In [170]:

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

In [171]:

```
data = pd.read_csv('Admission_Predict.csv')
data.head()
```

Out[171]:

	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 [172]:

```
clean_data = data
clean_data.head()
```

Out[172]:

	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 [173]:

```
#Removing Unused Data
clean_data = clean_data.drop('Serial No.', axis=1)
clean_data.head()
```

Out[173]:

	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

In [174]:

```
#Check if data is null
print(pd.isnull(clean_data).sum())
```

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

In [175]:

```
#Data Description
clean_data.describe()
```

Out[175]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
count	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000
mean	316.807500	107.410000	3.087500	3.400000	3.452500	8.598925	0.547500	0.724350
std	11.473646	6.069514	1.143728	1.006869	0.898478	0.596317	0.498362	0.142609
min	290.000000	92.000000	1.000000	1.000000	1.000000	6.800000	0.000000	0.340000
25%	308.000000	103.000000	2.000000	2.500000	3.000000	8.170000	0.000000	0.640000
50%	317.000000	107.000000	3.000000	3.500000	3.500000	8.610000	1.000000	0.730000
75%	325.000000	112.000000	4.000000	4.000000	4.000000	9.062500	1.000000	0.830000
max	340.000000	120.000000	5.000000	5.000000	5.000000	9.920000	1.000000	0.970000

In [176]:

```
#Chance Of Admit According to Research
chance_admit_research = clean_data[['Research', 'Chance of Admit ']].groupby(['Research'],
as_index=False).mean()
chance_admit_research
```

Out[176]:

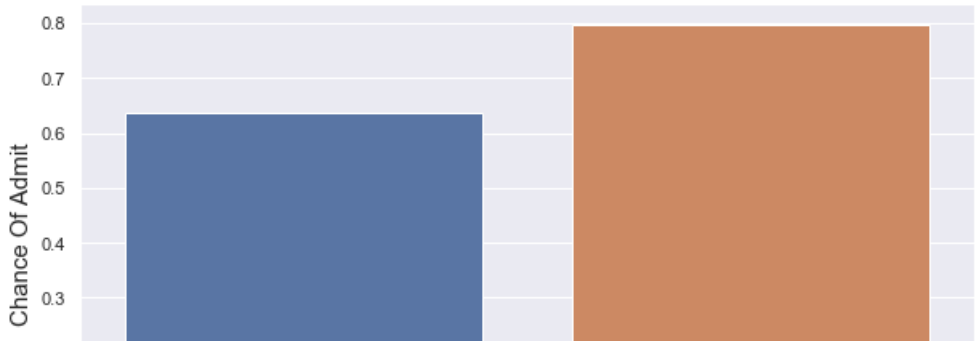
	Research	Chance of Admit
0	0	0.637680
1	1	0.795982

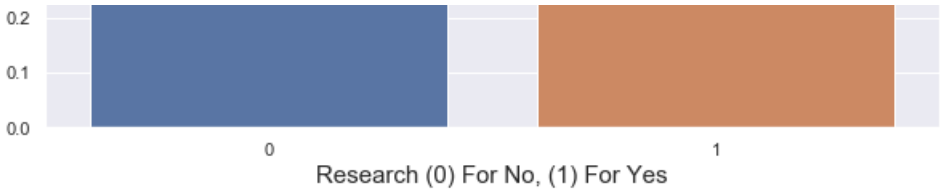
In [177]:

```
sns.barplot(x="Research", y="Chance of Admit ", data=chance_admit_research)
plt.xlabel('Research (0) For No, (1) For Yes', fontsize=15)
plt.ylabel('Chance Of Admit', fontsize=15)
```

Out[177]:

```
Text(0, 0.5, 'Chance Of Admit')
```





In [178]:

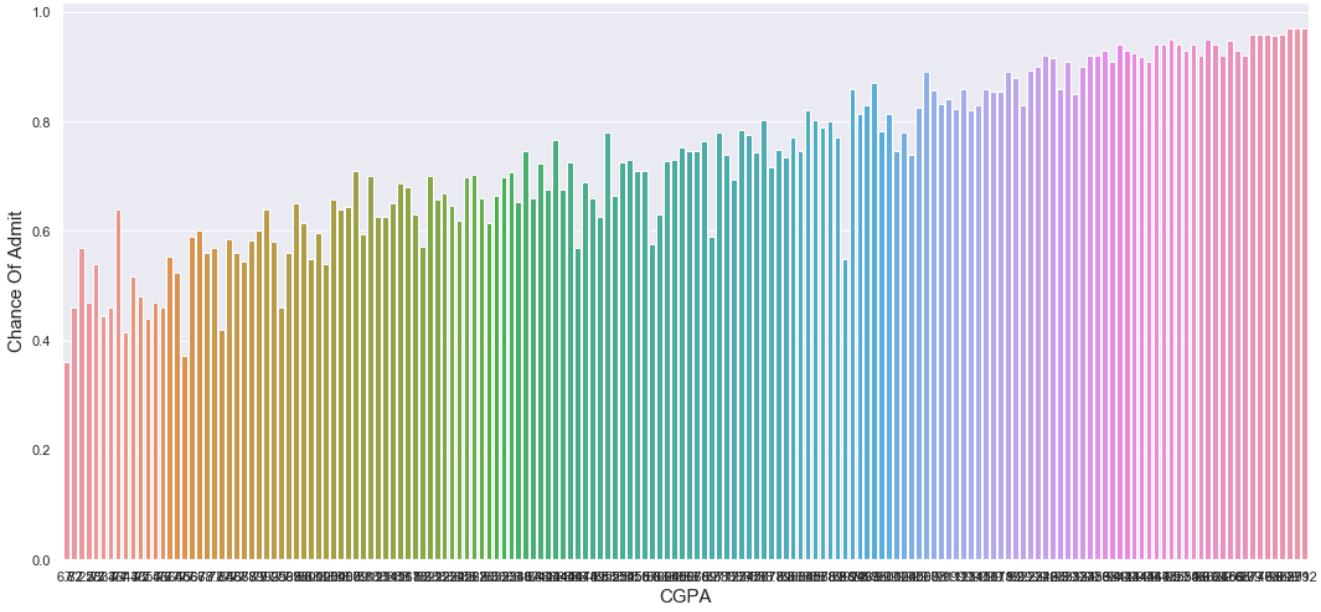
```
#Chance Of Admit According to Research
chance_admit_cgpa = clean_data[['CGPA', 'Chance of Admit ']].groupby(['CGPA'],
as_index=False).mean()
```

In [179]:

```
sns.set(rc={'figure.figsize':(18,8.27)})
sns.barplot(x="CGPA", y="Chance of Admit ", data=chance_admit_cgpa)
plt.xlabel('CGPA', fontsize=15)
plt.ylabel('Chance Of Admit', fontsize=15)
```

Out[179]:

```
Text(0, 0.5, 'Chance Of Admit')
```



In [180]:

```
#CGPA Minimum
clean_data['CGPA'].min()
```

Out[180]:

```
6.8
```

In [181]:

```
#CGPA MAXIMUM
clean_data['CGPA'].max()
```

Out[181]:

```
9.92
```

In [182]:

```
#Categorizing the CGPA
clean_data['CGPA_CATEGORY'] = clean_data['CGPA']
```

```
bins = [0, 5, 6, 7, 8, 9, 10]
labels = ['FAIL', 'PASS','AVERAGE', 'GOOD', 'EXCELLENT', 'OUTSTANDING']
clean_data['CGPA_CATEGORY'] = pd.cut(clean_data['CGPA_CATEGORY'], bins, labels=labels)
```

In [183]:

```
#Categorized CGPA
clean_data['CGPA_CATEGORY'].head()
```

Out[183]:

```
0    OUTSTANDING
1      EXCELLENT
2           GOOD
3      EXCELLENT
4      EXCELLENT
Name: CGPA_CATEGORY, dtype: category
Categories (6, object): [FAIL < PASS < AVERAGE < GOOD < EXCELLENT < OUTSTANDING]
```

In [184]:

```
#Chance of Admit According to Grades
chance_admit_grades = clean_data[['CGPA_CATEGORY','Chance of Admit ']].groupby(['CGPA_CATEGORY'],
as_index=False).mean()
chance_admit_grades
```

Out[184]:

	CGPA_CATEGORY	Chance of Admit
0	FAIL	NaN
1	PASS	NaN
2	AVERAGE	0.360000
3	GOOD	0.541515
4	EXCELLENT	0.699773
5	OUTSTANDING	0.882212

In [185]:

```
#Set 0 for Chance of Admit where data is null or NaN
chance_admit_grades['Chance of Admit '] = np.where(pd.isnull(chance_admit_grades['Chance of Admit '
]), 0, chance_admit_grades['Chance of Admit '])
```

In [186]:

```
chance_admit_grades
```

Out[186]:

	CGPA_CATEGORY	Chance of Admit
0	FAIL	0.000000
1	PASS	0.000000
2	AVERAGE	0.360000
3	GOOD	0.541515
4	EXCELLENT	0.699773
5	OUTSTANDING	0.882212

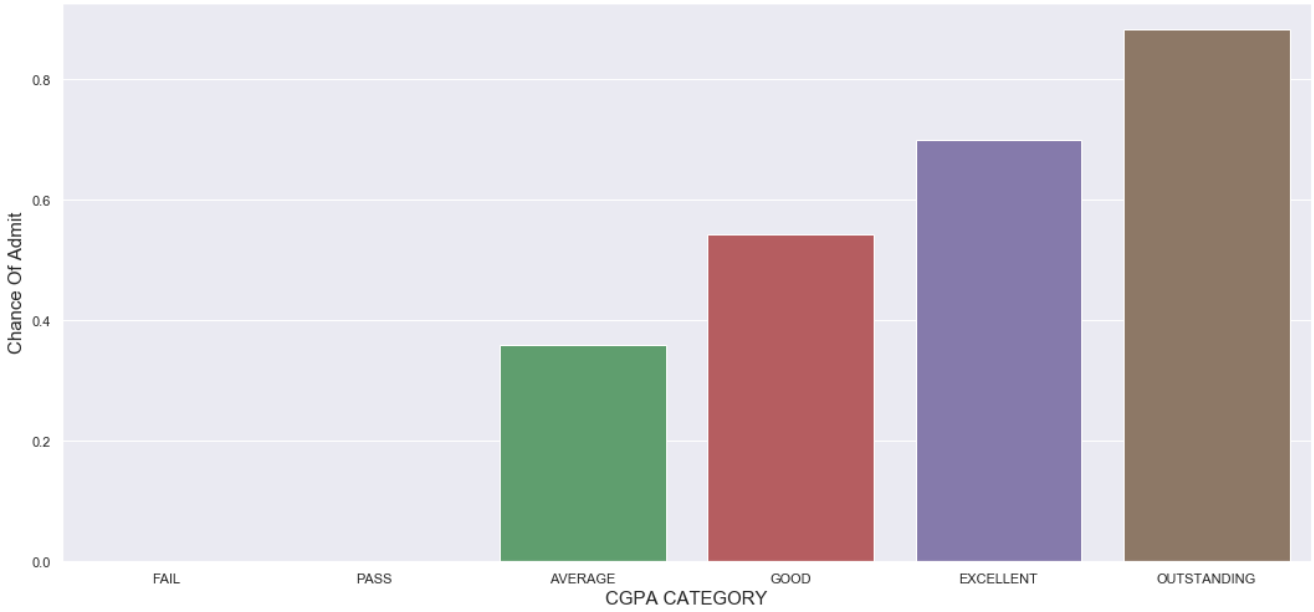
In [187]:

```
#Visualising the chance of admit according to grades
sns.barplot(x="CGPA_CATEGORY", y="Chance of Admit ", data=chance_admit_grades)
plt.xlabel("CGPA_CATEGORY", fontsize=15)
```

```
plt.ylabel("Chance Of Admit", fontsize=15)
```

Out[187]:

```
Text(0, 0.5, 'Chance Of Admit')
```



In [188]:

```
#Research according to grades
research_wrt_grades = clean_data[['CGPA_CATEGORY', 'Research']].groupby(['CGPA_CATEGORY'],
as_index=False).mean()
research_wrt_grades
```

Out[188]:

	CGPA_CATEGORY	Research
0	FAIL	NaN
1	PASS	NaN
2	AVERAGE	1.000000
3	GOOD	0.196970
4	EXCELLENT	0.459091
5	OUTSTANDING	0.920354

