In [2]:
```
#Name:Pawar ved balsaheb(T512037)

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [4]:
```
#Loading data into dataframe
data = pd.read_csv("Admission_Predict.csv")
```

In [6]:
```
data.head()
```

Out[6]:

	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
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65

In [8]:
```
data.tail()
```

Out[8]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
395	396	324	110	3	3.5	3.5	9.04	1	0.82
396	397	325	107	3	3.0	3.5	9.11	1	0.84
397	398	330	116	4	5.0	4.5	9.45	1	0.91
398	399	312	103	3	3.5	4.0	8.78	0	0.67
399	400	333	117	4	5.0	4.0	9.66	1	0.95

In [10]:
```
data.shape
```

Out[10]:
```
(400, 9)
```

In [12]:
```
data.columns
```

Out[12]:
```
Index(['Serial No.', 'GRE Score', 'TOEFL Score', 'University Rating', 'SOP',
       'LOR ', 'CGPA', 'Research', 'Chance of Admit '],
      dtype='object')
```

In [14]:
```
data.drop("Serial No.",axis=1,inplace=True)
```

In [16]:
```
data
```

Out[16]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	337	118	4	4.5	4.5	9.65	1	0.92
1	324	107	4	4.0	4.5	8.87	1	0.76
2	316	104	3	3.0	3.5	8.00	1	0.72
3	322	110	3	3.5	2.5	8.67	1	0.80
4	314	103	2	2.0	3.0	8.21	0	0.65
...	...	...	...	...	...	...	...	...
395	324	110	3	3.5	3.5	9.04	1	0.82
396	325	107	3	3.0	3.5	9.11	1	0.84
397	330	116	4	5.0	4.5	9.45	1	0.91
398	312	103	3	3.5	4.0	8.78	0	0.67
399	333	117	4	5.0	4.0	9.66	1	0.95

400 rows × 8 columns

In [18]:
```
data["Chance of Admit "]=data["Chance of Admit "].apply(lambda x: 1 if x>0.5 els
```

In [20]:
```
data
```

Out[20]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	337	118	4	4.5	4.5	9.65	1	1
1	324	107	4	4.0	4.5	8.87	1	1
2	316	104	3	3.0	3.5	8.00	1	1
3	322	110	3	3.5	2.5	8.67	1	1
4	314	103	2	2.0	3.0	8.21	0	1
...	...	...	...	...	...	...	...	...
395	324	110	3	3.5	3.5	9.04	1	1
396	325	107	3	3.0	3.5	9.11	1	1
397	330	116	4	5.0	4.5	9.45	1	1
398	312	103	3	3.5	4.0	8.78	0	1
399	333	117	4	5.0	4.0	9.66	1	1

400 rows × 8 columns

In [22]:
```
#Find missing values
print("Missing values:\n")
data.isnull().sum()
```

```
Missing values:
```

Out[22]:
```
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
dtype: int64
```

In [24]:
```
data.info()
```

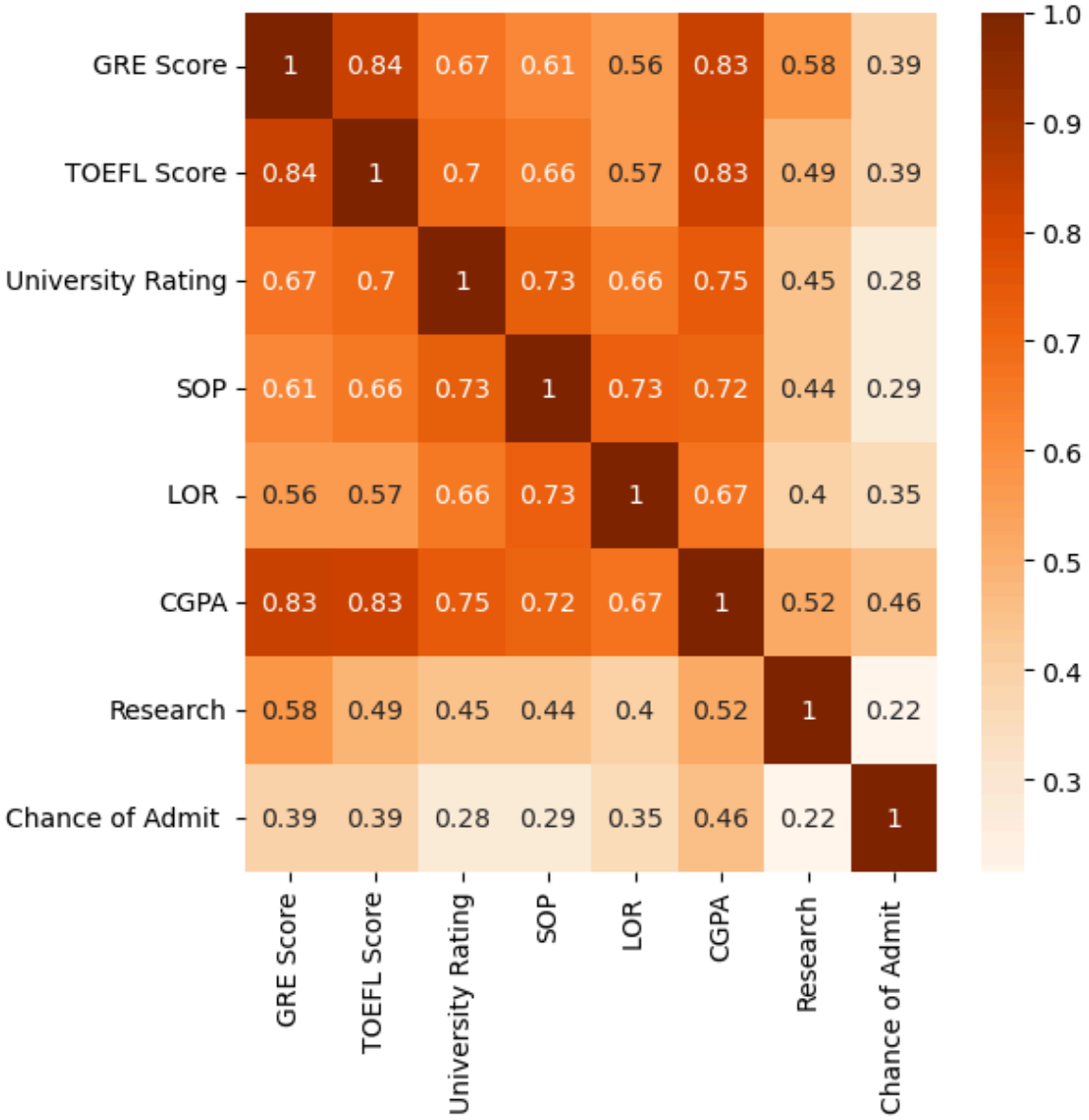
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   GRE Score          400 non-null    int64  
 1   TOEFL Score        400 non-null    int64  
 2   University Rating  400 non-null    int64  
 3   SOP                400 non-null    float64
 4   LOR                400 non-null    float64
 5   CGPA               400 non-null    float64
 6   Research           400 non-null    int64  
 7   Chance of Admit    400 non-null    int64  
dtypes: float64(3), int64(5)
memory usage: 25.1 KB
```

