In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
from scipy.stats.stats import pearsonr
import numpy as np
from sklearn.model_selection import train_test_split
import seaborn as sns
```

In [2]:
```
raw_data= pd.read_csv('Bank_Personal_Loan_Modelling.csv')
```

In [3]:
```
raw_data.head()
```

Out[3]:

	ID	Age	Experience	Income	ZIP Code	Family	CCAvg	Education	Mortgage	Personal Loan	Secu Ac
0	1	25	1	49	91107	4	1.6	1	0	0	
1	2	45	19	34	90089	3	1.5	1	0	0	
2	3	39	15	11	94720	1	1.0	1	0	0	
3	4	35	9	100	94112	1	2.7	2	0	0	
4	5	35	8	45	91330	4	1.0	2	0	0	

In [4]:
```
np.log(raw_data)
```

```
C:\Users\ppragallapati\AppData\Local\Continuum\anaconda3\lib\site-package
s\ipykernel_launcher.py:1: RuntimeWarning: divide by zero encountered in
log
  """Entry point for launching an IPython kernel.
C:\Users\ppragallapati\AppData\Local\Continuum\anaconda3\lib\site-package
s\ipykernel_launcher.py:1: RuntimeWarning: invalid value encountered in l
og
  """Entry point for launching an IPython kernel.
```

In [5]:
```
raw_data.corr()
```

Out[5]:

	ID	Age	Experience	Income	ZIP Code	Family	CCAvg	E
ID	1.000000	-0.008473	-0.008326	-0.017695	0.013432	-0.016797	-0.024675	
Age	-0.008473	1.000000	0.994215	-0.055269	-0.029216	-0.046418	-0.052012	
Experience	-0.008326	0.994215	1.000000	-0.046574	-0.028626	-0.052563	-0.050077	
Income	-0.017695	-0.055269	-0.046574	1.000000	-0.016410	-0.157501	0.645984	-
ZIP Code	0.013432	-0.029216	-0.028626	-0.016410	1.000000	0.011778	-0.004061	-
Family	-0.016797	-0.046418	-0.052563	-0.157501	0.011778	1.000000	-0.109275	
CCAvg	-0.024675	-0.052012	-0.050077	0.645984	-0.004061	-0.109275	1.000000	-
Education	0.021463	0.041334	0.013152	-0.187524	-0.017377	0.064929	-0.136124	
Mortgage	-0.013920	-0.012539	-0.010582	0.206806	0.007383	-0.020445	0.109905	-
Personal Loan	-0.024801	-0.007726	-0.007413	0.502462	0.000107	0.061367	0.366889	

Checking Outliers

In [6]:
```
raw_data.describe()
```

Out[6]:

	ID	Age	Experience	Income	ZIP Code	Family	C
count	5000.000000	5000.000000	5000.000000	5000.000000	5000.000000	5000.000000	5000.0
mean	2500.500000	45.338400	20.104600	73.774200	93152.503000	2.396400	1.9
std	1443.520003	11.463166	11.467954	46.033729	2121.852197	1.147663	1.7
min	1.000000	23.000000	-3.000000	8.000000	9307.000000	1.000000	0.0
25%	1250.750000	35.000000	10.000000	39.000000	91911.000000	1.000000	0.7
50%	2500.500000	45.000000	20.000000	64.000000	93437.000000	2.000000	1.5
75%	3750.250000	55.000000	30.000000	98.000000	94608.000000	3.000000	2.5
max	5000.000000	67.000000	43.000000	224.000000	96651.000000	4.000000	10.0

In [7]:

```
sns.boxplot(data=raw_data['Experience'])
Experience= raw_data['Experience']
count=0
for i in range(5000):
    if Experience[i]< 0:
        count+=1
        print(Experience[i])
        Experience[i]=abs(Experience[i])
        #print(Experience[i])
print(count)
#Experience can not be negative. These are outliers. Converted these negative
```

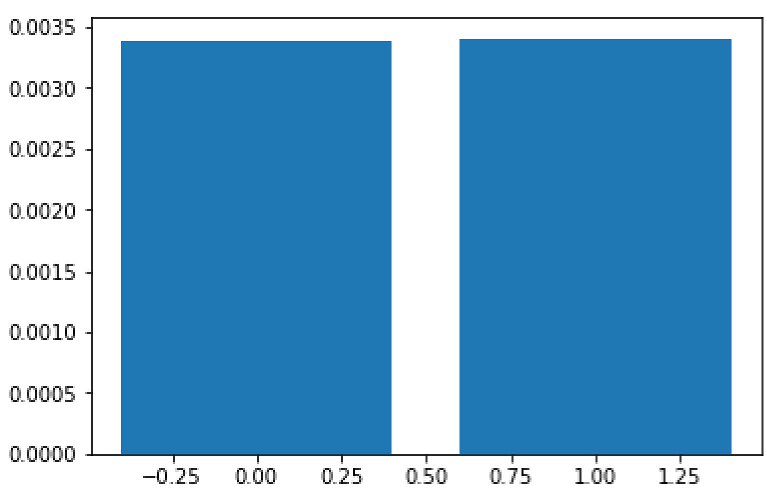
```
C:\Users\ppragallapati\AppData\Local\Continuum\anaconda3\lib\site-package
s\ipykernel_launcher.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy (http://pandas.pydata.or
g/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [8]:

```
#After checking the distributions of all attributes, only experience has wror
```

