Loan Approval Prediction

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
## Data Collection & Pre-Processing
```

In [4]:
```
df=pd.read_csv("loan_approval_dataset.csv")
df.head()
```

Out[4]:

	loan_id	no_of_dependents	education	self_employed	income_annum	loan_amount	loan_term
0	1	2	Graduate	No	9600000	29900000	12
1	2	0	Not Graduate	Yes	4100000	12200000	8
2	3	3	Graduate	No	9100000	29700000	20
3	4	3	Graduate	No	8200000	30700000	8
4	5	5	Not Graduate	Yes	9800000	24200000	20

In [5]:
```
df.shape
```

Out[5]:
```
(4269, 13)
```

In [6]:
```
df.isnull().sum()
```

Out[6]:
```
loan_id                      0
 no_of_dependents            0
 education                   0
 self_employed               0
 income_annum                0
 loan_amount                 0
 loan_term                   0
 cibil_score                 0
 residential_assets_value    0
 commercial_assets_value     0
 luxury_assets_value         0
 bank_asset_value            0
 loan_status                 0
dtype: int64
```

In [7]:
```
df.dropna(inplace=True)
```

In [8]:

```
df.head()
```

Out[8]:

	loan_id	no_of_dependents	education	self_employed	income_annum	loan_amount	loan_term
0	1	2	Graduate	No	9600000	29900000	12
1	2	0	Not Graduate	Yes	4100000	12200000	8
2	3	3	Graduate	No	9100000	29700000	20
3	4	3	Graduate	No	8200000	30700000	8
4	5	5	Not Graduate	Yes	9800000	24200000	20

In [9]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4269 entries, 0 to 4268
Data columns (total 13 columns):
 #   Column                     Non-Null Count  Dtype 
---  ------                     --------------  ----- 
 0   loan_id                    4269 non-null   int64 
 1    no_of_dependents          4269 non-null   int64 
 2    education                 4269 non-null   object
 3    self_employed             4269 non-null   object
 4    income_annum              4269 non-null   int64 
 5    loan_amount               4269 non-null   int64 
 6    loan_term                 4269 non-null   int64 
 7    cibil_score               4269 non-null   int64 
 8    residential_assets_value  4269 non-null   int64 
 9    commercial_assets_value   4269 non-null   int64 
 10   luxury_assets_value       4269 non-null   int64 
 11   bank_asset_value          4269 non-null   int64 
 12   loan_status               4269 non-null   object
dtypes: int64(10), object(3)
memory usage: 466.9+ KB
```

In [10]:

```
df.columns
```

Out[10]:

```
Index(['loan_id', ' no_of_dependents', ' education', ' self_employed',
       ' income_annum', ' loan_amount', ' loan_term', ' cibil_score',
       ' residential_assets_value', ' commercial_assets_value',
       ' luxury_assets_value', ' bank_asset_value', ' loan_status'],
      dtype='object')
```

In [11]:

```
df[' education'].unique()
```

Out[11]:

```
array([' Graduate', ' Not Graduate'], dtype=object)
```

In [12]:

```
df[' education'].dtype
```

Out[12]:

```
dtype('O')
```

In [13]:

```
#Data Preprocessing and Visualization
```

In [14]:

```
df.drop("loan_id",axis=1,inplace=True)
```

In [15]:

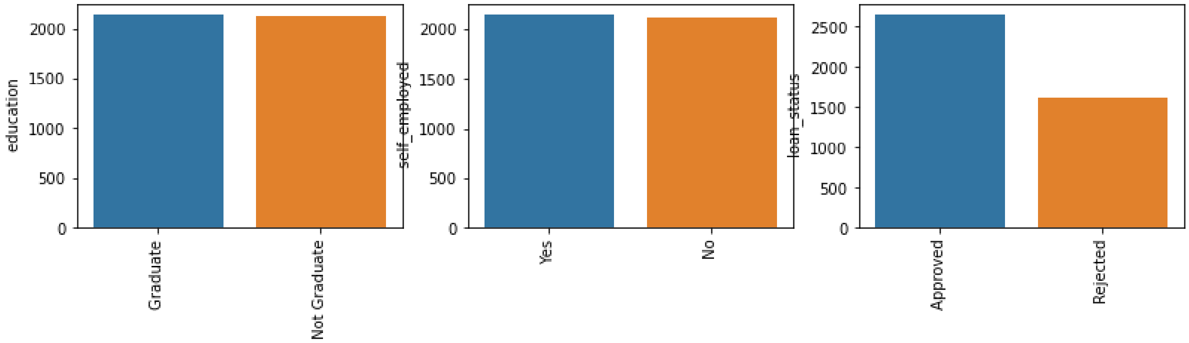
```
obj=(df.dtypes=="object")
print("Categorical variables:",len(list(obj[obj].index)))
```

```
Categorical variables: 3
```