In [26]:
```
data.corr()
```

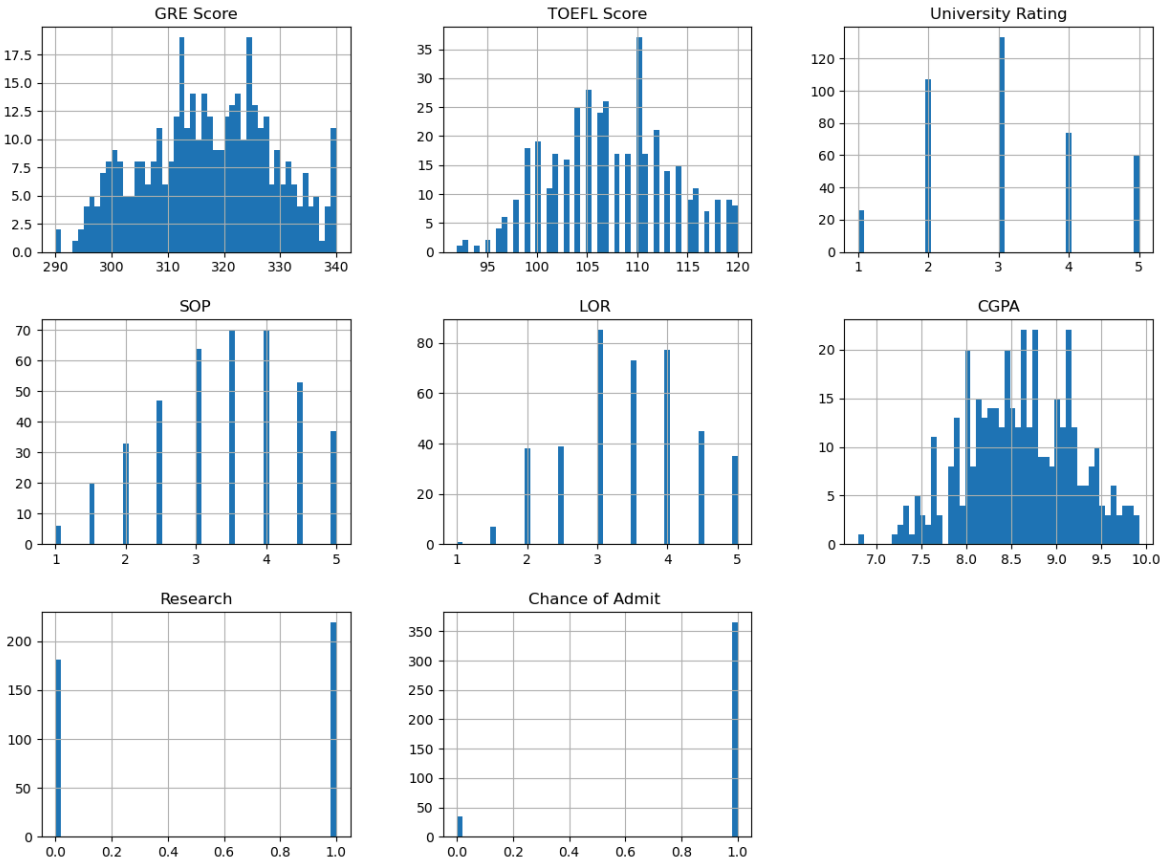
Out[26]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Cha Ad
GRE Score	1.000000	0.835977	0.668976	0.612831	0.557555	0.833060	0.580391	0.390
TOEFL Score	0.835977	1.000000	0.695590	0.657981	0.567721	0.828417	0.489858	0.393
University Rating	0.668976	0.695590	1.000000	0.734523	0.660123	0.746479	0.447783	0.279
SOP	0.612831	0.657981	0.734523	1.000000	0.729593	0.718144	0.444029	0.285
LOR	0.557555	0.567721	0.660123	0.729593	1.000000	0.670211	0.396859	0.353
CGPA	0.833060	0.828417	0.746479	0.718144	0.670211	1.000000	0.521654	0.455
Research	0.580391	0.489858	0.447783	0.444029	0.396859	0.521654	1.000000	0.216
Chance of Admit	0.390875	0.393121	0.279316	0.285939	0.353341	0.455949	0.216193	1.000

In [28]:
```
plt.figure(figsize=(6,6))
sns.heatmap(data.corr(), annot=True, cmap='Oranges')
plt.show()
```



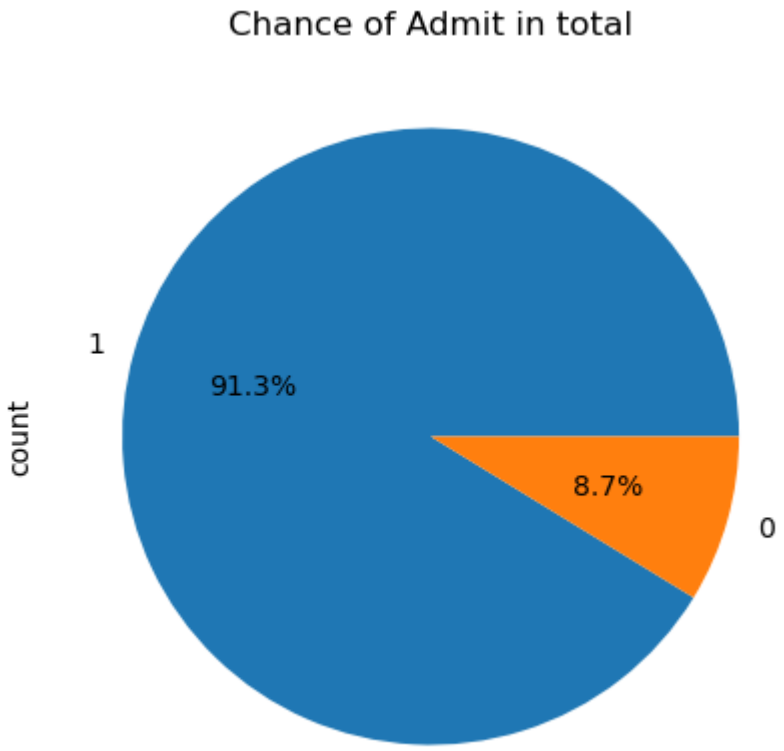
In [30]:
```
data.hist(bins = 50,figsize = (15,11));
```



