PART A (telco churn analysis)

```
This code reads the dataset, splits it into training and test sets, builds
Decision Tree and Logistic Regression models, and performs 10-fold cross-
validation. It also calculates and reports the accuracy for each fold,
average accuracy, and standard deviation.
```

In [70]:
```
# !pip install scikit-learn pandas//You can install scikit-learn and pandas us
!pip install openpyxl
```

```
Requirement already satisfied: openpyxl in c:\users\n\anaconda3\lib\site-pack
ages (3.0.9)
Requirement already satisfied: et-xmlfile in c:\users\n\anaconda3\lib\site-pa
ckages (from openpyxl) (1.1.0)
```

In [71]:
```
#Import all the required libraries
import pandas as pd
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.tree import DecisionTreeClassifier
from sklearn.linear_model import LogisticRegression
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
print("All librares imported successfully!")
```

```
All librares imported successfully!
```

In [72]:
```

# Load the dataset
# file_path = "C://Users//n//Downloads//churn2.numbers" # Replace with your da
# df = pd.read_csv(file_path, sep='\t')  # Adjust the delimiter if needed

df = pd.read_excel('C://Users//n//Downloads//churn2 (1).xls')
```

In [73]:
```
df.head()
```

Out[73]:

	churn2	Unnamed: 1	Unnamed: 2	Unnamed: 3	Unnamed: 4	Unnamed: 5	
0	COLLEGE	INCOME	OVERAGE	LEFTOVER	HOUSE	HANDSET_PRICE	OVER_15MINS_CA
1	zero	31953	0	6	313378	161	
2	one	36147	0	13	800586	244	
3	one	27273	230	0	305049	201	
4	zero	120070	38	33	788235	780	

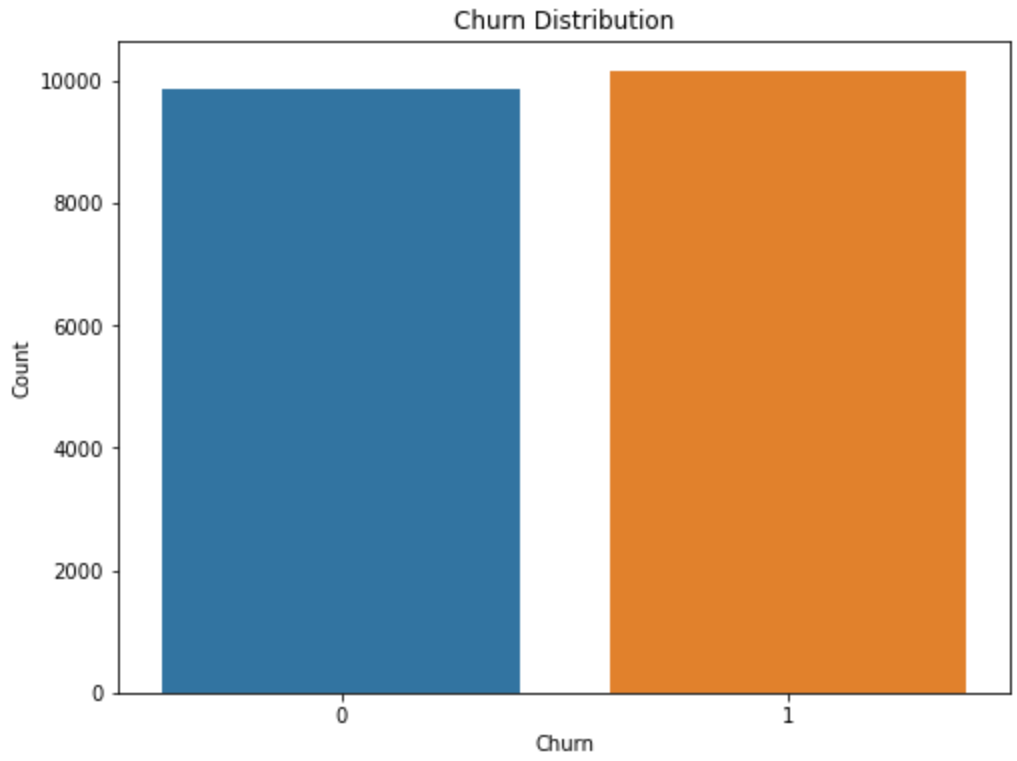
In [74]:
```
df.tail()
```

Out[74]:

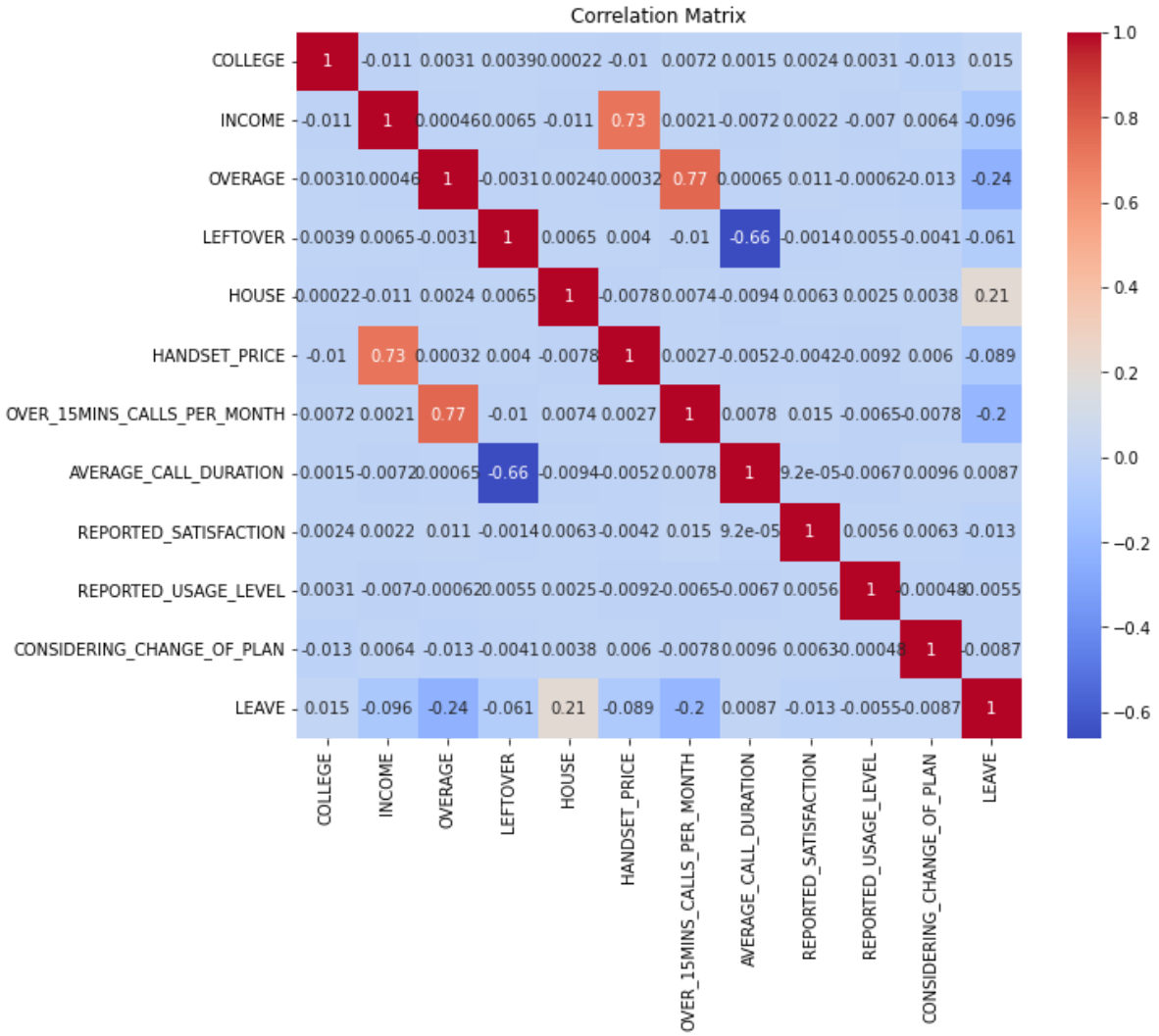
	churn2	Unnamed: 1	Unnamed: 2	Unnamed: 3	Unnamed: 4	Unnamed: 5	Unnamed: 6	Unnamed: 7	U
19996	zero	153252	0	23	368403	597	1	6	
19997	one	107126	71	82	237397	609	5	2	
19998	zero	78529	0	66	172589	275	0	2	
19999	zero	78674	47	41	572406	288	4	2	v
20000	zero	124697	0	0	845575	808	24	14	

