Objective: This project aims to Build a decision tree classifier to predict whether a customer will purchase a product or service based on their demographic and behavioral data. Use a dataset such as the Bank Marketing dataset from the UCI Machine Learning Repository.

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
%matplotlib inline
import warnings
warnings.filterwarnings('ignore')
```

```
#Importing the file and looking at the sample data
df = pd.read_csv("/content/bank11.csv")
df.sample(7)
```

	age	job	marital	education	default	balance	housing	loan	contact	day	month	duration	campaign	pdays	previous	po
3263	35	management	married	tertiary	no	24	yes	no	cellular	8	apr	169	1	231	2	
4157	55	retired	married	secondary	no	159	no	no	cellular	28	aug	159	1	-1	0	u
4353	30	admin.	married	tertiary	no	400	yes	no	cellular	7	may	223	1	-1	0	u
4140	54	self-employed	divorced	primary	no	4382	yes	no	telephone	18	may	193	4	-1	0	u
3411	57	management	married	tertiary	no	0	no	no	cellular	19	aug	188	4	-1	0	u
4286	39	admin.	married	tertiary	no	722	no	no	telephone	23	apr	141	1	-1	0	u

```
#Statistical Summary of the dataframe
df.describe()
```

	age	balance	day	duration	campaign	pdays	previous
count	4521.000000	4521.000000	4521.000000	4521.000000	4521.000000	4521.000000	4521.000000
mean	41.170095	1422.657819	15.915284	263.961292	2.793630	39.766645	0.542579
std	10.576211	3009.638142	8.247667	259.856633	3.109807	100.121124	1.693562
min	19.000000	-3313.000000	1.000000	4.000000	1.000000	-1.000000	0.000000
25%	33.000000	69.000000	9.000000	104.000000	1.000000	-1.000000	0.000000
50%	39.000000	444.000000	16.000000	185.000000	2.000000	-1.000000	0.000000
75%	49.000000	1480.000000	21.000000	329.000000	3.000000	-1.000000	0.000000
max	87.000000	71188.000000	31.000000	3025.000000	50.000000	871.000000	25.000000

```
df.isnull().sum()
#dataset has no null values.
```

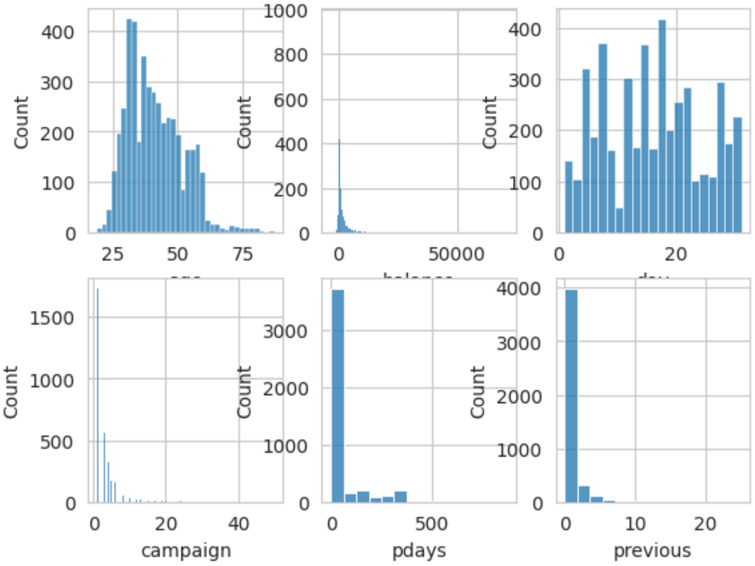
```
age          0
job          0
marital      0
education    0
default      0
balance      0
housing      0
loan         0
contact      0
day          0
month        0
duration     0
campaign     0
pdays        0
previous     0
poutcome     0
y            0
dtype: int64
```