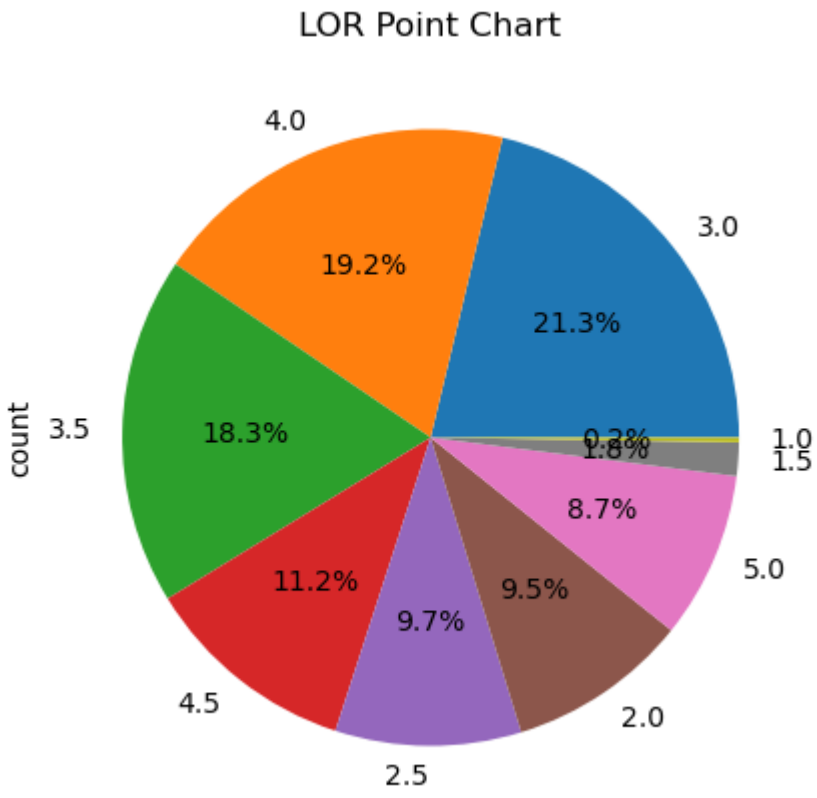
In [32]:
```
data_admit = data[data['Chance of Admit ']==1]
data_non_admit = data[data['Chance of Admit ']==0]
print("Admitted count       : " ,data_admit.shape[0])
print("Non - Admitted count : " ,data_non_admit.shape[0])
```

```
Admitted count       :  365
Non - Admitted count :  35
```

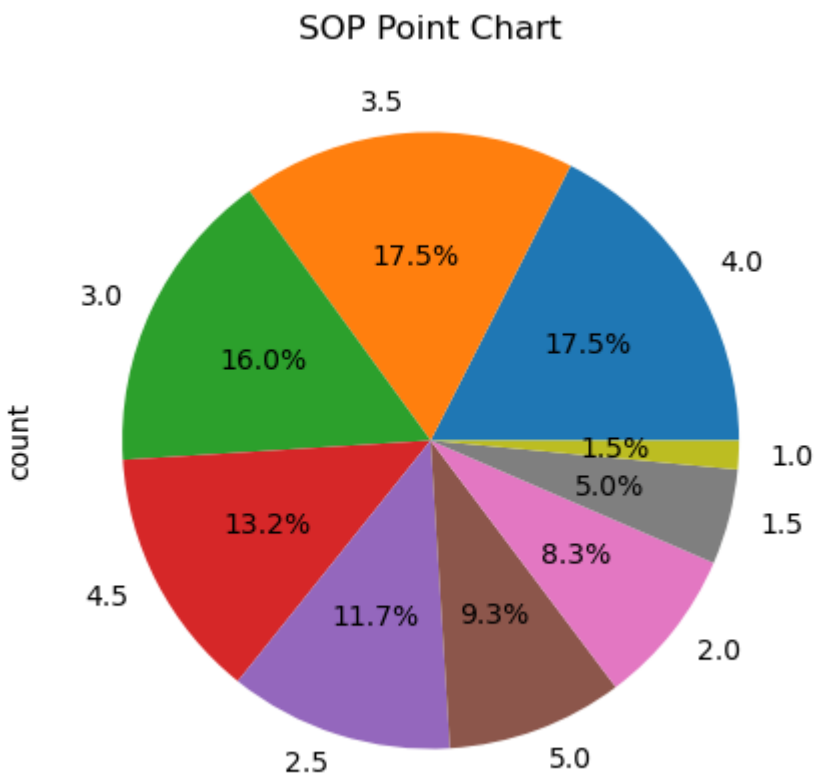
In [34]:
```
data['Chance of Admit '].value_counts().plot(kind='pie',figsize=(5,5),autopct='%
plt.title("Chance of Admit in total")
plt.show()
```



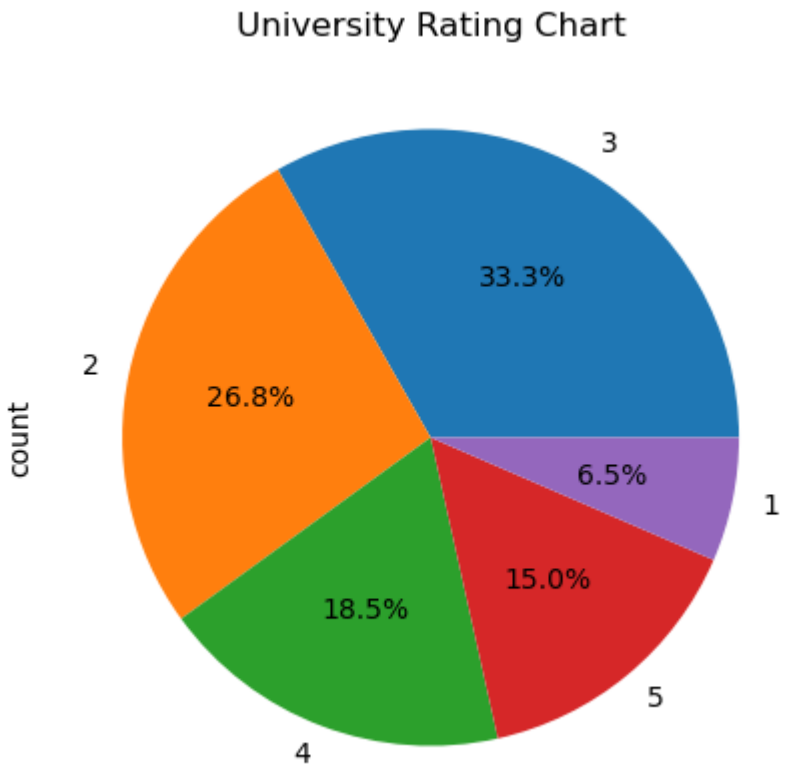
In [36]:
```
data['LOR '].value_counts().plot(kind='pie',figsize=(5,5),autopct='%1.1f%%')
plt.title("LOR Point Chart")
plt.show()
```