BASIC EDA AND VISUALIZATIONS

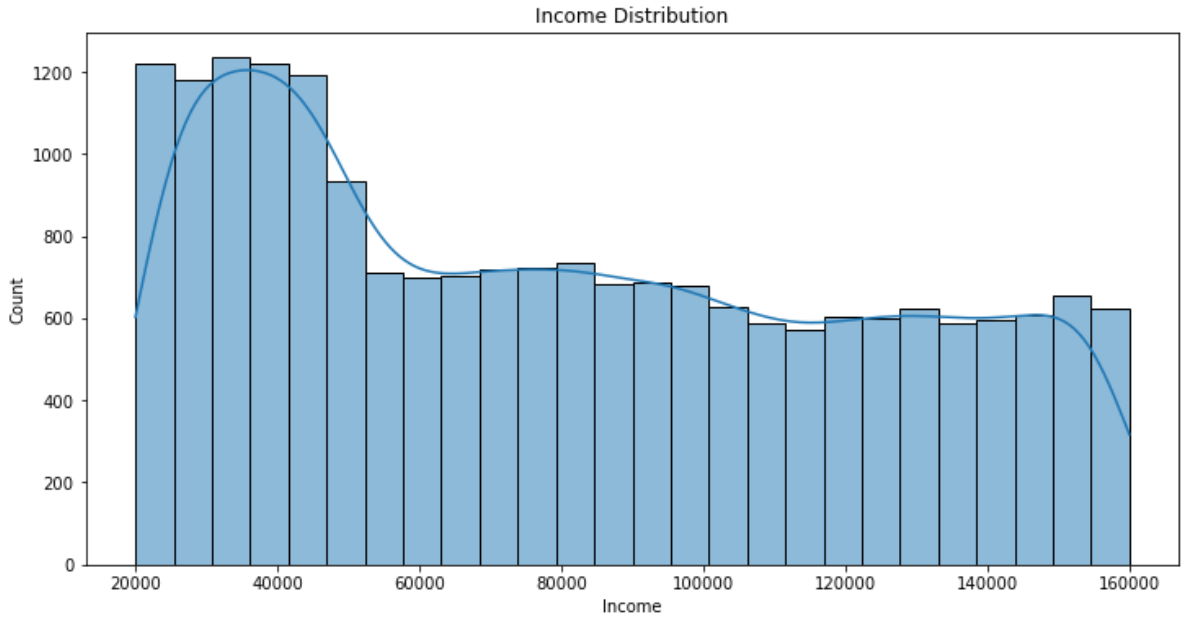
In [75]:
```
# Distribution of Churn (Target Variable)
# countplot to visualize the distribution of customers who left (churned) and 
plt.figure(figsize=(8, 6))
sns.countplot(data=data, x='LEAVE')
plt.title('Churn Distribution')
plt.xlabel('Churn')
plt.ylabel('Count')
plt.show()
```