```
df.info()
df.columns
df.shape
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4521 entries, 0 to 4520
Data columns (total 17 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   age        4521 non-null   int64 
 1   job        4521 non-null   object
 2   marital    4521 non-null   object
 3   education  4521 non-null   object
 4   default    4521 non-null   object
 5   balance    4521 non-null   int64 
 6   housing    4521 non-null   object
 7   loan       4521 non-null   object
 8   contact    4521 non-null   object
 9   day        4521 non-null   int64 
 10  month      4521 non-null   object
 11  duration   4521 non-null   int64 
 12  campaign   4521 non-null   int64 
 13  pdays      4521 non-null   int64 
 14  previous   4521 non-null   int64 
 15  poutcome   4521 non-null   object
 16  y          4521 non-null   object
dtypes: int64(7), object(10)
memory usage: 600.6+ KB
(4521, 17)
```

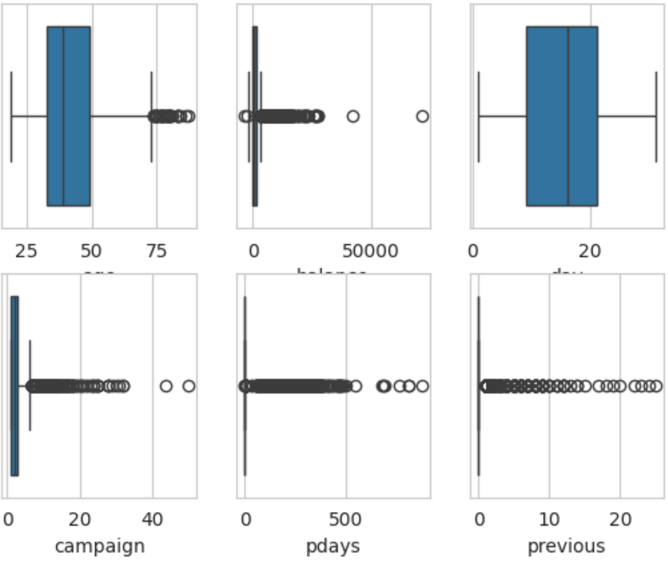
```
fig,axes = plt.subplots(2,3)
sns.histplot(data = df, x ='age', ax = axes[0,0])
sns.histplot(data = df, x ='balance', ax = axes[0,1])
sns.histplot(data = df, x ='day', ax = axes[0,2])
sns.histplot(data = df, x ='campaign', ax = axes[1,0])
sns.histplot(data = df, x ='pdays', ax = axes[1,1])
sns.histplot(data = df, x ='previous', ax = axes[1,2])
```

```
<Axes: xlabel='previous', ylabel='Count'>
```



```
fig,axes = plt.subplots(2,3)
sns.boxplot(data = df, x ='age', ax = axes[0,0])
sns.boxplot(data = df, x ='balance', ax = axes[0,1])
sns.boxplot(data = df, x ='day', ax = axes[0,2])
sns.boxplot(data = df, x ='campaign', ax = axes[1,0])
sns.boxplot(data = df, x ='pdays', ax = axes[1,1])
sns.boxplot(data = df, x ='previous', ax = axes[1,2])
```

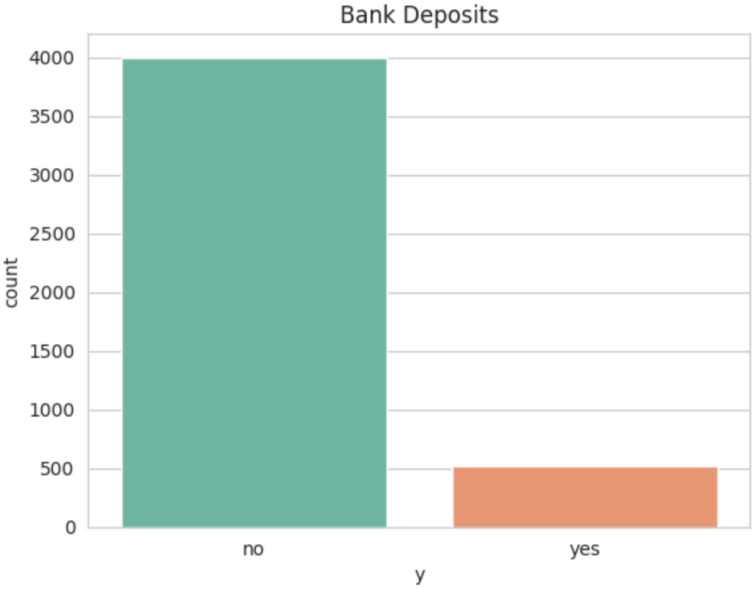
```
<Axes: xlabel='previous'>
```