In [38]:
```
data['SOP'].value_counts().plot(kind='pie',figsize=(5,5),autopct='%1.1f%%')
plt.title("SOP Point Chart")
plt.show()
```



In [40]:
```
data["University Rating"].value_counts().plot(kind='pie',figsize=(5,5),autopct='
plt.title("University Rating Chart")
plt.show()
```

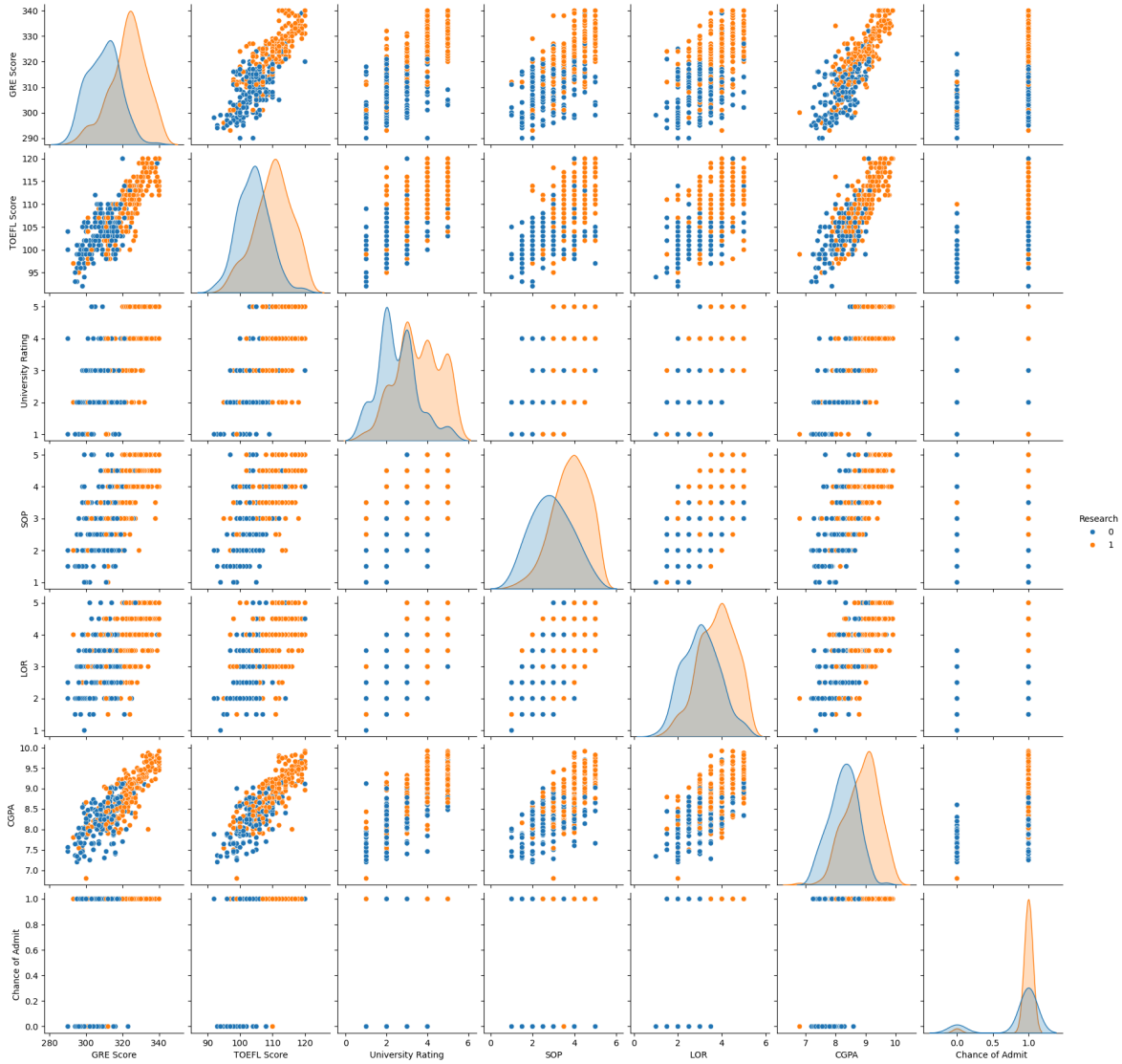


In [42]:
```
#highest GRE score
print("maximum GRE Score : ",data['GRE Score'].max())
#lowest GRE score
print("minimum GRE Score : ",data['GRE Score'].min())
```

