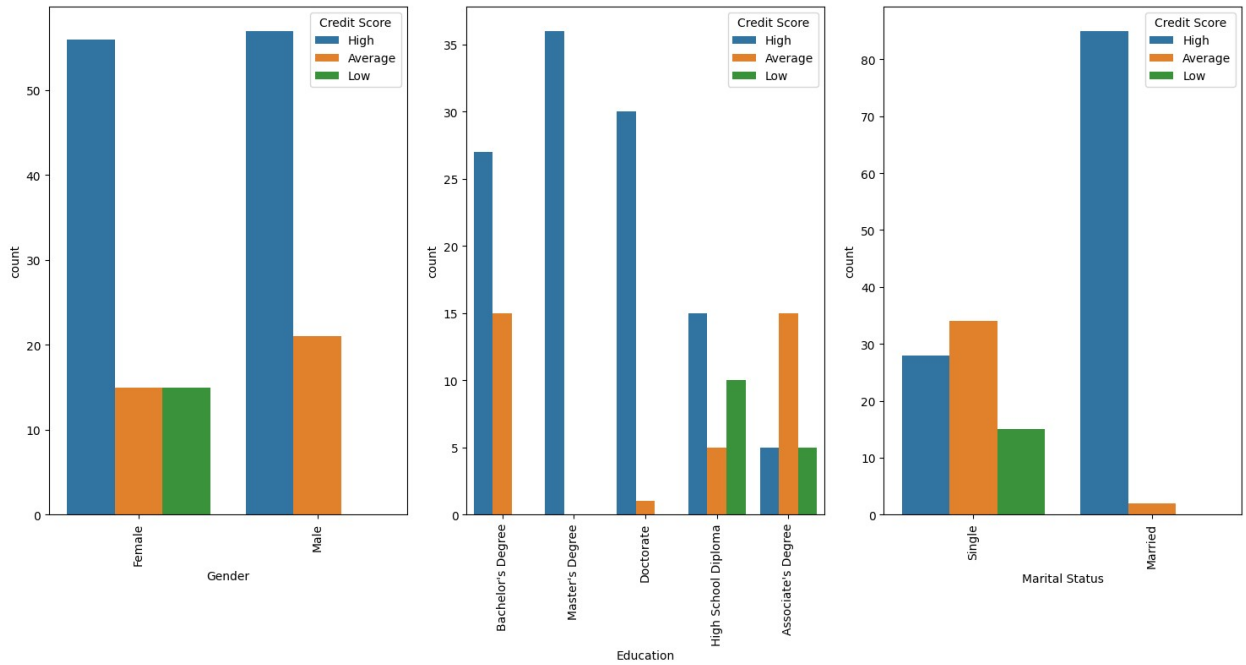
```
# printing the unique values in all the columns

categorial_features_list = ["Gender", "Education", "Marital
Status","Home Ownership","Credit Score"]

for col in df.columns:
  if col  in categorial_features_list:
    print(col, df[col].unique())
    print("-"*50)
```

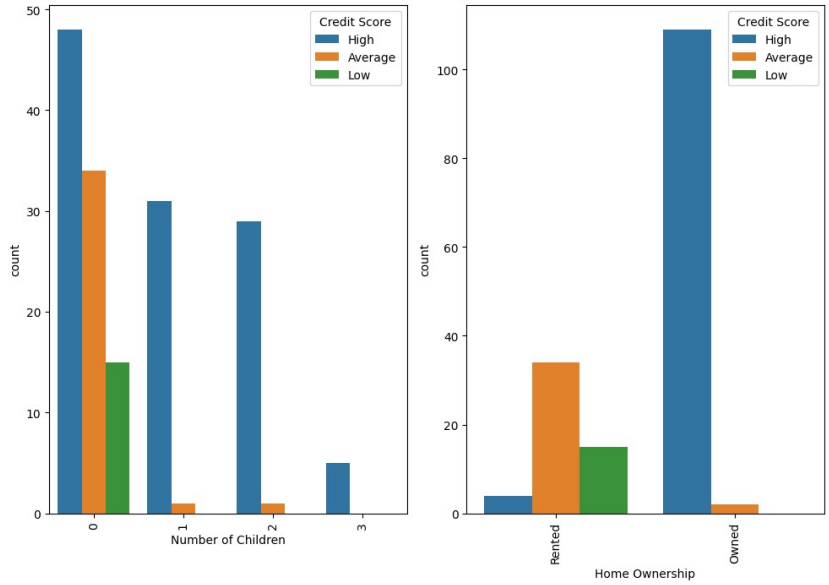
```
Gender ['Female' 'Male']
--------------------------------------------------
Education ["Bachelor's Degree" "Master's Degree" 'Doctorate' 'High
School Diploma'
 "Associate's Degree"]
--------------------------------------------------
Marital Status ['Single' 'Married']
--------------------------------------------------
Home Ownership ['Rented' 'Owned']
--------------------------------------------------
Credit Score ['High' 'Average' 'Low']
--------------------------------------------------
```

```python
# checking the class distribution of target column
print(df["Credit Score"].value_counts())