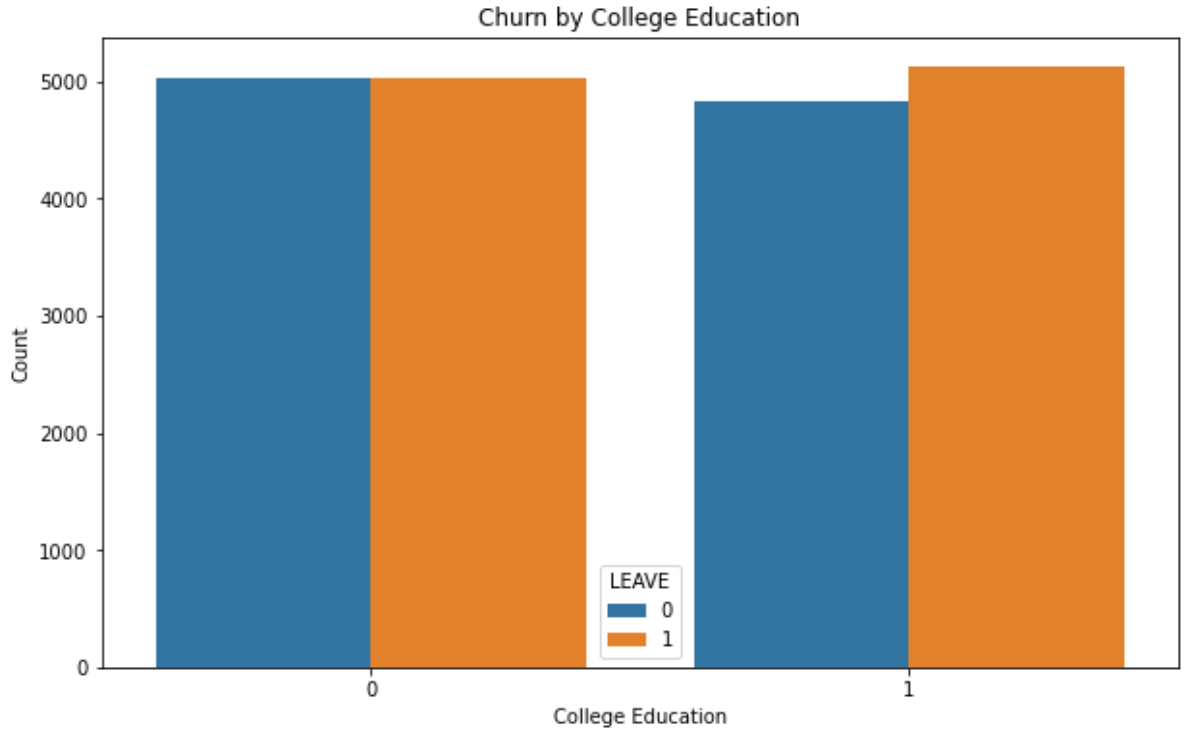
In [76]:
```
# Correlation Matrix
# To understand the relationships between variables, create a correlation matr
correlation_matrix = data.corr()
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()
```



In [77]:
```
# Distribution of Numeric Features
# Histograms to visualize the distribution of numeric features like 'INCOME',
plt.figure(figsize=(12, 6))
sns.histplot(data=data, x='INCOME', kde=True)
plt.title('Income Distribution')
plt.xlabel('Income')
plt.ylabel('Count')
plt.show()
```



In [78]:
```
# Categorical Features
# For categorical features like 'COLLEGE' or 'CONSIDERING_CHANGE_OF_PLAN', cou
plt.figure(figsize=(10, 6))
sns.countplot(data=data, x='COLLEGE', hue='LEAVE')
plt.title('Churn by College Education')
plt.xlabel('College Education')
plt.ylabel('Count')
plt.show()
```