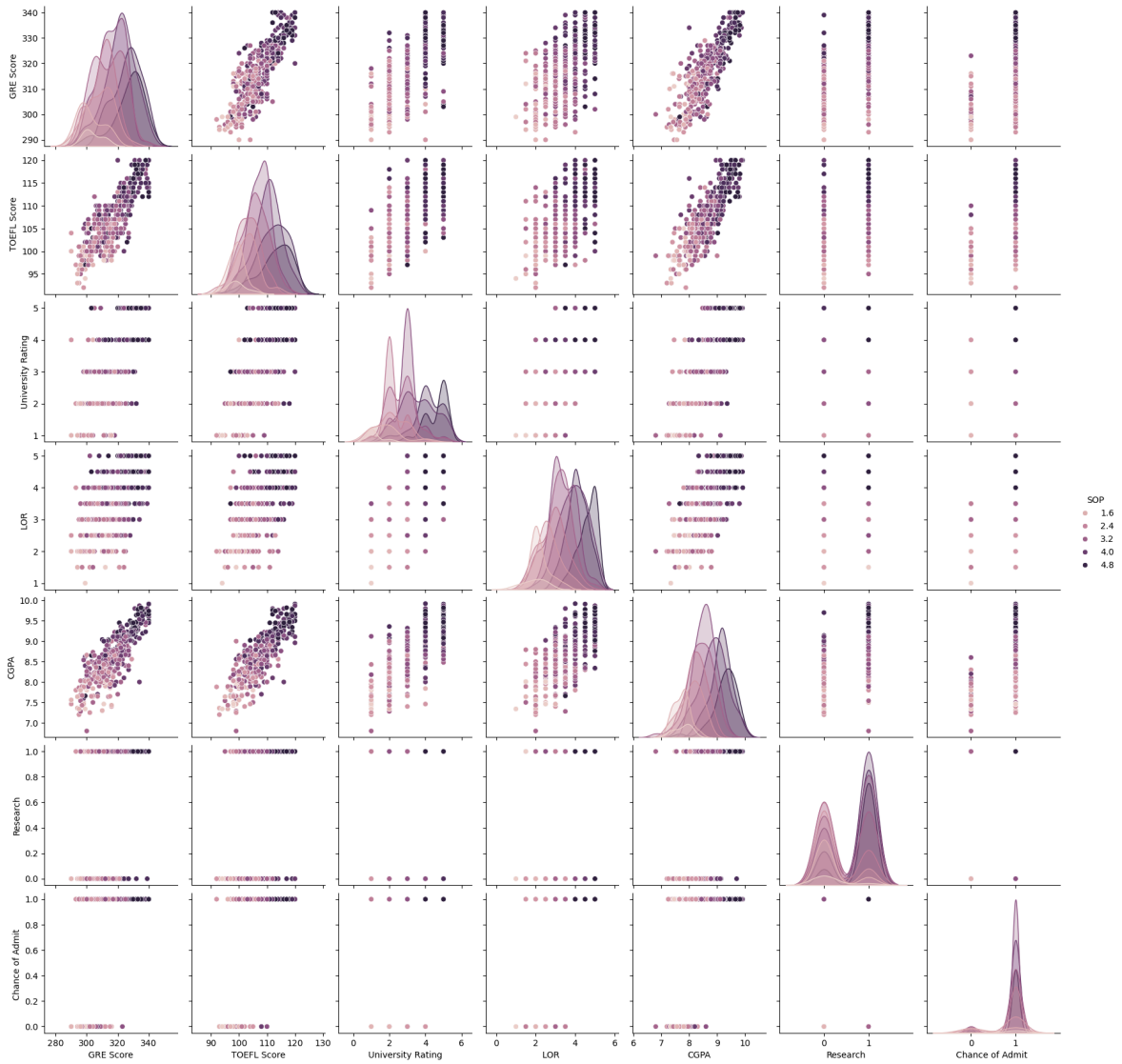
```
maximum GRE Score :  340
minimum GRE Score :  290
```

In [44]:
```
sns.pairplot(data,hue = "Research")
```

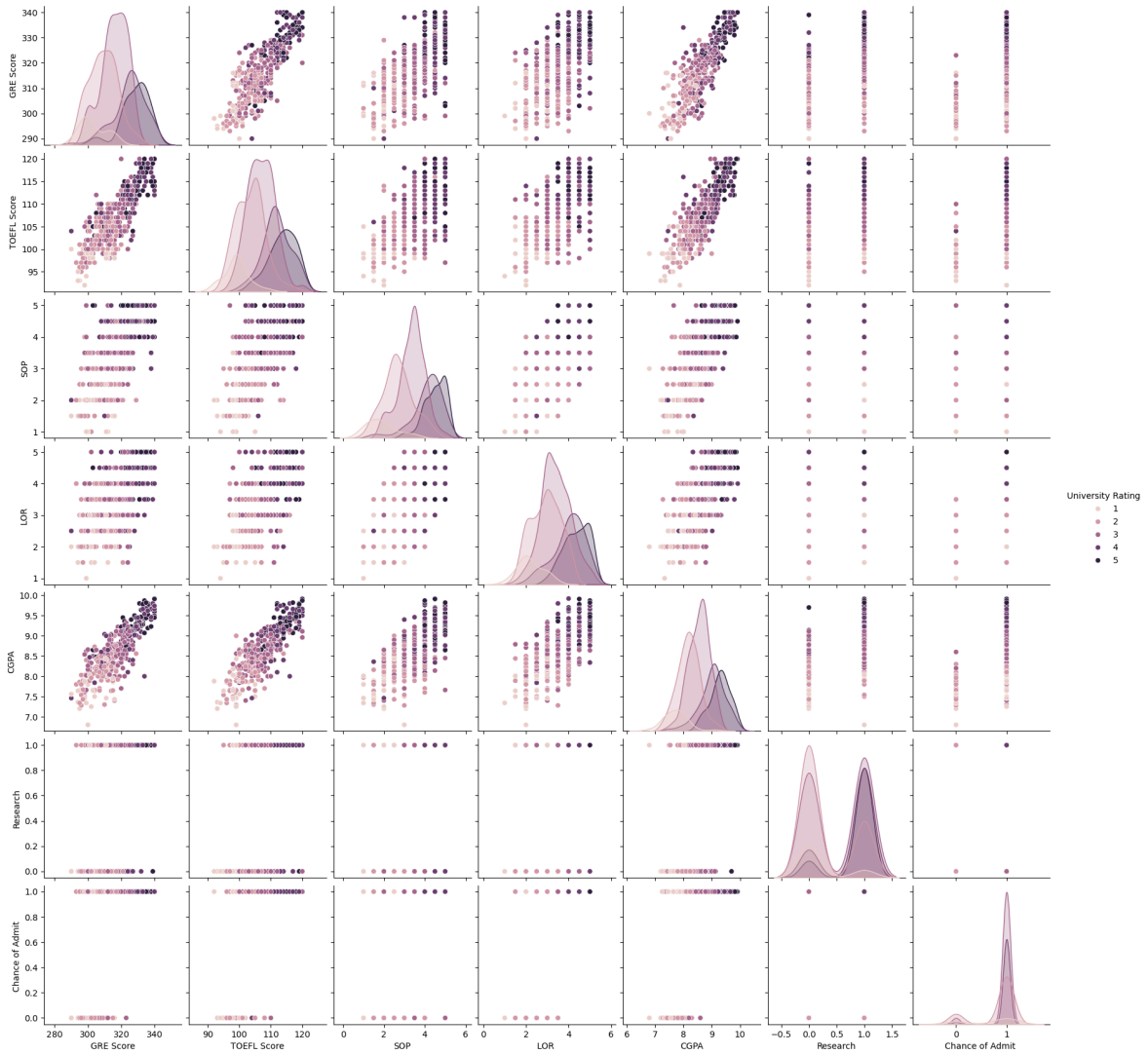
Out[44]: <seaborn.axisgrid.PairGrid at 0x24e2de89940>