```

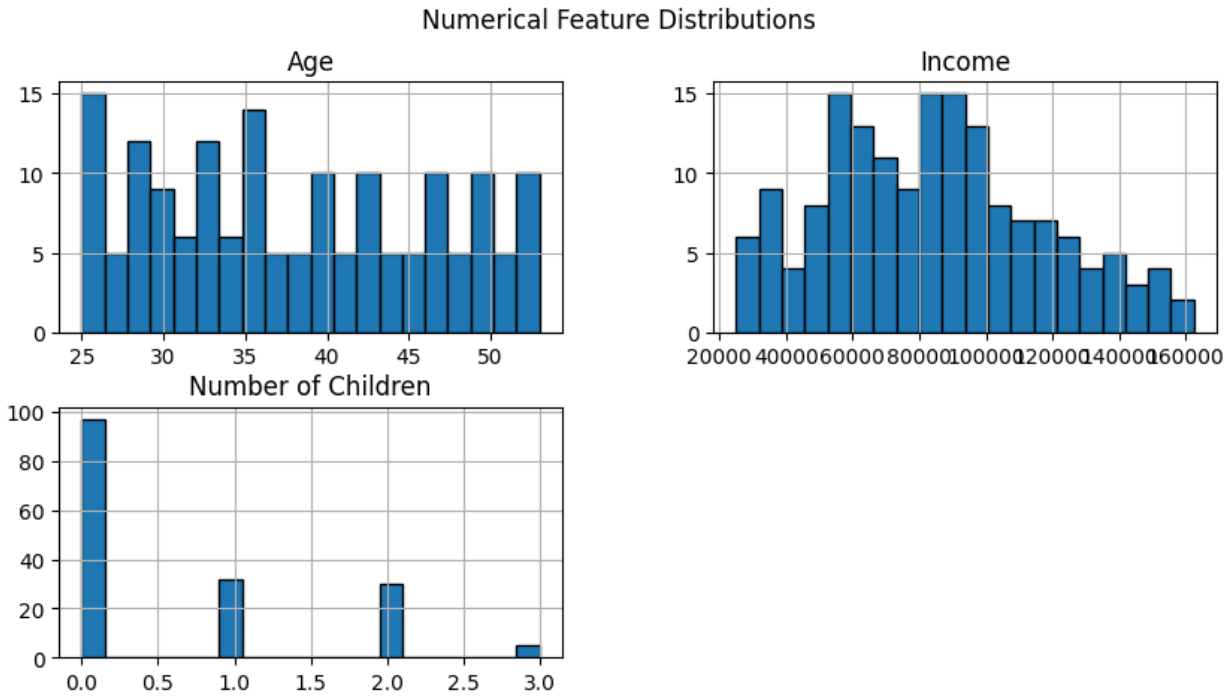
```
Credit Score
High       113
Average     36
Low         15
Name: count, dtype: int64
```

```python
# list of categorical variables to plot
cat_vars = ['Gender', 'Education', 'Marital Status', 'Number of
Children', 'Home Ownership']

# create figure with subplots
fig, axs = plt.subplots(nrows=2, ncols=3, figsize=(15, 15))
axs = axs.flatten()

# create barplot for each categorical variable
for i, var in enumerate(cat_vars):
    sns.countplot(x=var, hue='Credit Score', data=df, ax=axs[i])
    plt.setp(axs[i].get_xticklabels(), rotation=90)  # This is the
corrected way to rotate labels

# adjust spacing between subplots
fig.tight_layout()

# remove the sixth subplot
fig.delaxes(axs[5])

# show plot
plt.show()
```

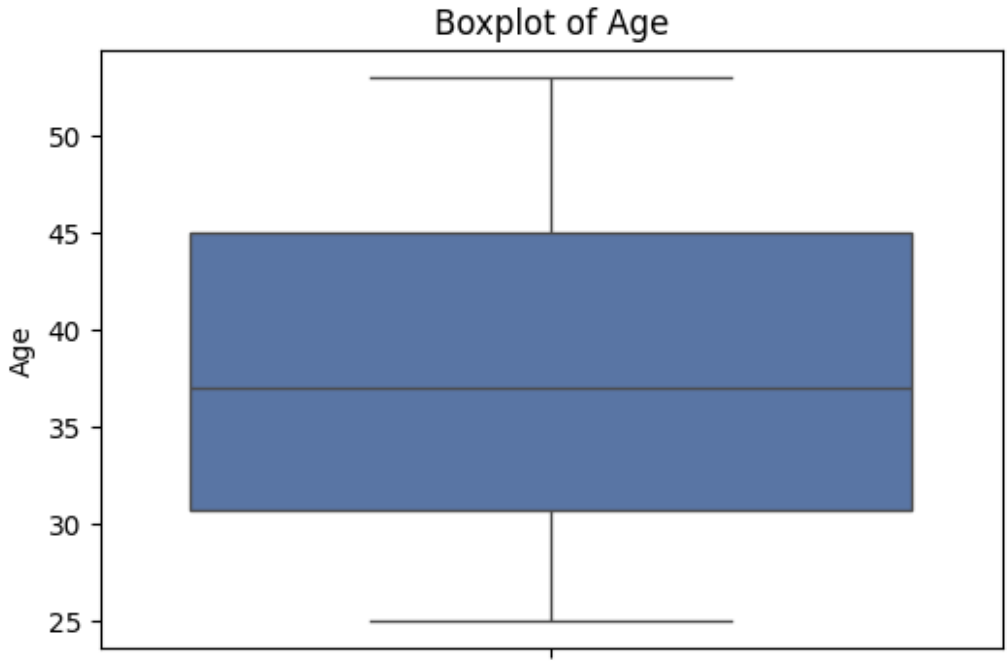


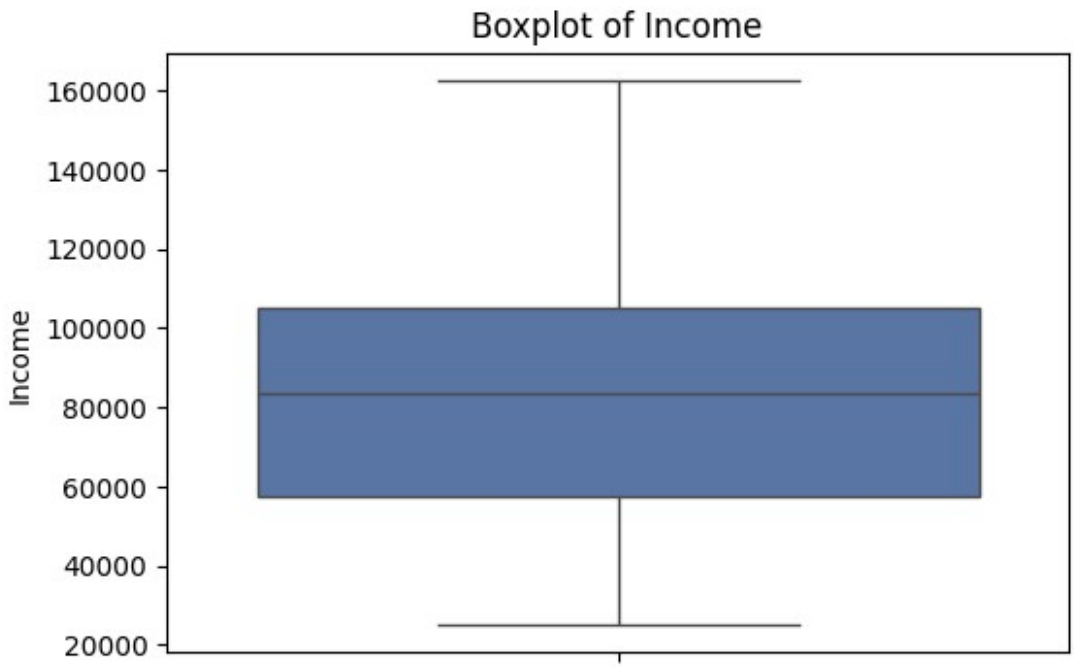


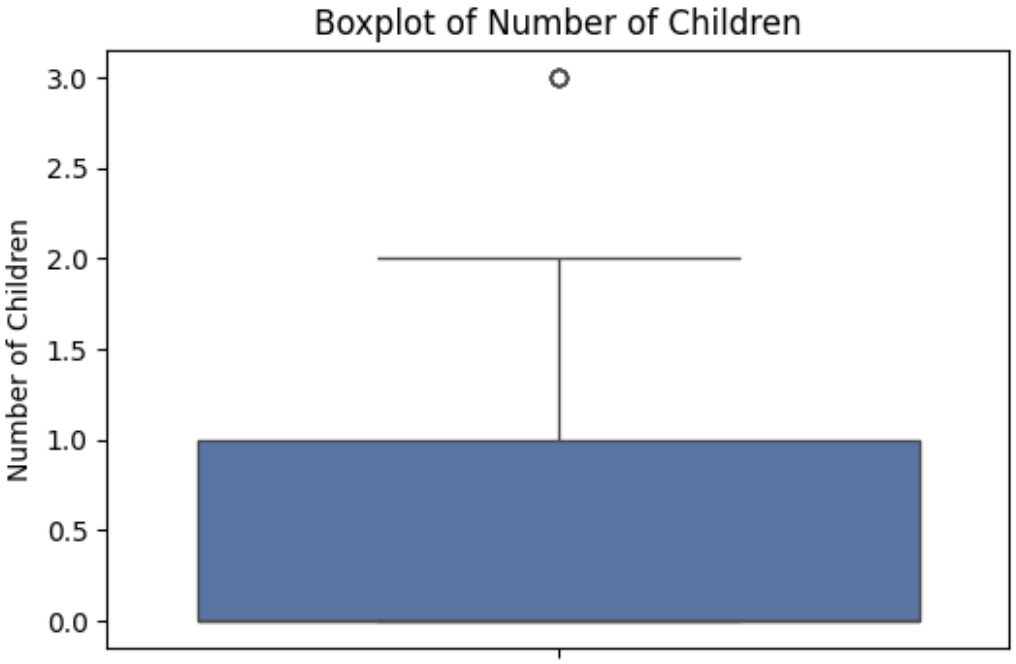