In [189]:

```
#Replacing 0 to Nan or null in Research Column
research_wrt_grades['Research'] = np.where(pd.isnull(research_wrt_grades['Research']), 0, research_
wrt_grades['Research'])
research_wrt_grades
```

Out[189]:

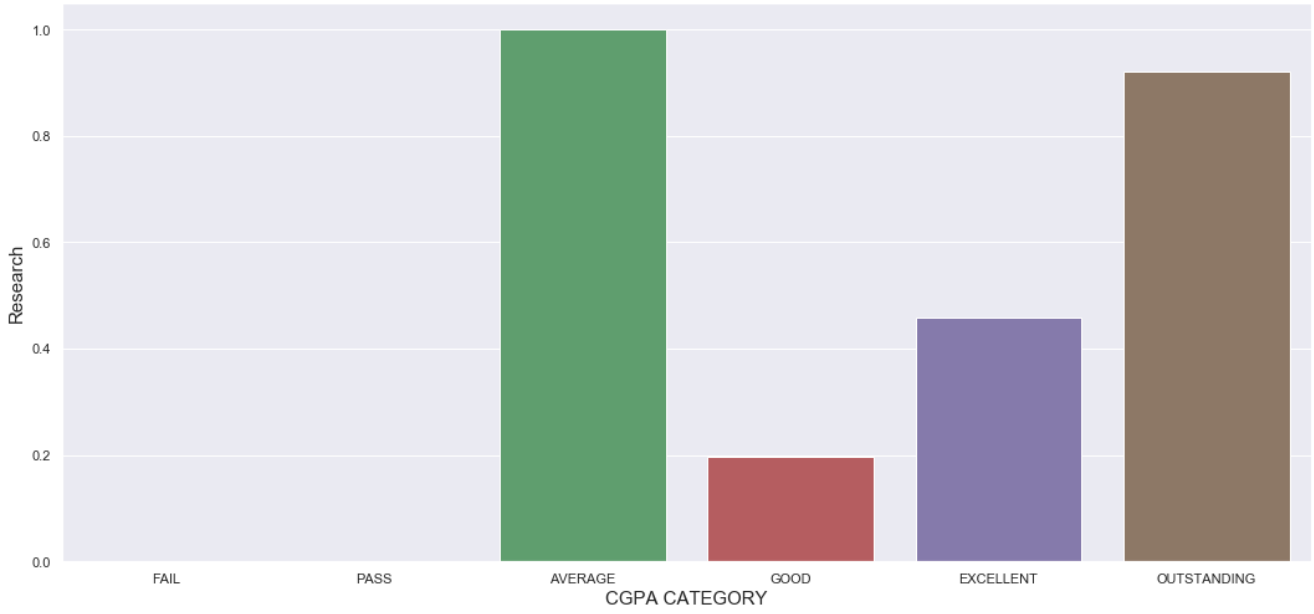
	CGPA_CATEGORY	Research
0	FAIL	0.000000
1	PASS	0.000000
2	AVERAGE	1.000000
3	GOOD	0.196970
4	EXCELLENT	0.459091
5	OUTSTANDING	0.920354

In [190]:

```
#This shows All Students with Average Grades have research
#Visualising Grades with Research
sns.barplot(x="CGPA_CATEGORY", y="Research", data=research_wrt_grades)
plt.xlabel('CGPA CATEGORY', fontsize=15)
plt.ylabel('Research', fontsize=15)
```

Out[190]:

```
Text(0, 0.5, 'Research')
```



In [191]:

```
clean_data.columns
```

Out[191]:

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

In [192]:

```
#Chance of Admit according to Letter of Recommendation
chance_admit_lor = clean_data[['Chance of Admit ', 'LOR ']].groupby(['LOR '], as_index=False).mean
()
chance_admit_lor
```

Out[192]:

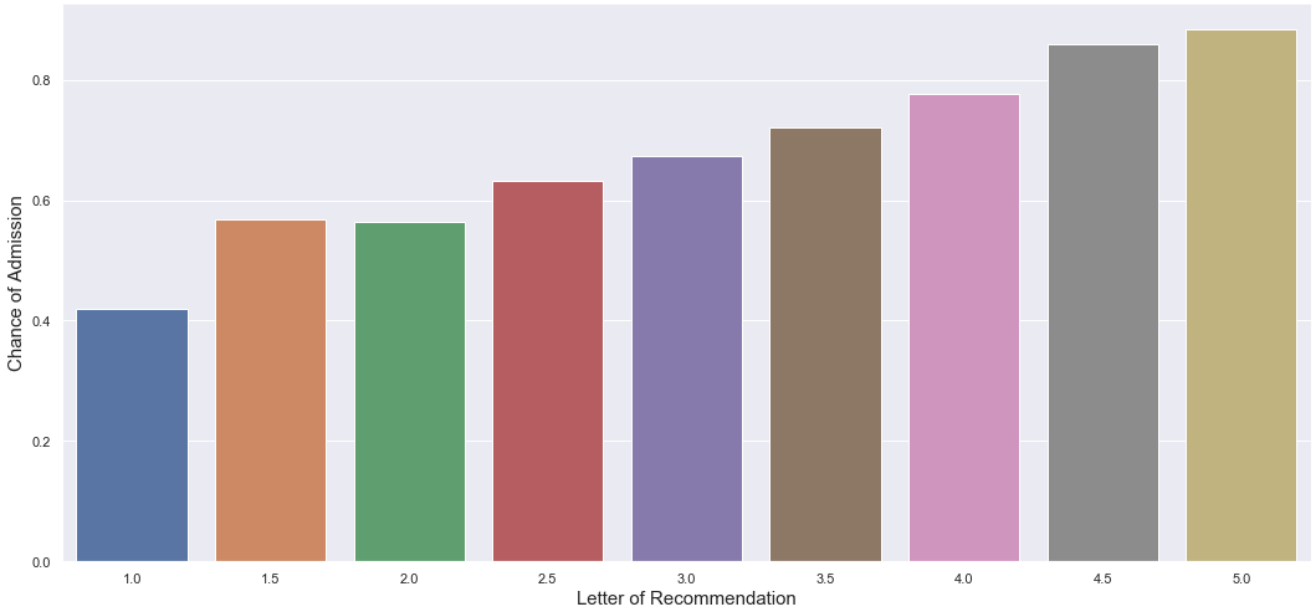
	LOR	Chance of Admit
0	1.0	0.420000
1	1.5	0.567143
2	2.0	0.563158
3	2.5	0.632564
4	3.0	0.674235
5	3.5	0.721096
6	4.0	0.776364
7	4.5	0.858444
8	5.0	0.883429

In [193]:

```
#Visualizing Chance of Admit according to Letter of Recommendation
sns.barplot(x="LOR ", y='Chance of Admit ', data=chance_admit_lor)
plt.xlabel('Letter of Recommendation', fontsize=15)
plt.ylabel('Chance of Admission', fontsize=15)
```

Out[193]:

```
Text(0, 0.5, 'Chance of Admission')
```



In [194]:

```
#Chance of Admit according to Statement of Purpose
chance_admit_purpose = clean_data[['Chance of Admit ', 'SOP']].groupby(['SOP'], as_index=False).me
an()
chance_admit_purpose
```

Out[194]:

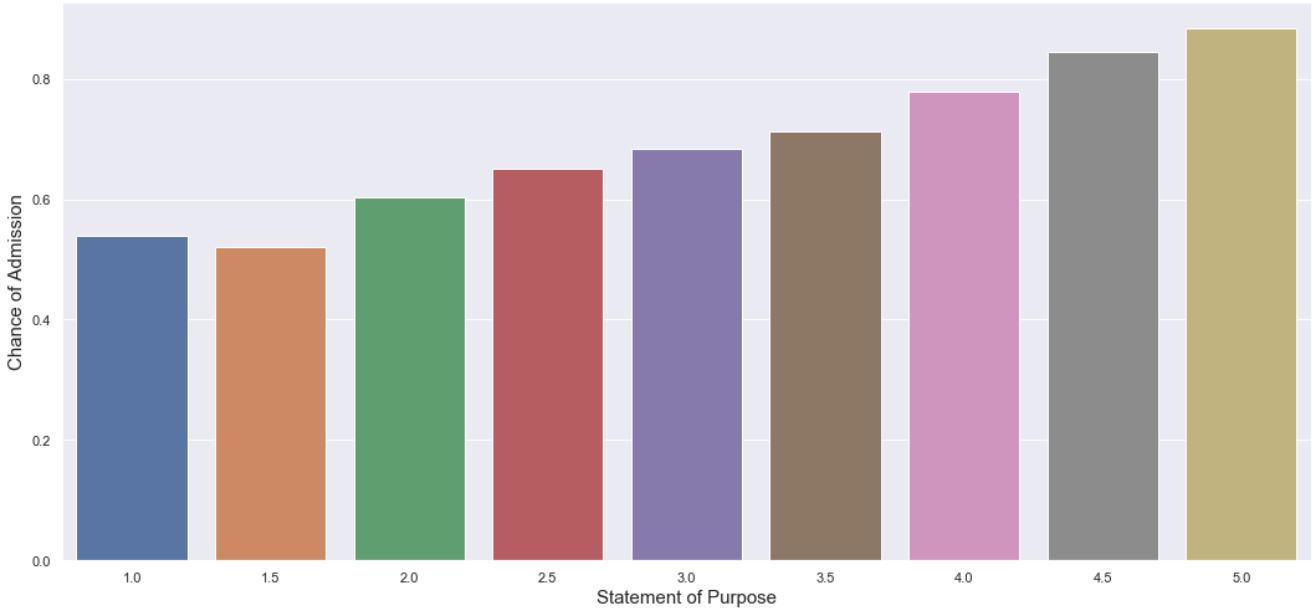
	SOP	Chance of Admit
0	1.0	0.538333
1	1.5	0.521500
2	2.0	0.602727
3	2.5	0.651277
4	3.0	0.683594
5	3.5	0.713571
6	4.0	0.778000
7	4.5	0.843962
8	5.0	0.883514

In [195]:

```
sns.barplot(x="SOP", y="Chance of Admit ", data=chance_admit_purpose)
plt.xlabel('Statement of Purpose', fontsize=15)
plt.ylabel('Chance of Admission', fontsize=15)
```

Out[195]:

```
Text(0, 0.5, 'Chance of Admission')
```



In [196]:

```
#Research University Ratings
research_wrt_uni = clean_data[['University Rating', 'Research']].groupby(['University Rating'], as
_index=False).mean()
research_wrt_uni
```

Out[196]:

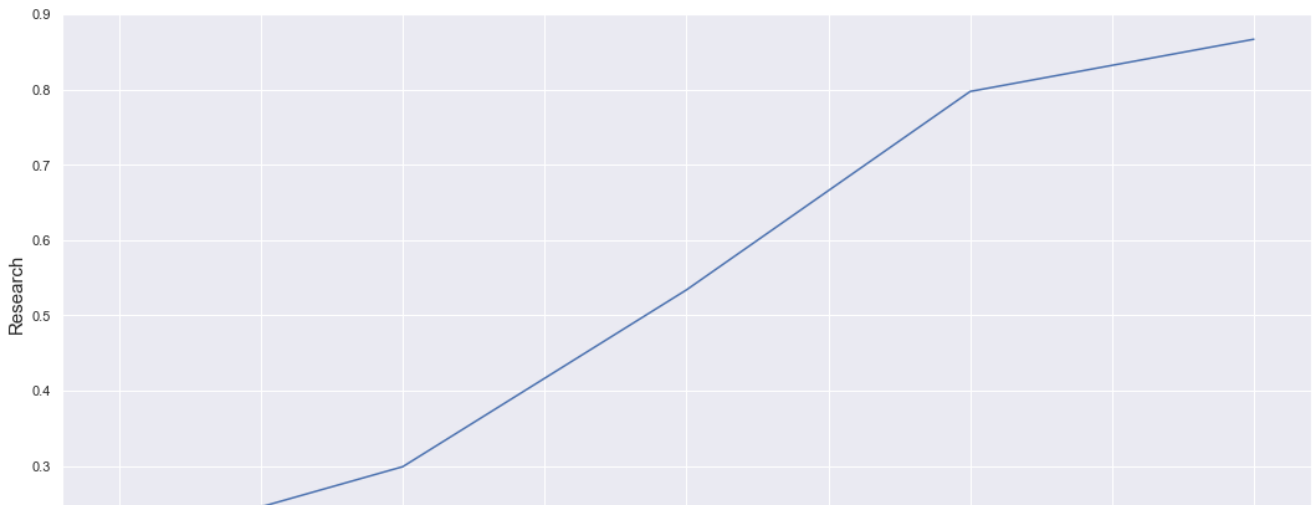
	University Rating	Research
0	1	0.192308
1	2	0.299065
2	3	0.533835
3	4	0.797297
4	5	0.866667