In [46]:
```
sns.pairplot(data,hue = "SOP");
```

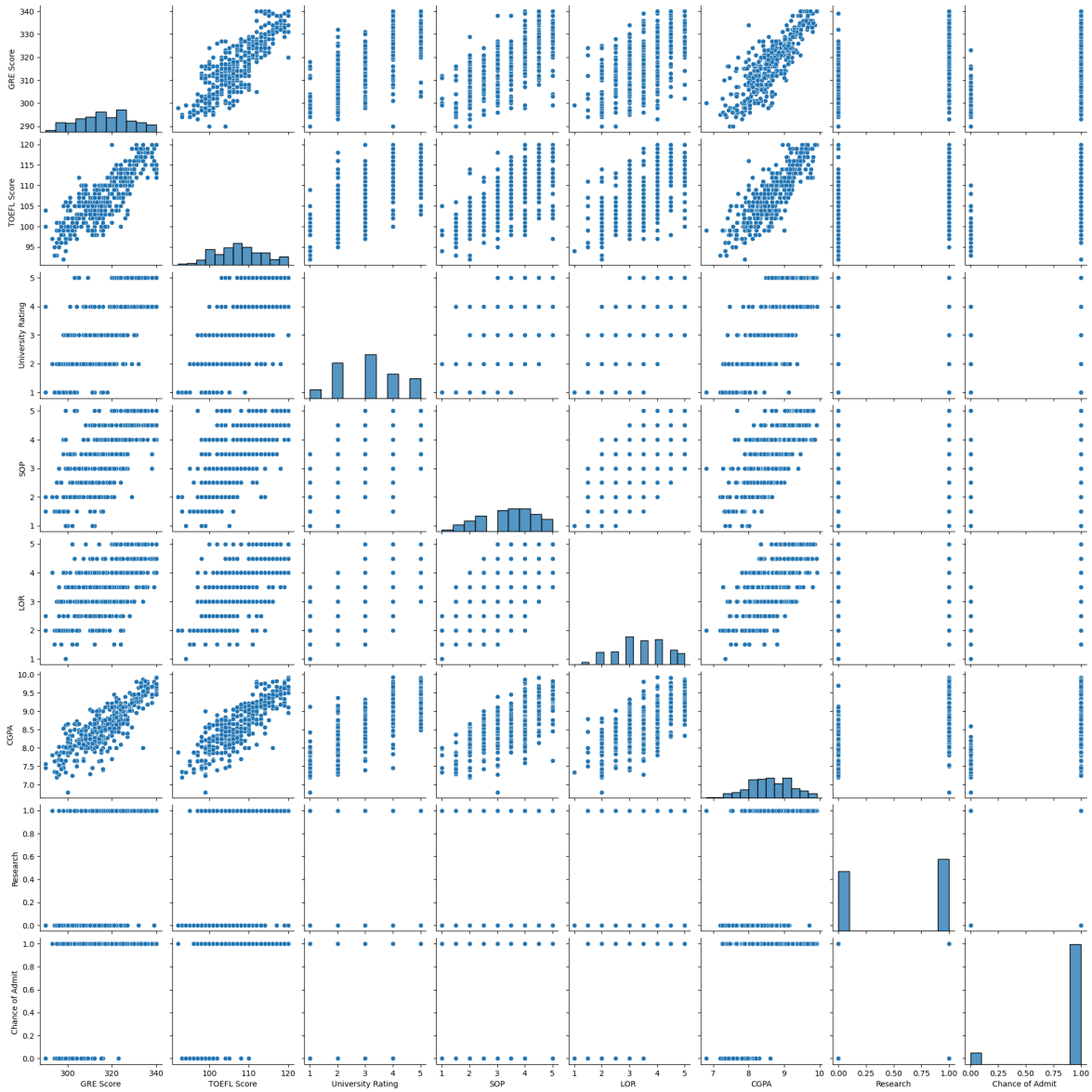


In [48]:
```
sns.pairplot(data,hue = "University Rating");
```



In [50]:
```
sns.pairplot(data)
```

Out[50]:
```
<seaborn.axisgrid.PairGrid at 0x24e375efe00>
```



In [52]:
```
X= data.drop("Chance of Admit ",axis =1 )
y= data["Chance of Admit "]
```

In [54]:
```
X.nunique()
```

Out[54]:
```
GRE Score            49
TOEFL Score          29
University Rating     5
SOP                   9
LOR                   9
CGPA                168
Research              2
dtype: int64
```

In [56]:
```
from sklearn.model_selection import train_test_split

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

# Shape of train Test Split
print(X_train.shape,y_train.shape)
print(X_test.shape,y_test.shape)
```

```
(320, 7) (320,)
(80, 7) (80,)
```

In [58]:
```
from sklearn.tree import DecisionTreeClassifier

# instantiate the model
tree = DecisionTreeClassifier()

# fit the model
tree.fit(X_train, y_train)
```

Out[58]:
```
DecisionTreeClassifier()
```

In [60]:
```
y_train_tree = tree.predict(X_train)
y_test_tree = tree.predict(X_test)
```