In [16]:

```
obj = (df.dtypes == 'object')
object_cols = list(obj[obj].index)
plt.figure(figsize=(18,36))
index = 1

for col in object_cols:
  y = df[col].value_counts()
  plt.subplot(11,4,index)
  plt.xticks(rotation=90)
  sns.barplot(x=list(y.index), y=y)
  index +=1
```



In [17]:

```
# Import label encoder

from sklearn import preprocessing
label_encoder = preprocessing.LabelEncoder()
obj = (df.dtypes == 'object')
for col in list(obj[obj].index):
    df[col]=label_encoder.fit_transform(df[col])
```

In [18]:

```
# To find the number of columns with
# datatype==object
obj = (df.dtypes == 'object')
print("Categorical variables:",len(list(obj[obj].index)))
```

```
Categorical variables: 0
```

```
## to fill all na values in once we can use below function (mean,mode and
median)

for col in data.columns:
  data[col] = data[col].fillna(data[col].mean())
```

```
data.isna().sum()
```

Splitting Dataset

In [19]:

```
from sklearn.model_selection import train_test_split
```

In [20]:

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

In [21]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
```

In [22]:

```
print('Shape of X_train = ', X_train.shape)
print('Shape of y_train = ', y_train.shape)
print('Shape of X_test = ', X_test.shape)
print('Shape of y_test = ', y_test.shape)
```

```
Shape of X_train =  (3415, 11)
Shape of y_train =  (3415,)
Shape of X_test =  (854, 11)
Shape of y_test =  (854,)
```

```
Model Training and Evaluation

As this is a classification problem so we will be using these models :

KNeighborsClassifiers
RandomForestClassifiers
Support Vector Classifiers (SVC)
Logistics Regression
```

In [23]:

```
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.linear_model import LogisticRegression
from sklearn import metrics
```

In [24]:

```
knn = KNeighborsClassifier(n_neighbors=3)
rfc = RandomForestClassifier(n_estimators = 7,
                             criterion = 'entropy',
                             random_state =7)
svc = SVC()
lc = LogisticRegression()
```

In [25]:

```
# making predictions on the training set

for clf in (rfc, knn, svc,lc):
    clf.fit(X_train, y_train)
    y_pred = clf.predict(X_train)
    print("Accuracy score of ", clf.__class__.__name__,
          "=",100*metrics.accuracy_score(y_train,
                                          y_pred))
```

```
Accuracy score of  RandomForestClassifier = 99.70717423133236
Accuracy score of  KNeighborsClassifier = 78.03806734992679
Accuracy score of  SVC = 62.079062957540266
Accuracy score of  LogisticRegression = 73.26500732064422
```

In [26]:

```
# making predictions on the testing set

for clf in (rfc, knn, svc,lc):
    clf.fit(X_train, y_train)
    y_pred = clf.predict(X_test)
    print("Accuracy score of ",
          clf.__class__.__name__,"=",
          100*metrics.accuracy_score(y_test,
                                      y_pred))
```

```
Accuracy score of  RandomForestClassifier = 97.65807962529274
Accuracy score of  KNeighborsClassifier = 53.39578454332553
Accuracy score of  SVC = 62.76346604215457
Accuracy score of  LogisticRegression = 72.48243559718969
```

Conclusion

```
Random Forest Classifier is giving the best accuracy with an accuracy score
of 97% for the testing dataset. And to get much better results ensemble
learning techniques like Bagging and Boosting can also be used.
```