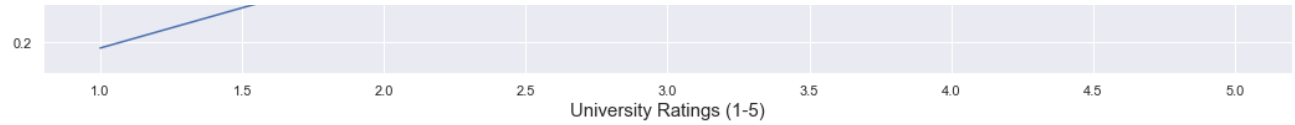
In [197]:

```
#Clearly shows students with better university have more research
sns.lineplot(x="University Rating", y="Research", data=research_wrt_uni)
plt.xlabel('University Ratings (1-5)', fontsize=15)
plt.ylabel('Research', fontsize=15)
```

Out[197]:

```
Text(0, 0.5, 'Research')
```





In [198]:

```
#Universities and CGPA Category
uni_wrt_gpa = clean_data[['University Rating', 'CGPA']].groupby(['University Rating'],
as_index=False).mean()
uni_wrt_gpa
```

Out[198]:

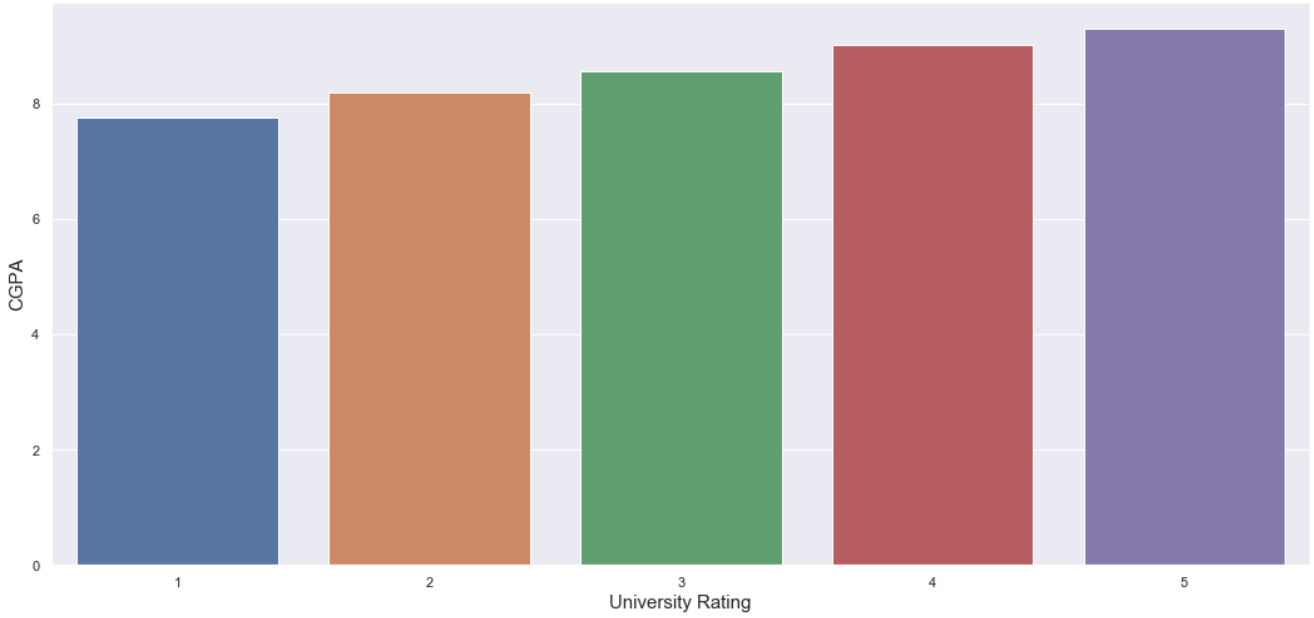
	University Rating	CGPA
0	1	7.745769
1	2	8.183738
2	3	8.552256
3	4	9.021622
4	5	9.291167