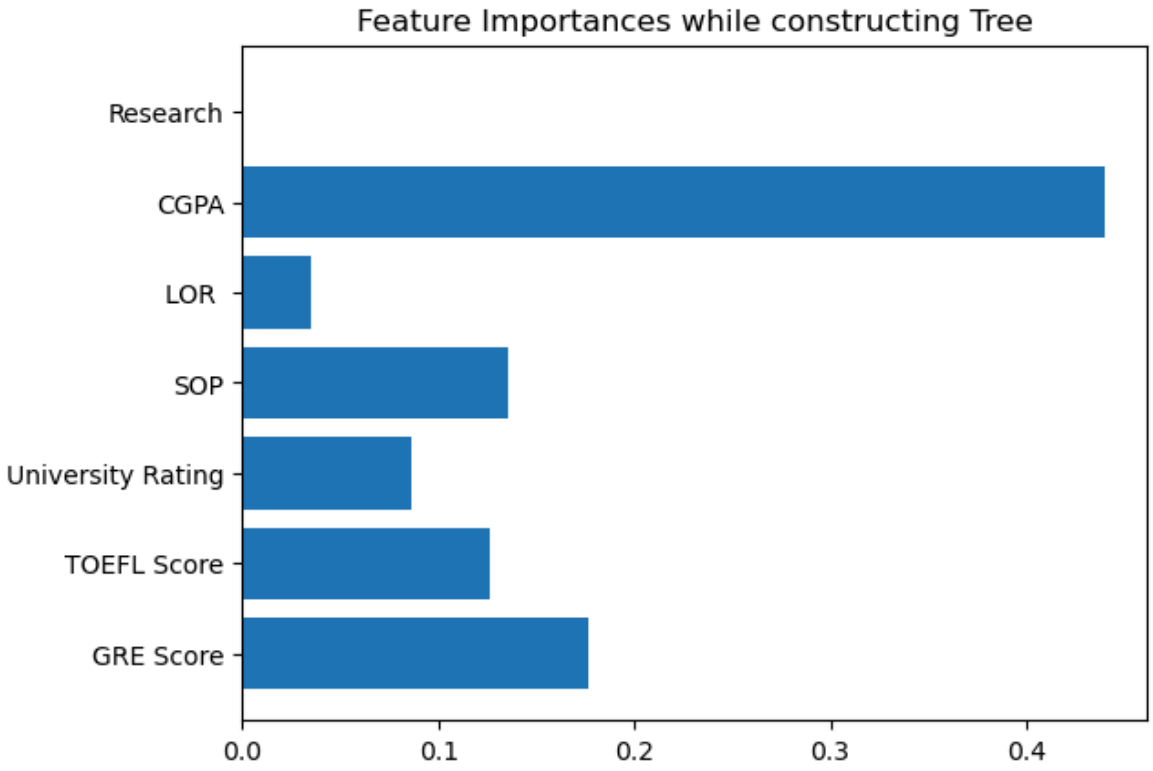
In [62]:
```
from sklearn.metrics import accuracy_score
#computing the accuracy of the model performance
acc_train_tree = accuracy_score(y_train,y_train_tree)
acc_test_tree = accuracy_score(y_test,y_test_tree)


print("Decision Tree : Accuracy on training Data: {:.3f}".format(acc_train_tree))
print("Decision Tree : Accuracy on test Data: {:.3f}".format(acc_test_tree))
```

```
Decision Tree : Accuracy on training Data: 1.000
Decision Tree : Accuracy on test Data: 0.863
```

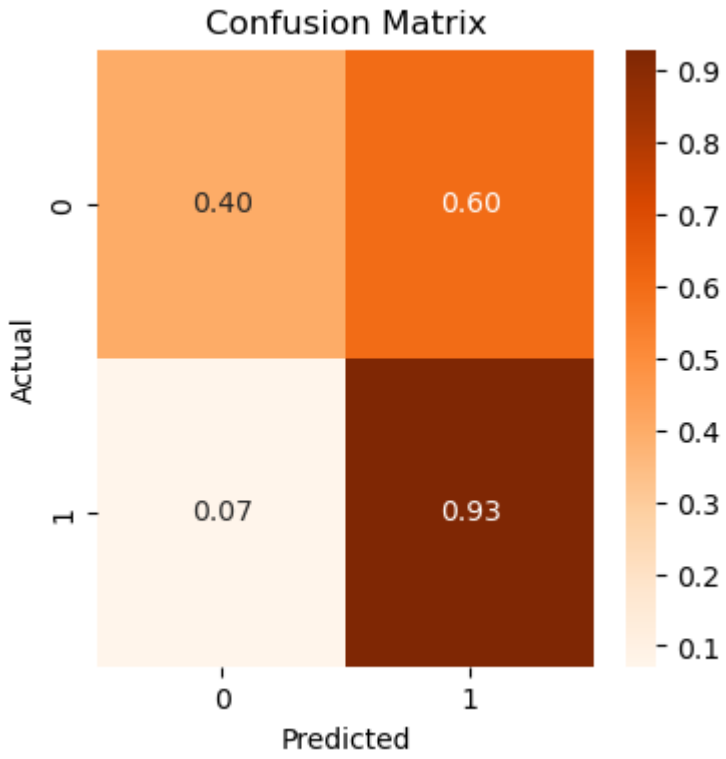
In [64]:
```
from sklearn.metrics import classification_report
#computing the classification report of the model

print(classification_report(y_test, y_test_tree))
```

```
              precision    recall  f1-score   support

           0       0.44      0.40      0.42        10
           1       0.92      0.93      0.92        70

    accuracy                           0.86        80
   macro avg       0.68      0.66      0.67        80
weighted avg       0.86      0.86      0.86        80
```

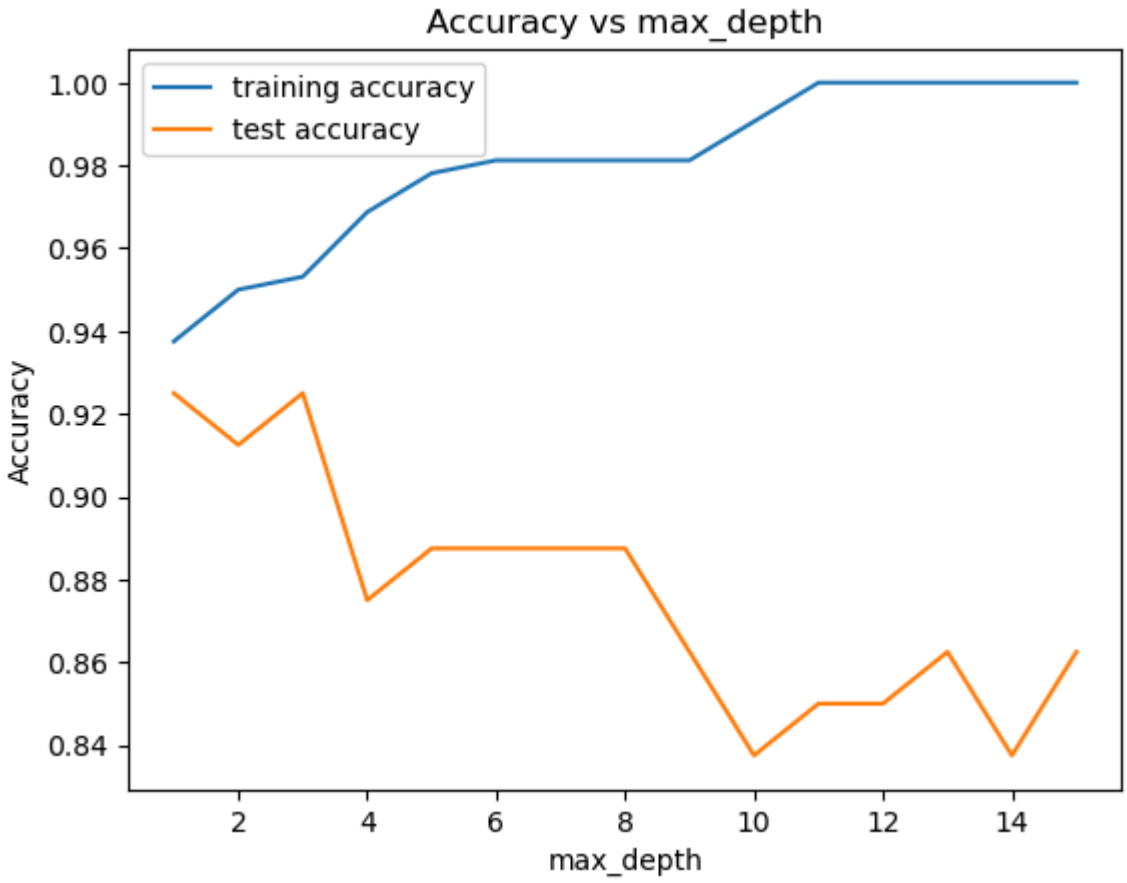
In [66]:
```
plt.barh(X.columns,tree.feature_importances_)
plt.title("Feature Importances while constructing Tree")
plt.show()
```