```
# Distribution of numerical features
numerical_features = ['Age', 'Income', 'Number of Children']
df[numerical_features].hist(figsize=(10, 5), bins=20,
edgecolor="black")
plt.suptitle("Numerical Feature Distributions")
plt.show()
```




```
# Boxplots for detecting outliers
for col in numerical_features:
    plt.figure(figsize=(6, 4))
    sns.boxplot(y=df[col], color='#4C72B0')  # Using a single color
instead of palette
    plt.title(f"Boxplot of {col}")
    plt.show()
```







Data Preprocessing

```
#Check missing value
check_missing = df.isnull().sum() * 100 / df.shape[0]
check_missing[check_missing > 0].sort_values(ascending=False)
```

```
Series([], dtype: float64)
```

** Label Encoding for object datatypes **

```
# identifying columns with object data type
object_columns = df.select_dtypes(include="object").columns

print(object_columns)
```

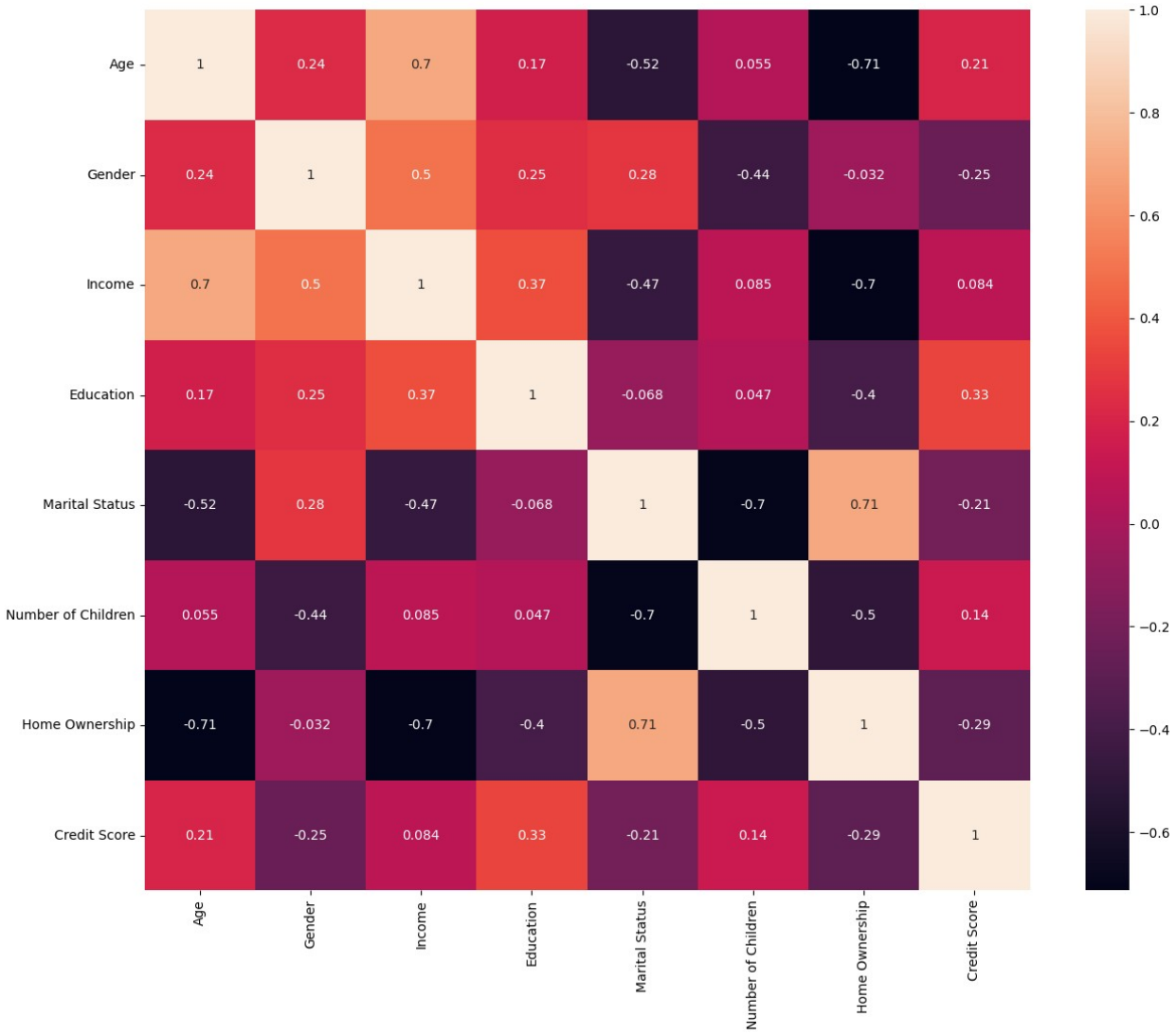
```