```
df.y.value_counts()
```

```
no     4000
yes     521
Name: y, dtype: int64
```

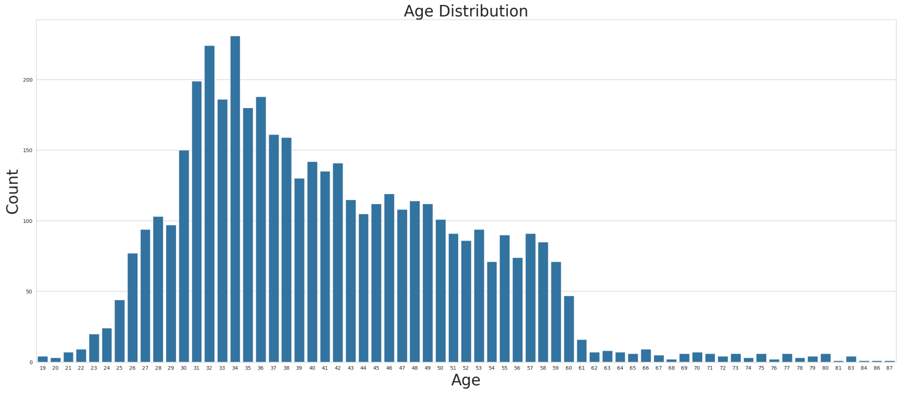
```
x1 = sns.countplot(x = 'y', data = df, palette='Set2')
plt.title('Bank Deposits')
plt.show()
```



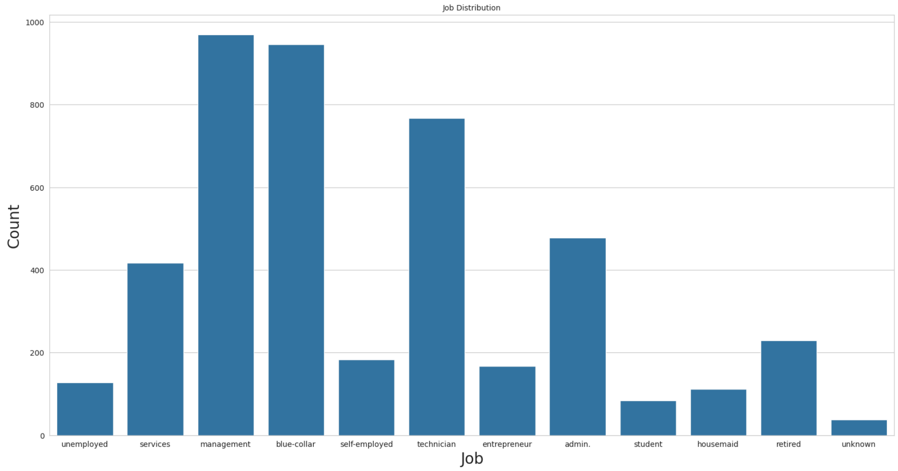
Bank deposit products or service subscribed by 521 people out of 4521 people.

Bank deposit products or service not subscribed by 4000 people out of 4521 people.

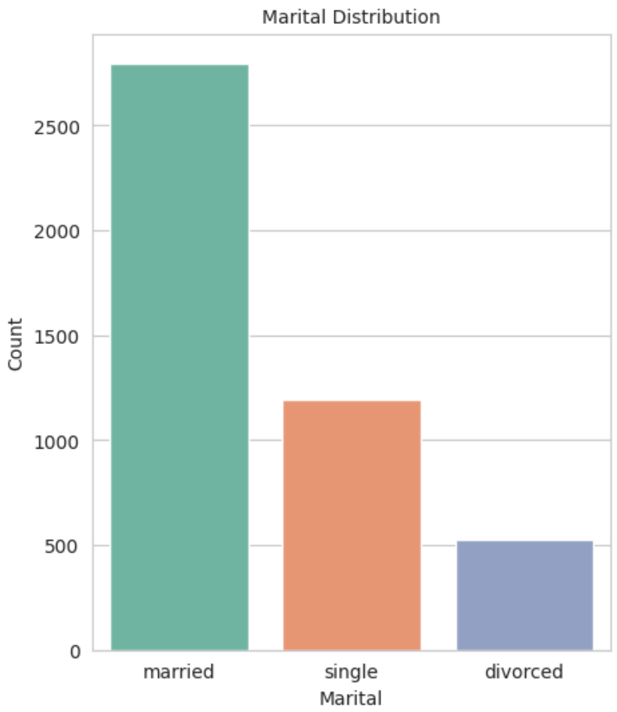
```
plt.figure(figsize = (30,12))
sns.countplot(x ='age', data = df)
plt.title('Age Distribution',fontsize = 30)
plt.xlabel('Age',fontsize = 30)
plt.ylabel('Count',fontsize = 30)
plt.show()
```



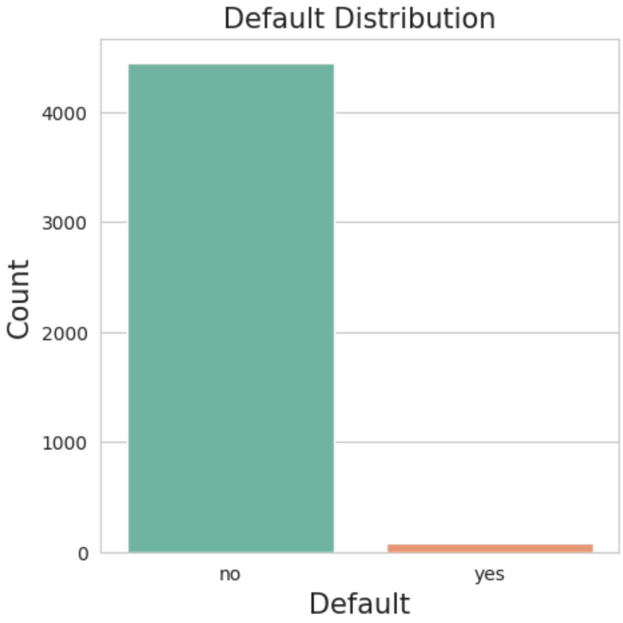
```
plt.figure(figsize = (20,10))
sns.countplot(x ='job', data = df)
plt.title('Job Distribution',fontsize = 10)
plt.xlabel('Job',fontsize = 20)
plt.ylabel('Count',fontsize = 20)
plt.show()
```



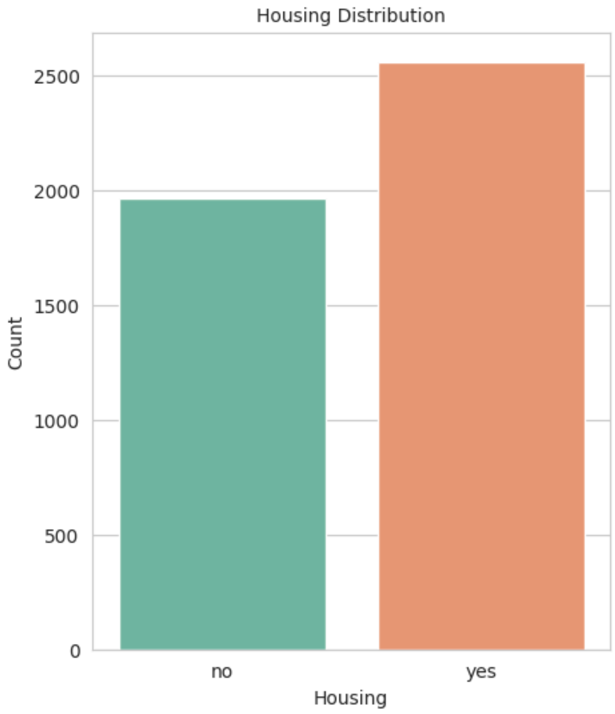
```
plt.figure(figsize = (5,6))
sns.countplot(x ='marital', data = df, palette='Set2')
plt.title('Marital Distribution',fontsize = 10)
plt.xlabel('Marital',fontsize = 10)
plt.ylabel('Count',fontsize =10)
plt.show()
```