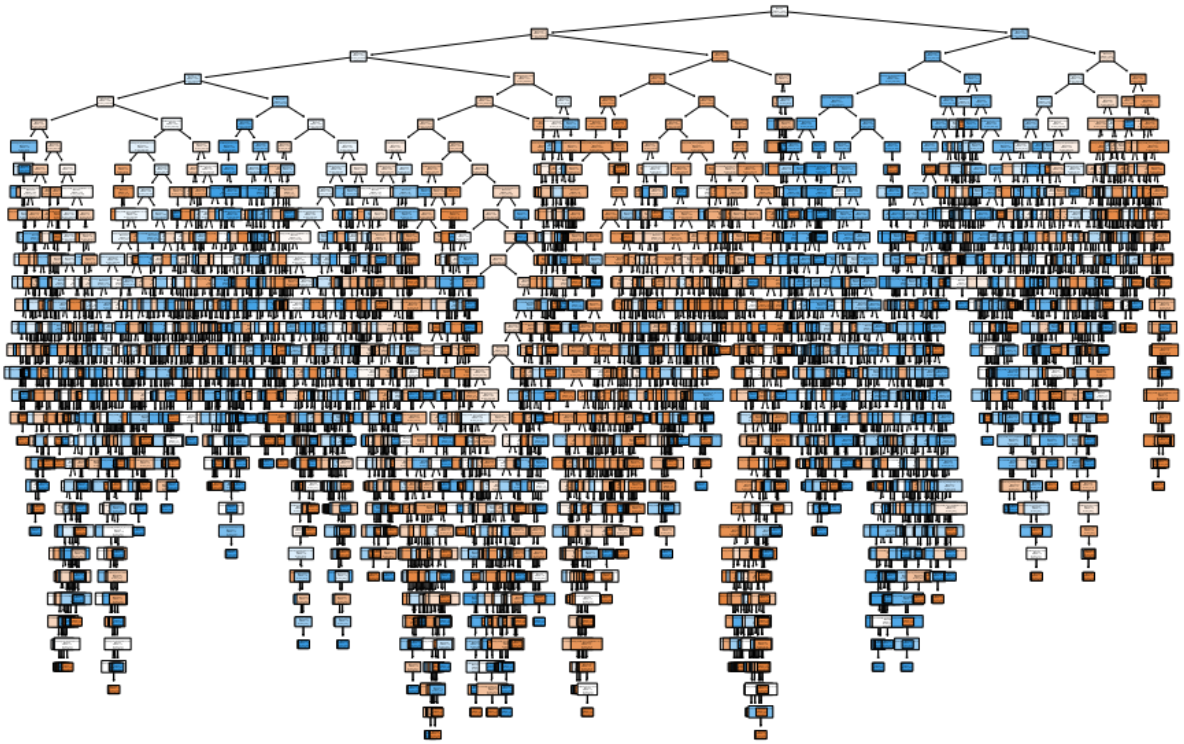
Data preprocessing

In [79]:
```
# Data preprocessing
data = pd.read_excel('C://Users//n//Downloads//churn2.xls')
label_encoder = LabelEncoder()
categorical_columns = ['COLLEGE', 'CONSIDERING_CHANGE_OF_PLAN', 'REPORTED_SATI
for column in categorical_columns:
    data[column] = label_encoder.fit_transform(data[column])
# Divide the data into training and test sets (75% training, 25% test)
X = data.drop(columns=['LEAVE'])
y = data['LEAVE']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, rand
```

Decision Tree and Logistic Regression models

In [80]:
```
# Build Decision Tree and Logistic Regression models
dt_model = DecisionTreeClassifier()
lr_model = LogisticRegression()
```

In [81]:
```
# Fit the graphical presentation of the Decision Tree
dt_model.fit(X_train, y_train)
plt.figure(figsize=(15, 10))
plot_tree(dt_model, feature_names=X.columns, class_names=['LEAVE', 'STAY'], fi
plt.show()
```



10-fold cross-validation

In [82]:
```
# Perform 10-fold cross-validation
dt_scores = cross_val_score(dt_model, X_train, y_train, cv=10, scoring='accura
lr_scores = cross_val_score(lr_model, X_train, y_train, cv=10, scoring='accura

# Calculate average accuracy and standard deviation
avg_accuracy_dt = dt_scores.mean()
std_accuracy_dt = dt_scores.std()
avg_accuracy_lr = lr_scores.mean()
std_accuracy_lr = lr_scores.std()

# Report accuracy for each fold
for i in range(10):
    print(f"Fold {i + 1}: Decision Tree Accuracy = {dt_scores[i]:.2f}, Logisti

# Report average accuracy and standard deviation
print("Average Accuracy (Decision Tree):", avg_accuracy_dt)
print("Standard Deviation (Decision Tree):", std_accuracy_dt)
print("Average Accuracy (Logistic Regression):", avg_accuracy_lr)
print("Standard Deviation (Logistic Regression):", std_accuracy_lr)
```

```
Fold 1: Decision Tree Accuracy = 0.60, Logistic Regression Accuracy = 0.60
Fold 2: Decision Tree Accuracy = 0.62, Logistic Regression Accuracy = 0.63
Fold 3: Decision Tree Accuracy = 0.63, Logistic Regression Accuracy = 0.63
Fold 4: Decision Tree Accuracy = 0.61, Logistic Regression Accuracy = 0.65
Fold 5: Decision Tree Accuracy = 0.60, Logistic Regression Accuracy = 0.63
Fold 6: Decision Tree Accuracy = 0.63, Logistic Regression Accuracy = 0.64
Fold 7: Decision Tree Accuracy = 0.61, Logistic Regression Accuracy = 0.64
Fold 8: Decision Tree Accuracy = 0.61, Logistic Regression Accuracy = 0.63
Fold 9: Decision Tree Accuracy = 0.62, Logistic Regression Accuracy = 0.63
Fold 10: Decision Tree Accuracy = 0.60, Logistic Regression Accuracy = 0.63
Average Accuracy (Decision Tree): 0.6136
Standard Deviation (Decision Tree): 0.008744267963770447
Average Accuracy (Logistic Regression): 0.6307333333333334
Standard Deviation (Logistic Regression): 0.011648366599847578
```

In [ ]:
```
#THE END
```