Index(['Gender', 'Education', 'Marital Status', 'Home Ownership',
       'Credit Score'],
      dtype='object')
```

```
from sklearn.preprocessing import LabelEncoder
# initialize a dictionary to save the encoders
encoders = {}

# apply label encoding and store the encoders
for column in object_columns:
  label_encoder = LabelEncoder()
  df[column] = label_encoder.fit_transform(df[column])
  encoders[column] = label_encoder

encoders
```

```
{'Gender': LabelEncoder(),
 'Education': LabelEncoder(),
 'Marital Status': LabelEncoder(),
 'Home Ownership': LabelEncoder(),
 'Credit Score': LabelEncoder()}
```

```
#Correlation Heatmap
plt.figure(figsize=(15,12))
sns.heatmap(df.corr(), fmt='.2g', annot=True)
```

```
<Axes: >
```



Train Test Split

```
X = df.drop('Credit Score', axis=1)
y = df['Credit Score']

from sklearn.model_selection import train_test_split
# split training and test data
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)

print(y_train.shape)

(131,)

print(y_train.value_counts())
```

```
Credit Score
1    90
0    31
2    10
Name: count, dtype: int64
```

Decision Tree

```
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import GridSearchCV
dtree = DecisionTreeClassifier(class_weight='balanced')
param_grid = {
    'max_depth': [3, 4, 5, 6, 7, 8],
    'min_samples_split': [2, 3, 4],
    'min_samples_leaf': [1, 2, 3, 4],
    'random_state': [0, 42]
}

# Perform a grid search with cross-validation to find the best
hyperparameters
grid_search = GridSearchCV(dtree, param_grid, cv=5)
grid_search.fit(X_train, y_train)

# Print the best hyperparameters
print(grid_search.best_params_)
```

```
{'max_depth': 3, 'min_samples_leaf': 1, 'min_samples_split': 2,
'random_state': 0}
```

```
from sklearn.tree import DecisionTreeClassifier
dtree = DecisionTreeClassifier(random_state=0, max_depth=3,