```
plt.figure(figsize = (5,5))
sns.countplot(x ='default', data = df, palette= "Set2")
plt.title('Default Distribution',fontsize = 15)
plt.xlabel('Default',fontsize = 15)
plt.ylabel('Count',fontsize = 15)
plt.show()
```



```
plt.figure(figsize = (5,6))
sns.countplot(x ='housing', data = df,palette= "Set2")
plt.title('Housing Distribution',fontsize = 10)
plt.xlabel('Housing',fontsize = 10)
plt.ylabel('Count',fontsize = 10)
plt.show()
```

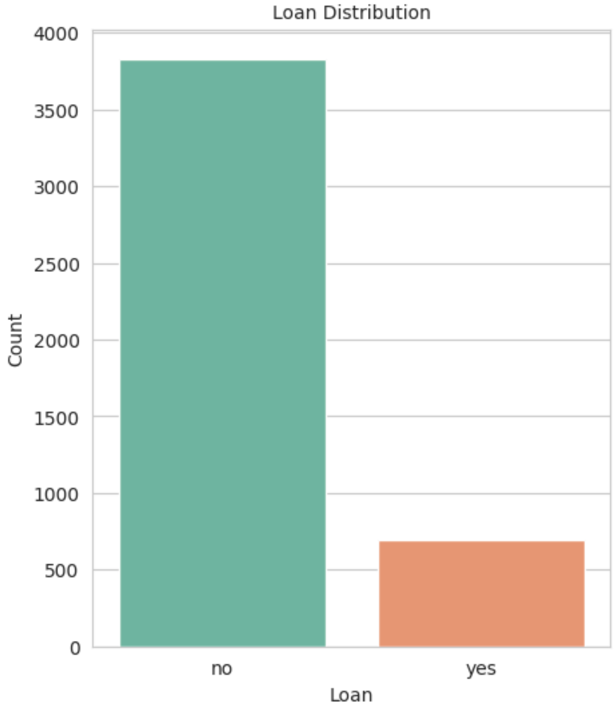