In [68]:
```
#visualization of Confusion Matrix
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(y_test,y_test_tree)
cmn = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
fig, ax = plt.subplots(figsize=(4,4))
sns.heatmap(cmn, annot=True, fmt='.2f',cmap='Oranges')
plt.title("Confusion Matrix")
plt.ylabel('Actual')
plt.xlabel('Predicted')
plt.show(block=False);
```



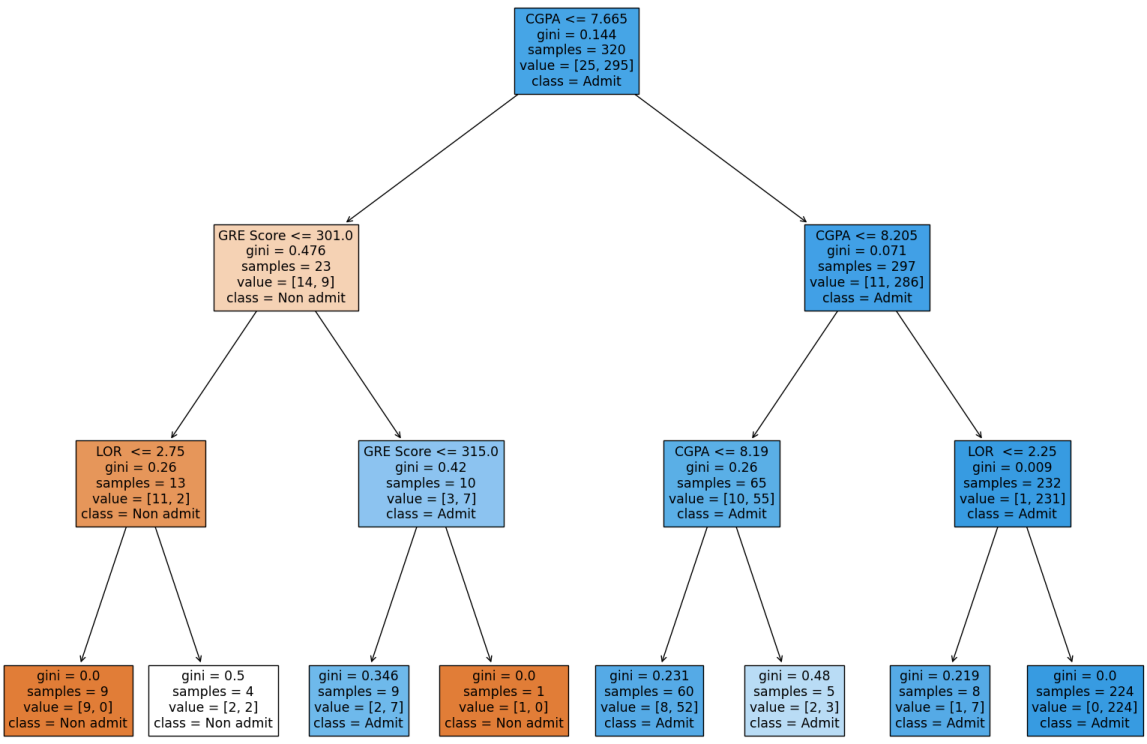
In [70]:
```
training_accuracy = []
test_accuracy = []
# try max_depth from 1 to 15
depth = range(1,16)
for n in depth:
    tree_test = DecisionTreeClassifier(max_depth=n)
    tree_test.fit(X_train, y_train)
    # record training set accuracy
    training_accuracy.append(tree_test.score(X_train, y_train))
    # record generalization accuracy
    test_accuracy.append(tree_test.score(X_test, y_test))


#plotting the training & testing accuracy for max_depth from 1 to 15
plt.plot(depth, training_accuracy, label="training accuracy")
plt.plot(depth, test_accuracy, label="test accuracy")
plt.title("Accuracy vs max_depth")
plt.ylabel("Accuracy")
plt.xlabel("max_depth")
plt.legend();
```



In [72]:
```
from sklearn.tree import export_text
from sklearn.tree import DecisionTreeClassifier

# instantiate the model
tree = DecisionTreeClassifier(max_depth=3)

# fit the model
tree.fit(X_train, y_train)
text_representation = export_text(tree)
print(text_representation)
```

```
|--- feature_5 <= 7.66
|   |--- feature_0 <= 301.00
|   |   |--- feature_4 <= 2.75
|   |   |   |--- class: 0
|   |   |--- feature_4 >  2.75
|   |   |   |--- class: 0
|   |--- feature_0 >  301.00
|   |   |--- feature_0 <= 315.00
|   |   |   |--- class: 1
|   |   |--- feature_0 >  315.00
|   |   |   |--- class: 0
|--- feature_5 >  7.66
|   |--- feature_5 <= 8.20
|   |   |--- feature_5 <= 8.19
|   |   |   |--- class: 1
|   |   |--- feature_5 >  8.19
|   |   |   |--- class: 1
|   |--- feature_5 >  8.20
|   |   |--- feature_4 <= 2.25
|   |   |   |--- class: 1
|   |   |--- feature_4 >  2.25
|   |   |   |--- class: 1
```

In [74]:
```
import sklearn.tree as tr
fig = plt.figure(figsize=(20,15))
_ = tr.plot_tree(tree,
                 feature_names=X.columns,
                 class_names=np.array(["Non admit","Admit"]),
                 filled=True)
```



In [ ]:
```

```