Importing the libraries

In [157…
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [158…
```
cd
```

```
C:\Users\rusha
```

Reading the dataset

In [159…
```
df = pd.read_csv(r"C:\Users\rusha\Downloads\data.csv")
```

In [160…
```
df.head()
```

Out[160]:

	age	job	marital	education	default	balance	housing	loan	contact	day	month
0	38	technician	married	tertiary	no	127	yes	no	cellular	14	oct
1	41	housemaid	married	primary	no	365	no	no	cellular	8	aug
2	39	management	single	tertiary	no	2454	yes	no	cellular	4	may
3	49	blue-collar	married	primary	no	6215	yes	no	cellular	11	may
4	37	services	married	secondary	no	1694	yes	yes	cellular	29	jan

Checking the data

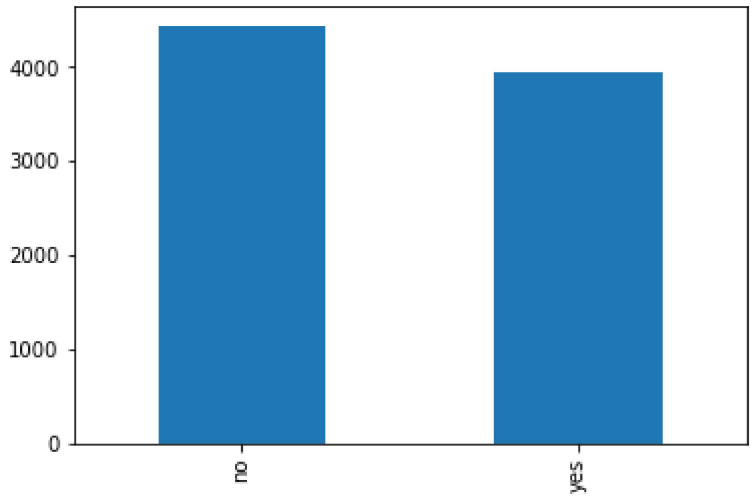
In [161…
```
count=df['deposit'].value_counts()
```

In [162…
```
count
```

Out[162]:
```
no     4428
yes    3943
Name: deposit, dtype: int64
```

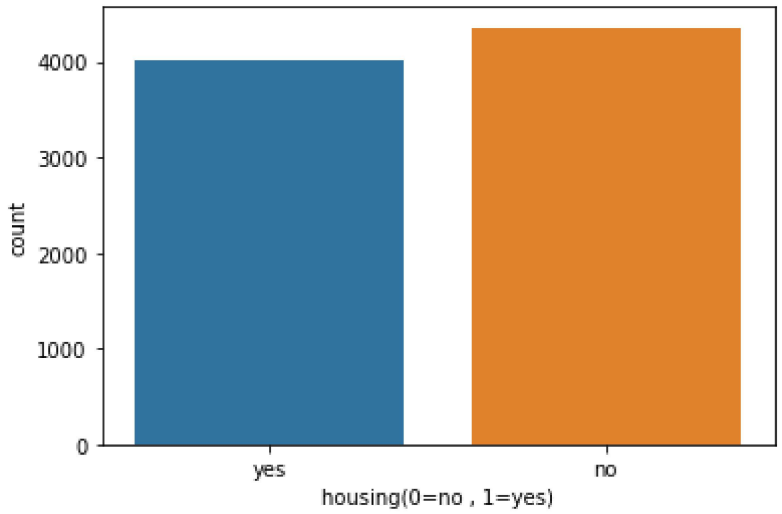
In [163…
```
count.plot(kind="bar")
```

Out[163]:
```
<AxesSubplot:>
```



In [164…
```
sns.countplot(x = "housing" ,data=df)
plt.xlabel("housing(0=no , 1=yes)")
```

Out[164]:
```
Text(0.5, 0, 'housing(0=no , 1=yes)')
```



In [165…
```
count=df['housing'].value_counts()
count
```

Out[165]:
```
no     4354
yes    4017
Name: housing, dtype: int64
```

We conclude from the above plot that

1. 4354 individuals did not deposit the money
2. 4017 individuals depositted the money

Applying Machine Learning Techniques

Logistic Regression

In [166…
```
from sklearn import linear_model
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn import preprocessing
```

In [167…
```
le=preprocessing.LabelEncoder()
df=df.apply(le.fit_transform)
```

In [168…
```
x= df.iloc[:,:-1].values
y= df.iloc[:,-1].values
```

In [169…
```
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size = 0.2,random_sta
```

In [170…
```
lr=linear_model.LogisticRegression()
lr.fit(x_train,y_train)
```

```
D:\machinelearning\lib\site-packages\sklearn\linear_model\_logistic.py:814: Conver
genceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Out[170]:
```
LogisticRegression()
```

In [171…
```
y_pred=lr.predict(x_test)
```

In [172…
```
y_pred
```

Out[172]:
```
array([0, 0, 1, ..., 0, 1, 1])
```

Confusion Matrix

In [173…
```
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(y_test,y_pred)
```

In [174…
```
cm
```

Out[174]:
```
array([[716, 183],
       [213, 563]], dtype=int64)
```

In [175…
```
confusion_matrix(y_train,y_train)
```

Out[175]:
```
array([[3529,    0],
       [   0, 3167]], dtype=int64)
```

In [176…
```
from sklearn.metrics import precision_score , recall_score
```

In [177…
```
precision_score(y_test,y_pred)
```

Out[177]:
```
0.7546916890080428
```

In [178…
```
recall_score(y_test,y_pred)
```

Out[178]:
```
0.7255154639175257
```

In [179…
```
from sklearn.metrics import f1_score
```

In [180…
```
f1_score(y_test,y_pred)
```

Out[180]:
```
0.7398160315374506
```

In [181…
```
accuracy=(716+563)/(716+183+213+563)
```

In [182…
```
accuracy*100
```

Out[182]:
```
76.35820895522389
```

In [183…
```
from sklearn.metrics import classification_report
```

In [184…
```
print(classification_report(y_test,y_pred))
```

	precision	recall	f1-score	support
0	0.77	0.80	0.78	899
1	0.75	0.73	0.74	776
accuracy			0.76	1675
macro avg	0.76	0.76	0.76	1675
weighted avg	0.76	0.76	0.76	1675

Decision Tree Matrix

In [185…
```
from sklearn.tree import DecisionTreeClassifier
dtc=DecisionTreeClassifier()
dtc.fit(x_train,y_train)
print("Decision Tree Test Accuracy {:.2f}%".format(dtc.score(x_test,y_test)*100))
```

```
Decision Tree Test Accuracy 75.34%
```

Random Forest Matrix

In [186…
```
from sklearn.ensemble import RandomForestClassifier
rf = RandomForestClassifier(n_estimators = 1000, random_state = 1)
rf.fit(x_train, y_train)
print("Random Forest Algorithm Accuracy Score : {:.2f}%".format(rf.score(x_test,y_
```

```
Random Forest Algorithm Accuracy Score : 83.52%
```