```
print('Housing:\n No Housing:' , df[df['housing']=='no'] ['age'].count(),
 '\n Yes Housing:' , df[df['housing']=='yes'] ['age'].count())
```

```
Housing:
 No Housing: 1962
 Yes Housing: 2559
```

The clients having housing loan is 597 more then clients who did not opted for housing loan.

```
plt.figure(figsize = (5,6))
sns.countplot(x ='loan', data = df, palette = 'Set2')
plt.title('Loan Distribution',fontsize = 10)
plt.xlabel('Loan',fontsize = 10)
plt.ylabel('Count',fontsize = 10)
plt.show()
```

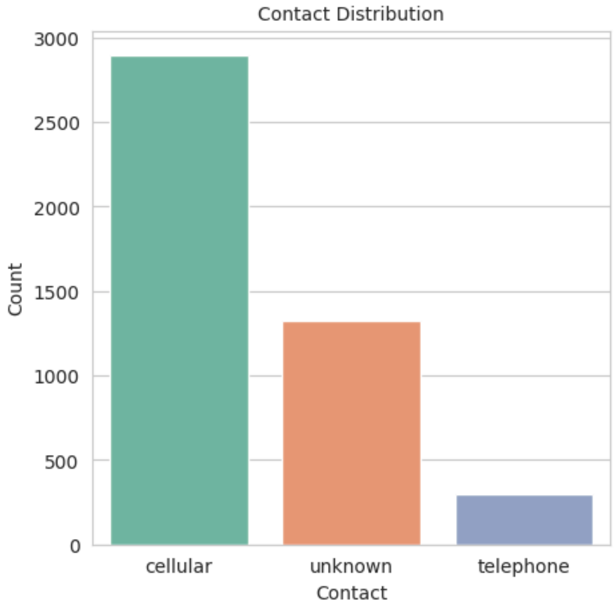


```
print('Loan:\n No Personal Loan:' , df[df['loan']=='no'] ['age'].count(),
 '\n Yes Personal Loan:' , df[df['loan']=='yes'] ['age'].count())
```

```
Loan:
 No Personal Loan: 3830
 Yes Personal Loan: 691
```

The clients having personal loan is 3139 less then clients who did not opted for personal loan.

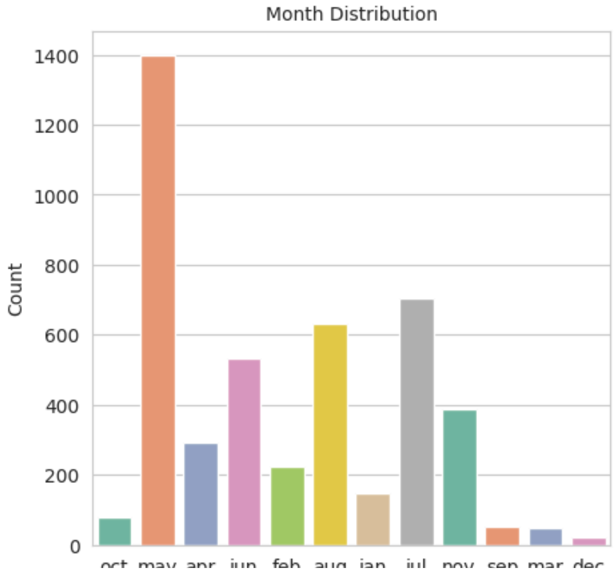
```
plt.figure(figsize = (5,5))
sns.countplot(x ='contact', data = df, palette ='Set2')
plt.title('Contact Distribution',fontsize = 10)
plt.xlabel('Contact',fontsize = 10)
plt.ylabel('Count',fontsize = 10)
plt.show()
```



The number of customers who has mobile phones are more easily accessible for a connect than other categories

```
plt.figure(figsize = (5,5))
```

```
    plt.figure(figsize = (5,5))
    sns.countplot(x ='month', data = df, palette = 'Set2')
    plt.title('Month Distribution',fontsize = 10)
    plt.xlabel('Month',fontsize = 10)
    plt.ylabel('Count',fontsize = 10)
    plt.show()
```


Month Distribution
Count
oct
may
apr
jun
feb
aug
jan
jul
nov
sep
mar
dec