1. DATA PREPROCESSING

a. IMPORT THE LIBRARIES

In [1]:

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import sklearn
import scipy
import xgboost
import seaborn as sns
%matplotlib inline
```

b. IMPORT THE DATASET

In [2]:

```python


d = pd.read_csv(r"C:\Users\BS663TU\Downloads\Admission_Predict_Ver1.1.csv")
```

In [3]:

```python
d.head(3)
```

Out[3]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72

In [4]:

```
d.describe()
```

Out[4]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Re
count	500.000000	500.000000	500.000000	500.000000	500.000000	500.00000	500.000000	500
mean	250.500000	316.472000	107.192000	3.114000	3.374000	3.48400	8.576440	0
std	144.481833	11.295148	6.081868	1.143512	0.991004	0.92545	0.604813	0
min	1.000000	290.000000	92.000000	1.000000	1.000000	1.00000	6.800000	0
25%	125.750000	308.000000	103.000000	2.000000	2.500000	3.00000	8.127500	0
50%	250.500000	317.000000	107.000000	3.000000	3.500000	3.50000	8.560000	1
75%	375.250000	325.000000	112.000000	4.000000	4.000000	4.00000	9.040000	1
max	500.000000	340.000000	120.000000	5.000000	5.000000	5.00000	9.920000	1

In [5]:

```
d['University Rating'].unique()
```

Out[5]:

```
array([4, 3, 2, 5, 1], dtype=int64)
```

In [6]:

```
d['SOP'].unique()
```

Out[6]:

```
array([4.5, 4. , 3. , 3.5, 2. , 5. , 1.5, 1. , 2.5])
```

c. TAKING CARE OF MISSING DATA

In [7]:

```
d.isnull().any()
```

Out[7]:

```
Serial No.           False
GRE Score            False
TOEFL Score          False
University Rating    False
SOP                  False
LOR                  False
CGPA                 False
Research             False
Chance of Admit      False
dtype: bool
```

d. NO LABEL ENCODING

In [8]:

```
x = d.iloc[:,1:8].values
y = d.iloc[:,8].values
```

In [9]:

```
x.shape
```

Out[9]:

```
(500, 7)
```

e. ONEHOT ENCODING

In [10]:

```
from sklearn.preprocessing import OneHotEncoder
oh=OneHotEncoder()
z=oh.fit_transform(x[:,2:3]).toarray()
p=oh.fit_transform(x[:,3:4]).toarray()
q=oh.fit_transform(x[:,4:5]).toarray()

```

In [11]:

```
z
```

Out[11]:

```
array([[0., 0., 0., 1., 0.],
       [0., 0., 0., 1., 0.],
       [0., 0., 1., 0., 0.],
       ...,
       [0., 0., 0., 0., 1.],
       [0., 0., 0., 1., 0.],
       [0., 0., 0., 1., 0.]])
```

In [12]:

```
p
```

Out[12]:

```
array([[0., 0., 0., ..., 0., 1., 0.],
       [0., 0., 0., ..., 1., 0., 0.],
       [0., 0., 0., ..., 0., 0., 0.],
       ...,
       [0., 0., 0., ..., 0., 1., 0.],
       [0., 0., 0., ..., 1., 0., 0.],
       [0., 0., 0., ..., 0., 1., 0.]])
```

In [13]:

```
q
```

Out[13]:

```
array([[0., 0., 0., ..., 0., 1., 0.],
       [0., 0., 0., ..., 0., 1., 0.],
       [0., 0., 0., ..., 0., 0., 0.],
       ...,
       [0., 0., 0., ..., 0., 0., 1.],
       [0., 0., 0., ..., 0., 0., 1.],
       [0., 0., 0., ..., 0., 1., 0.]])
```

In [14]:

```
x.shape
```

Out[14]:

```
(500, 7)
```

In [15]:

```
x=np.delete(x,[2,3,4],axis=1)
```

In [16]:

```
x.shape
```

Out[16]:

```
(500, 4)
```

In [17]:

```
x=np.concatenate((q,p,z,x),axis=1)
```

In [18]:

```
x.shape
```

Out[18]:

```
(500, 27)
```

In [19]:

```
y
```

Out[19]:

```
array([0.92, 0.76, 0.72, 0.8 , 0.65, 0.9 , 0.75, 0.68, 0.5 , 0.45, 0.52,
       0.84, 0.78, 0.62, 0.61, 0.54, 0.66, 0.65, 0.63, 0.62, 0.64, 0.7 ,
       0.94, 0.95, 0.97, 0.94, 0.76, 0.44, 0.46, 0.54, 0.65, 0.74, 0.91,
       0.9 , 0.94, 0.88, 0.64, 0.58, 0.52, 0.48, 0.46, 0.49, 0.53, 0.87,
       0.91, 0.88, 0.86, 0.89, 0.82, 0.78, 0.76, 0.56, 0.78, 0.72, 0.7 ,
       0.64, 0.64, 0.46, 0.36, 0.42, 0.48, 0.47, 0.54, 0.56, 0.52, 0.55,
       0.61, 0.57, 0.68, 0.78, 0.94, 0.96, 0.93, 0.84, 0.74, 0.72, 0.74,
       0.64, 0.44, 0.46, 0.5 , 0.96, 0.92, 0.92, 0.94, 0.76, 0.72, 0.66,
       0.64, 0.74, 0.64, 0.38, 0.34, 0.44, 0.36, 0.42, 0.48, 0.86, 0.9 ,
       0.79, 0.71, 0.64, 0.62, 0.57, 0.74, 0.69, 0.87, 0.91, 0.93, 0.68,
       0.61, 0.69, 0.62, 0.72, 0.59, 0.66, 0.56, 0.45, 0.47, 0.71, 0.94,
       0.94, 0.57, 0.61, 0.57, 0.64, 0.85, 0.78, 0.84, 0.92, 0.96, 0.77,
       0.71, 0.79, 0.89, 0.82, 0.76, 0.71, 0.8 , 0.78, 0.84, 0.9 , 0.92,
       0.97, 0.8 , 0.81, 0.75, 0.83, 0.96, 0.79, 0.93, 0.94, 0.86, 0.79,
       0.8 , 0.77, 0.7 , 0.65, 0.61, 0.52, 0.57, 0.53, 0.67, 0.68, 0.81,
       0.78, 0.65, 0.64, 0.64, 0.65, 0.68, 0.89, 0.86, 0.89, 0.87, 0.85,
       0.9 , 0.82, 0.72, 0.73, 0.71, 0.71, 0.68, 0.75, 0.72, 0.89, 0.84,
       0.93, 0.93, 0.88, 0.9 , 0.87, 0.86, 0.94, 0.77, 0.78, 0.73, 0.73,
```

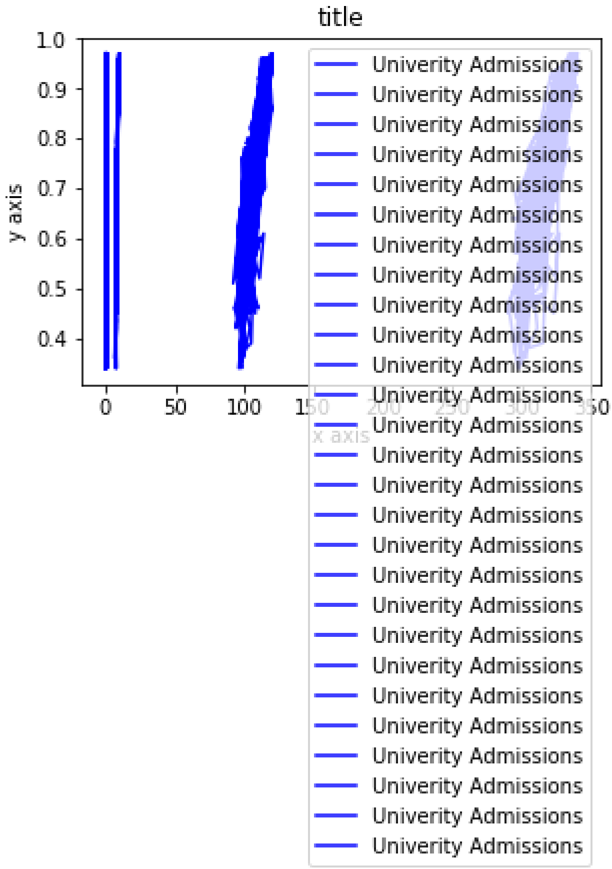
f.DATA VISUALISATON

In [20]:

```python
fig=plt.figure()
axes=fig.add_axes([0.4,0.4,0.6,0.6])
axes.plot(x,y,label="Univerity Admissions",color='blue')
axes.set_xlabel("x axis")
axes.set_ylabel("y axis")
axes.set_title("title")
axes.legend(loc='upper right')
```

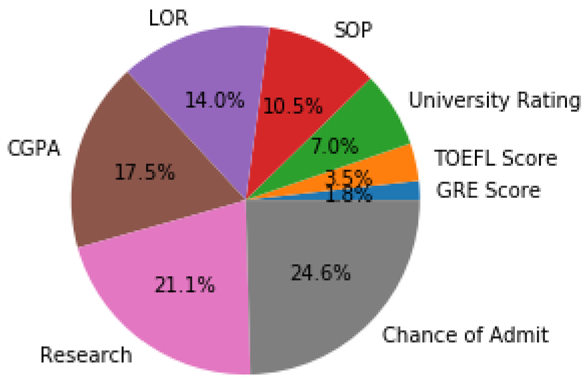
Out[20]:

```
<matplotlib.legend.Legend at 0x1b9f9eec708>
```



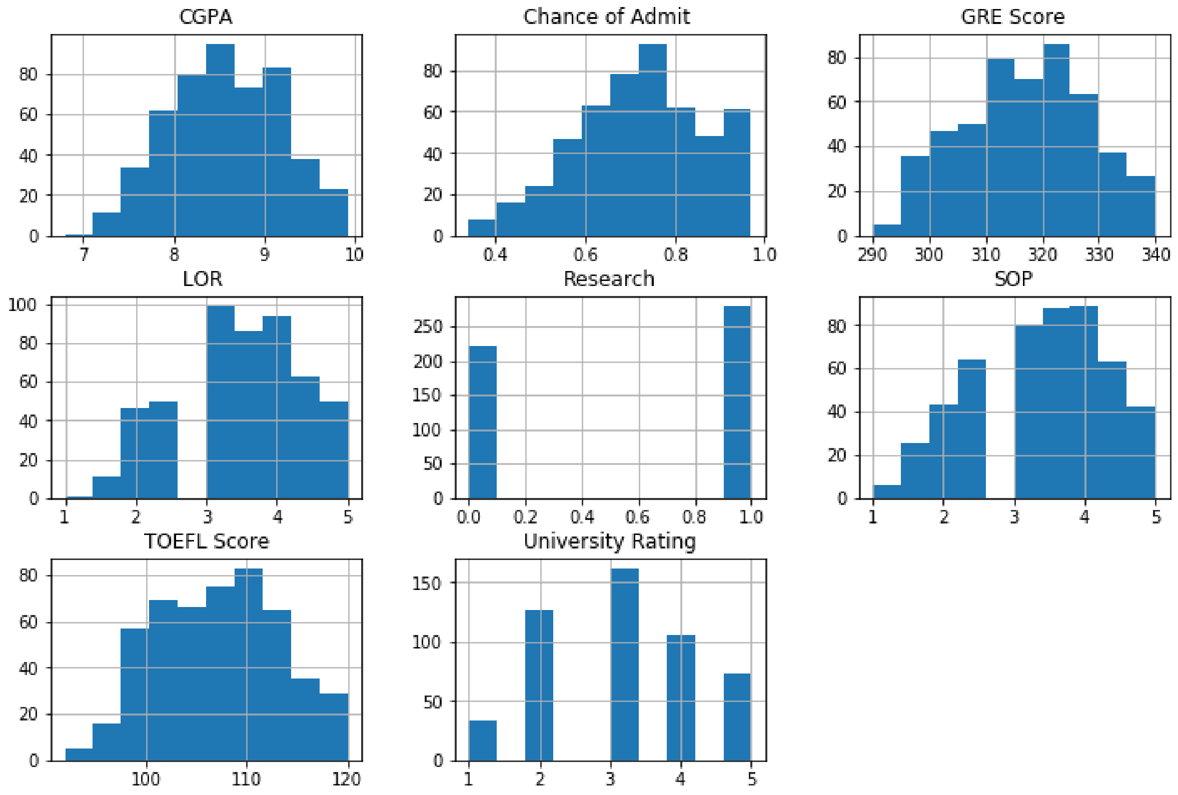
In [21]:

```
details=["GRE Score","TOEFL Score","University Rating","SOP","LOR","CGPA","Research","C
student=[25,50,100,150,200,250,300,350]
plt.pie(student,labels=details,autopct="%.1f%%")
plt.show()
```



In [22]:

```
d.pop('Serial No.')
d.hist(figsize=(12,8))
plt.show()
```



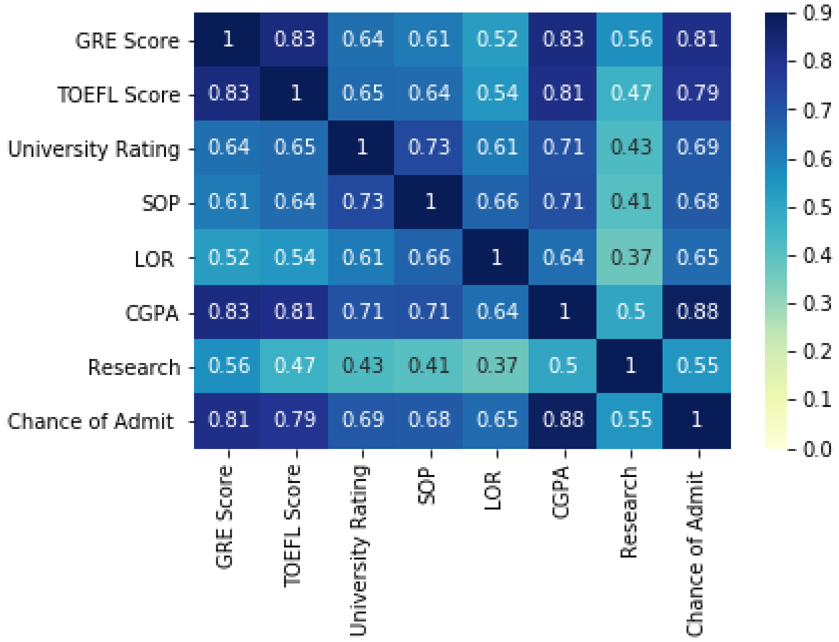
In [23]:

```
corr=d.corr()
sns.heatmap(corr, vmax=0.9,vmin=0,annot=True,cmap="YlGnBu")
corr

```

Out[23]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
GRE Score	1.000000	0.827200	0.635376	0.613498	0.524679	0.825878	0.563398	0.810351
TOEFL Score	0.827200	1.000000	0.649799	0.644410	0.541563	0.810574	0.467012	0.792228
University Rating	0.635376	0.649799	1.000000	0.728024	0.608651	0.705254	0.427047	0.690132
SOP	0.613498	0.644410	0.728024	1.000000	0.663707	0.712154	0.408116	0.684137
LOR	0.524679	0.541563	0.608651	0.663707	1.000000	0.637469	0.372526	0.645365
CGPA	0.825878	0.810574	0.705254	0.712154	0.637469	1.000000	0.501311	0.882413
Research	0.563398	0.467012	0.427047	0.408116	0.372526	0.501311	1.000000	0.545871
Chance of Admit	0.810351	0.792228	0.690132	0.684137	0.645365	0.882413	0.545871	1.000000

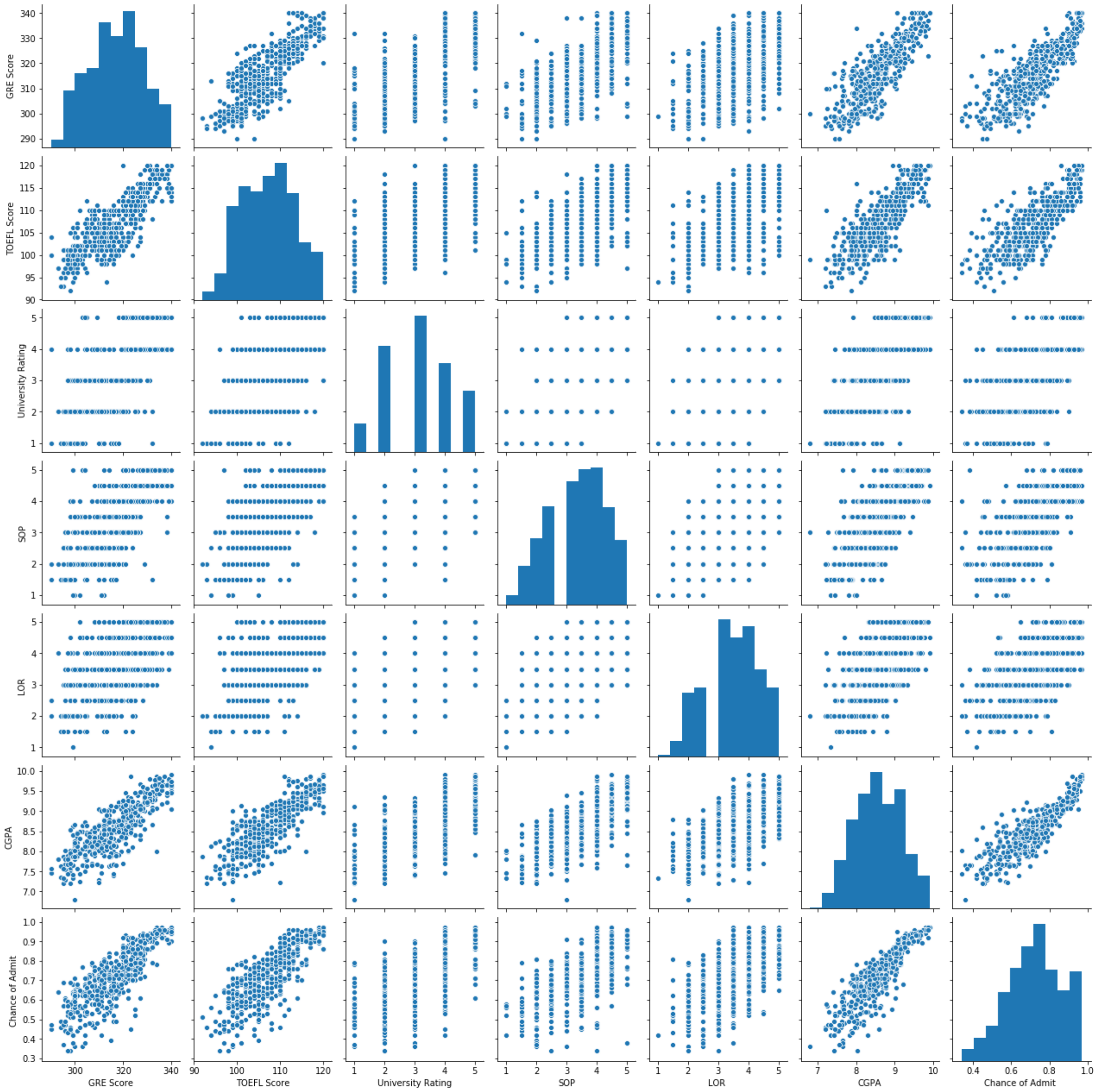


In [24]:

```
sns.pairplot(d.drop(columns='Research'))
```

Out[24]:

```
<seaborn.axisgrid.PairGrid at 0x1b9fabb4d08>
```

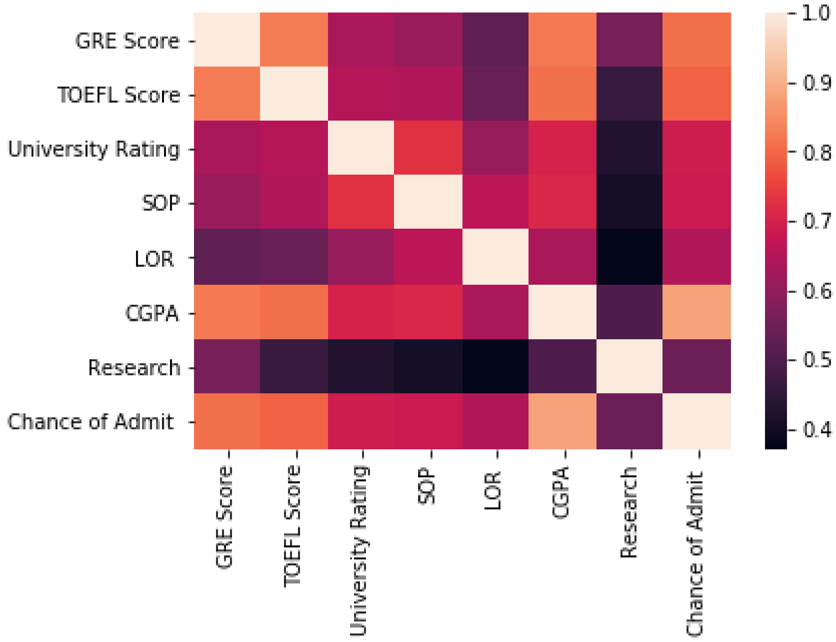


In [25]:

```
sns.heatmap(d.corr())
```

Out[25]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1b9fd16d0c8>
```



In [26]:

```
d['GRE Score'].unique()
```

Out[26]:

```
array([337, 324, 316, 322, 314, 330, 321, 308, 302, 323, 325, 327, 328,
       307, 311, 317, 319, 318, 303, 312, 334, 336, 340, 298, 295, 310,
       300, 338, 331, 320, 299, 304, 313, 332, 326, 329, 339, 309, 315,
       301, 296, 294, 306, 305, 290, 335, 333, 297, 293], dtype=int64)
```

In [27]:

```
d.columns.values
```

Out[27]:

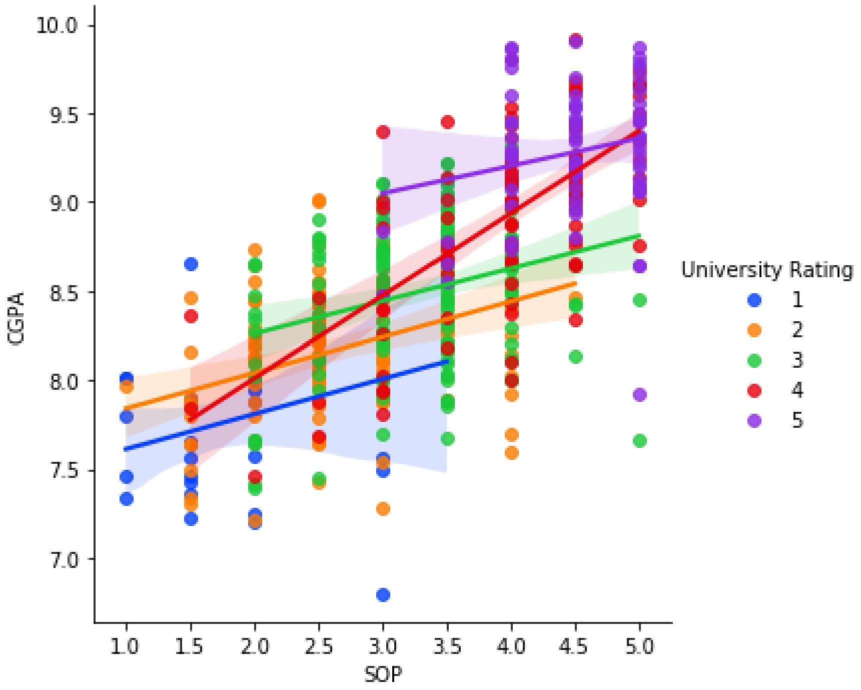
```
array(['GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'LOR ',
       'CGPA', 'Research', 'Chance of Admit '], dtype=object)
```

In [28]:

```
sns.lmplot(x='SOP',y='CGPA',data=d,hue='University Rating',palette='bright')
```