min_samples_leaf=1, min_samples_split=2, class_weight='balanced')
dtree.fit(X_train, y_train)
```

```
DecisionTreeClassifier(class_weight='balanced', max_depth=3,
random_state=0)
```

```
from sklearn.metrics import accuracy_score
y_pred = dtree.predict(X_test)
print("Accuracy Score :", round(accuracy_score(y_test,
y_pred)*100 ,2), "%")
```

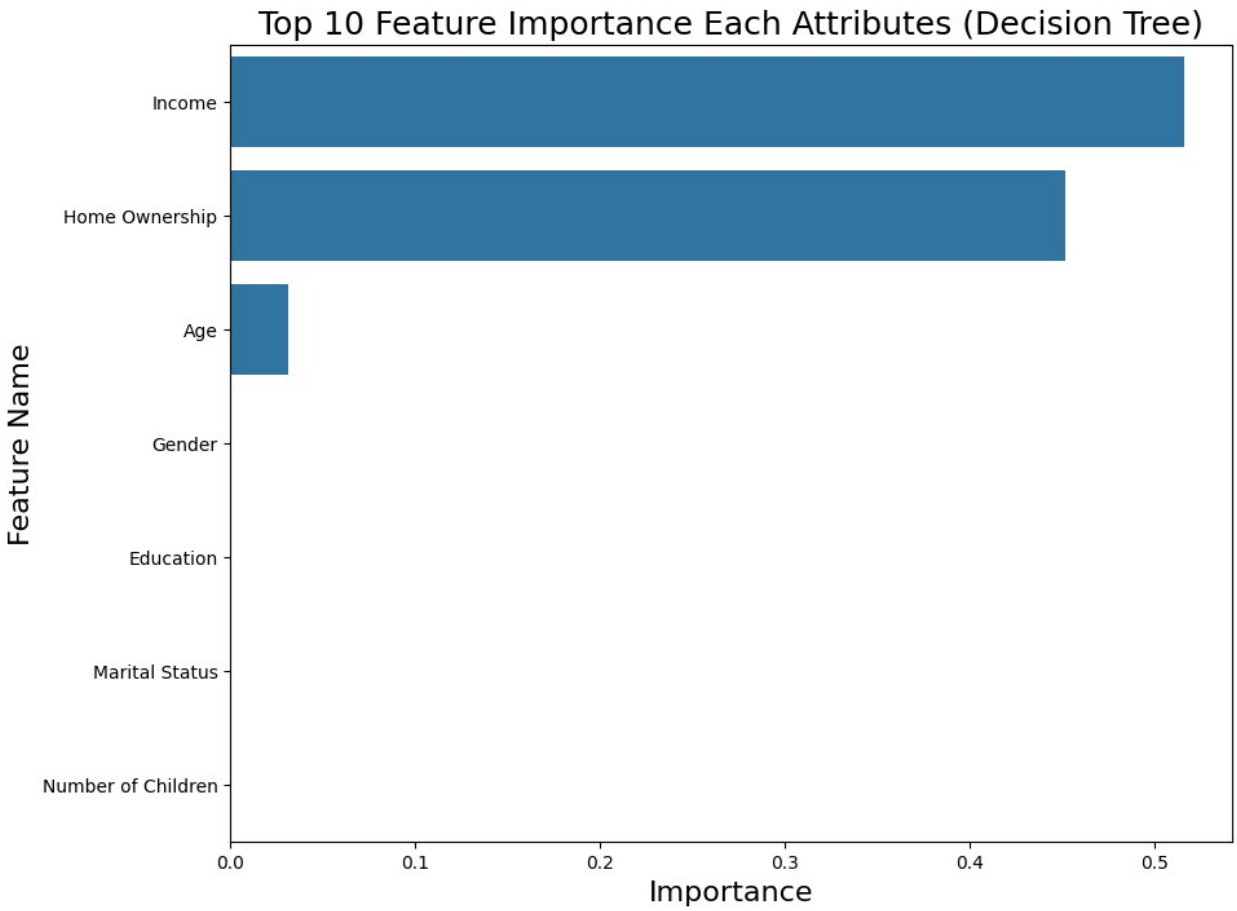
```
Accuracy Score : 96.97 %
```

```
from sklearn.metrics import accuracy_score, f1_score, precision_score,
recall_score, jaccard_score
print('F-1 Score : ',(f1_score(y_test, y_pred, average='micro')))
print('Precision Score : ',(precision_score(y_test, y_pred,
average='micro')))
```

```
print('Recall Score : ',(recall_score(y_test, y_pred,
average='micro')))
print('Jaccard Score : ',(jaccard_score(y_test, y_pred,
average='micro')))
```

```
F-1 Score :  0.9696969696969697
Precision Score :  0.9696969696969697
Recall Score :  0.9696969696969697
Jaccard Score :  0.9411764705882353
```

```
imp_df = pd.DataFrame({
    "Feature Name": X_train.columns,
    "Importance": dtree.feature_importances_
})
fi = imp_df.sort_values(by="Importance", ascending=False)

fi2 = fi.head(10)
plt.figure(figsize=(10,8))
sns.barplot(data=fi2, x='Importance', y='Feature Name')
plt.title('Top 10 Feature Importance Each Attributes (Decision Tree)',
fontsize=18)
plt.xlabel ('Importance', fontsize=16)
plt.ylabel ('Feature Name', fontsize=16)
plt.show()
```




```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(5,5))
sns.heatmap(data=cm,linewidths=.5, annot=True,  cmap = 'Blues')
plt.ylabel('Actual label')
plt.xlabel('Predicted label')
all_sample_title = 'Accuracy Score for Decision Tree:
{0}'.format(dtree.score(X_test, y_test))
plt.title(all_sample_title, size = 15)
```

```
Text(0.5, 1.0, 'Accuracy Score for Decision Tree: 0.9696969696969697')
```

Accuracy Score for Decision Tree: 0.9696969696969697