In [9]:

```
from scipy.stats import norm
plt.bar(raw_data['Personal Loan'], norm.pdf(raw_data['Personal Loan'], 56, 1(
plt.show()
```



In [ ]:
```
#There are no outlier/ false data in the target variable
```

In [10]:
```
from sklearn.feature_extraction.text import TfidfVectorizer
final_data = TfidfVectorizer(raw_data)
final_data= raw_data.drop(['ZIP Code', 'ID'], axis= 1)
final_data.head()
```

Out[10]:

	Age	Experience	Income	Family	CCAvg	Education	Mortgage	Personal Loan	Securities Account	Acc
0	25	1	49	4	1.6	1	0	0	1	
1	45	19	34	3	1.5	1	0	0	1	
2	39	15	11	1	1.0	1	0	0	0	
3	35	9	100	1	2.7	2	0	0	0	
4	35	8	45	4	1.0	2	0	0	0	

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In [11]:
```
x_train, x_test, y_train, y_test= train_test_split(final_data.drop(['Personal
```

Logistic Regression

In [12]:
```
from sklearn.linear_model import LogisticRegression
logistic= LogisticRegression()
logistic.fit(x_train, y_train)
logistic_prediction= logistic.predict(x_test)
```

```
C:\Users\ppragallapati\AppData\Local\Continuum\anaconda3\lib\site-packages
\sklearn\linear_model\logistic.py:433: FutureWarning: Default solver will b
e changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.
  FutureWarning)
```

In [13]:
```
from sklearn.metrics import classification_report
from sklearn import metrics
print(classification_report(y_test,logistic_prediction))
print("Accuracy:",metrics.accuracy_score(y_test, logistic_prediction))
metrics.confusion_matrix(y_test, logistic_prediction)
```

```
              precision    recall  f1-score   support

           0       0.96      0.99      0.97      1355
           1       0.83      0.62      0.71       145

   micro avg       0.95      0.95      0.95      1500
   macro avg       0.90      0.80      0.84      1500
weighted avg       0.95      0.95      0.95      1500

Accuracy: 0.9513333333333334
```

Out[13]:
```
array([[1337,   18],
       [  55,   90]], dtype=int64)
```

K- NN

In [14]:
```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors=5, metric='euclidean')
knn.fit(x_train, y_train)
knn_prediction= knn.predict(x_test)
```

In [15]:
```
print(classification_report(y_test,knn_prediction))
print("Accuracy:",metrics.accuracy_score(y_test, knn_prediction))
metrics.confusion_matrix(y_test, knn_prediction)
```

```
              precision    recall  f1-score   support

           0       0.93      0.97      0.95      1355
           1       0.53      0.30      0.38       145

   micro avg       0.91      0.91      0.91      1500
   macro avg       0.73      0.63      0.67      1500
weighted avg       0.89      0.91      0.89      1500

Accuracy: 0.9066666666666666
```

Out[15]:
```
array([[1317,   38],
       [ 102,   43]], dtype=int64)
```

Naive Bayes

In [16]:
```python
from sklearn.naive_bayes import BernoulliNB
nb= BernoulliNB()
nb.fit(x_train, y_train)
nb_prediction= nb.predict(x_test)
```

In [17]:
```python
print(classification_report(y_test,nb_prediction))
print("Accuracy:",metrics.accuracy_score(y_test, nb_prediction))
metrics.confusion_matrix(y_test, nb_prediction)
```

```
              precision    recall  f1-score   support

           0       0.91      0.99      0.95      1355
           1       0.39      0.06      0.11       145

   micro avg       0.90      0.90      0.90      1500
   macro avg       0.65      0.53      0.53      1500
weighted avg       0.86      0.90      0.87      1500

Accuracy: 0.9
```

Out[17]:
```
array([[1341,   14],
       [ 136,    9]], dtype=int64)
```

Confusion Matrices

In [18]:
```python
metrics.confusion_matrix(y_test, logistic_prediction)
```

Out[18]:
```
array([[1337,   18],
       [  55,   90]], dtype=int64)
```

In [19]:
```python
metrics.confusion_matrix(y_test, knn_prediction)
```

Out[19]:
```
array([[1317,   38],
       [ 102,   43]], dtype=int64)
```

In [20]:
```python
metrics.confusion_matrix(y_test, nb_prediction)
```

Out[20]:
```
array([[1341,   14],
       [ 136,    9]], dtype=int64)
```

Conclusion

In [ ]:
```python
#Logistic regression fetches the best results with an accuracy of 95.1%. This
```