Out[28]:

```
<seaborn.axisgrid.FacetGrid at 0x1b9fd88d408>
```

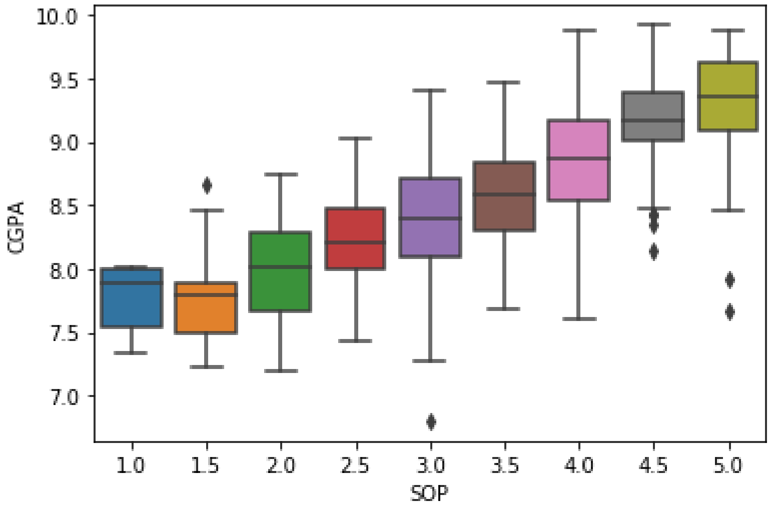


In [29]:

```
sns.boxplot(x="SOP",y="CGPA",data=d)
```

Out[29]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1b9fd95cdc8>
```

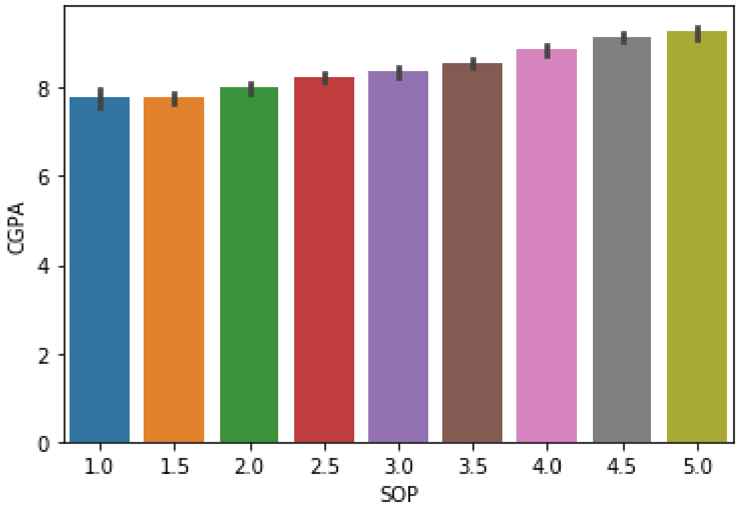


In [30]:

```
sns.barplot(x='SOP',y='CGPA',data=d)
```

Out[30]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1b9fda86b48>
```



In [31]:

```
X = d.drop(['Chance of Admit ','SOP'],axis=1) #SOP dropeed sue to high p-value
```

In [32]:

```
X
```

Out[32]:

	GRE Score	TOEFL Score	University Rating	LOR	CGPA	Research
0	337	118	4	4.5	9.65	1
1	324	107	4	4.5	8.87	1
2	316	104	3	3.5	8.00	1
3	322	110	3	2.5	8.67	1
4	314	103	2	3.0	8.21	0
...	...	...	...	...	...	...
495	332	108	5	4.0	9.02	1
496	337	117	5	5.0	9.87	1
497	330	120	5	5.0	9.56	1
498	312	103	4	5.0	8.43	0
499	327	113	4	4.5	9.04	0

500 rows × 6 columns

In [33]:

```
X.shape
```

Out[33]:

```
(500, 6)
```

In [34]:

```
np.array(X)
```

Out[34]:

```
array([[337.  , 118.  ,   4.  ,   4.5 ,   9.65,   1.  ],
       [324.  , 107.  ,   4.  ,   4.5 ,   8.87,   1.  ],
       [316.  , 104.  ,   3.  ,   3.5 ,   8.  ,   1.  ],
       ...,
       [330.  , 120.  ,   5.  ,   5.  ,   9.56,   1.  ],
       [312.  , 103.  ,   4.  ,   5.  ,   8.43,   0.  ],
       [327.  , 113.  ,   4.  ,   4.5 ,   9.04,   0.  ]])
```

g. FEATURE SCALING

In [35]:

```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler(feature_range=(0, 5))
cols=X.columns
array=np.asarray(X[cols])
rs = scaler.fit_transform(array)
rs

```

Out[35]:

```
array([[4.7       , 4.64285714, 3.75      , 4.375     , 4.56730769,
        5.        ],
       [3.4       , 2.67857143, 3.75      , 4.375     , 3.31730769,
        5.        ],
       [2.6       , 2.14285714, 2.5       , 3.125     , 1.92307692,
        5.        ],
       ...,
       [4.        , 5.        , 5.        , 5.        , 4.42307692,
        5.        ],
       [2.2       , 1.96428571, 3.75      , 5.        , 2.61217949,
        0.        ],
       [3.7       , 3.75      , 3.75      , 4.375     , 3.58974359,
        0.        ]])
```

In [36]:

```
X= pd.DataFrame(data=rs,columns=cols)
X.head()
```

Out[36]:

	GRE Score	TOEFL Score	University Rating	LOR	CGPA	Research
0	4.7	4.642857	3.75	4.375	4.567308	5.0
1	3.4	2.678571	3.75	4.375	3.317308	5.0
2	2.6	2.142857	2.50	3.125	1.923077	5.0
3	3.2	3.214286	2.50	1.875	2.996795	5.0
4	2.4	1.964286	1.25	2.500	2.259615	0.0

h.SPLITTING DATA INTO TRAIN AND TEST

In [37]:

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test=train_test_split(X,y,test_size=0.3,random_state=50)
```

In [38]:

```
X_train.shape
```

Out[38]:

```
(350, 6)
```

In [39]:

```
X_test.shape
```

Out[39]:

```
(150, 6)
```

In [40]:

```
y_train.shape
```

Out[40]:

```
(350,)
```

2.MODEL BUILDING

a. TRAINING AND TESTING

b.EVALUATION

linear regression

In [41]:

```
from sklearn.linear_model import LinearRegression
reg=LinearRegression()
reg.fit(X_train,y_train)
predictions=reg.predict(X_test)
```

In [42]:

```
from sklearn.metrics import r2_score
R2=r2_score(y_test,predictions)
```

In [43]:

```
R2
```

Out[43]:

```
0.8089840729252642
```

In [44]:

```
print(f'R-square= {round(R2*100,2)}% ')
```

```
R-square= 80.9%
```

Support vector Regressor (svm)

In [45]:

```python
from sklearn.svm import SVR
clf = SVR()
clf.fit(X_train, y_train)
predictions=clf.predict(X_test)
predictions=clf.predict(X_test)
from sklearn.metrics import r2_score
R2=r2_score(y_test,predictions)

print(f'R-square= {round(R2*100,2)}% ')
```

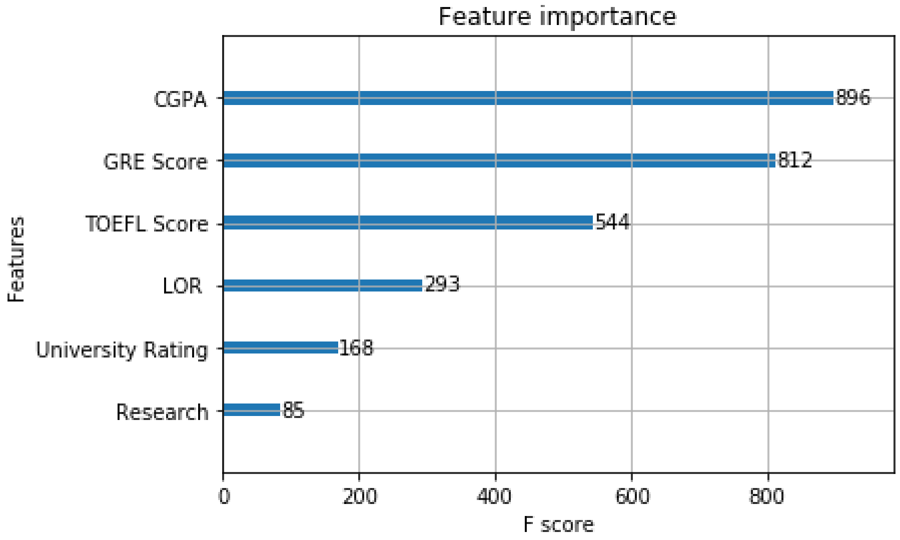
```
R-square= 71.48%
```

XGB Regressor

In [46]:

```python
from xgboost import XGBRegressor
XGBreg=XGBRegressor()
XGBreg.fit(X_train,y_train)
xgboost.plot_importance(XGBreg)
plt.show()

```



In [47]:

```python
predictions=XGBreg.predict(X_test)
from sklearn.metrics import r2_score
R2=r2_score(y_test,predictions)

print(f'R-square= {round(R2*100,2)}% ')
```

```
R-square= 71.89%
```

Random Forest Regressor

In [48]:

```
from sklearn.ensemble import RandomForestRegressor
rfr = RandomForestRegressor(n_estimators = 100, random_state = 42)
rfr.fit(X_train,y_train)
predictions = rfr.predict(X_test)
from sklearn.metrics import r2_score
R2=r2_score(y_test,predictions)

print(f'R-square= {round(R2*100,2)}% ')
```

```
R-square= 75.92%
```

In [49]:

```
import pickle
pickle.dump(clf,open('concrete.pkl','wb'))
model=pickle.load(open('concrete.pkl','rb'))
```