In [199]:

```
sns.barplot(x="University Rating", y="CGPA", data=uni_wrt_gpa)
plt.xlabel('University Rating', fontsize=15)
plt.ylabel('CGPA', fontsize=15)
```

Out[199]:

```
Text(0, 0.5, 'CGPA')
```



In [200]:

```
#Research with TOEFL Score
research_wrt_toefl = clean_data[['TOEFL Score', 'Research']].groupby(['Research'], as_index=False)
.mean()
research_wrt_toefl
```

Out[200]:

Research	TOEFL Score

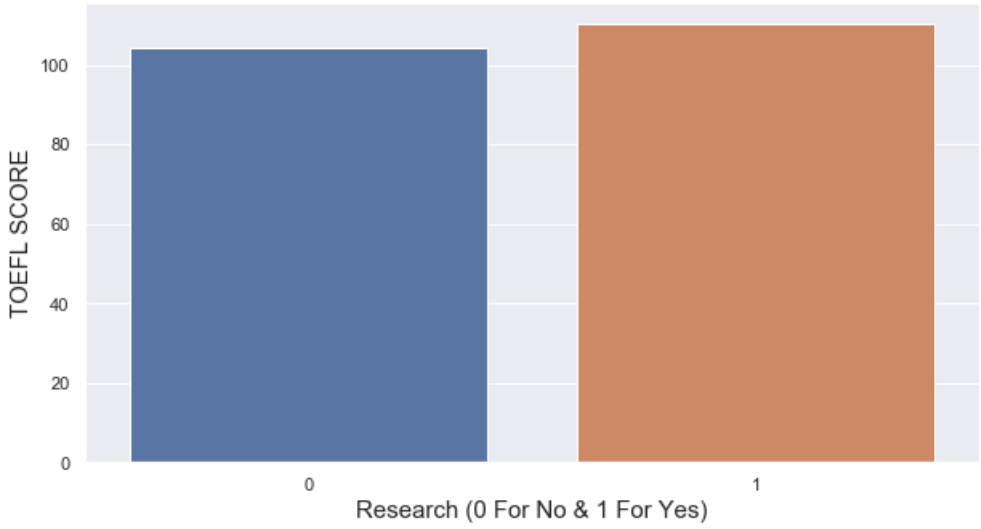
	Research	TOEFL Score
0	0	104.143646
1	1	110.109589

In [201]:

```
#Averagely Student who has score under 104 or equal to 104 have no research
sns.set(rc={'figure.figsize':(10,5.27)})
sns.barplot(x="Research", y="TOEFL Score", data=research_wrt_toefl)
plt.xlabel('Research (0 For No & 1 For Yes)', fontsize=15)
plt.ylabel('TOEFL SCORE', fontsize=15)
```

Out[201]:

```
Text(0, 0.5, 'TOEFL SCORE')
```



In [202]:

```
#Research With GRE SCORES
research_wrt_gre = clean_data[['GRE Score', 'Research']].groupby(['Research'], as_index=False).mean()
research_wrt_gre
```

Out[202]:

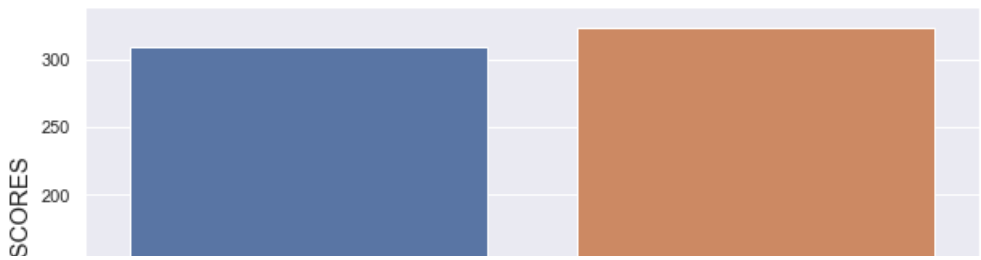
	Research	GRE Score
0	0	309.491713
1	1	322.853881

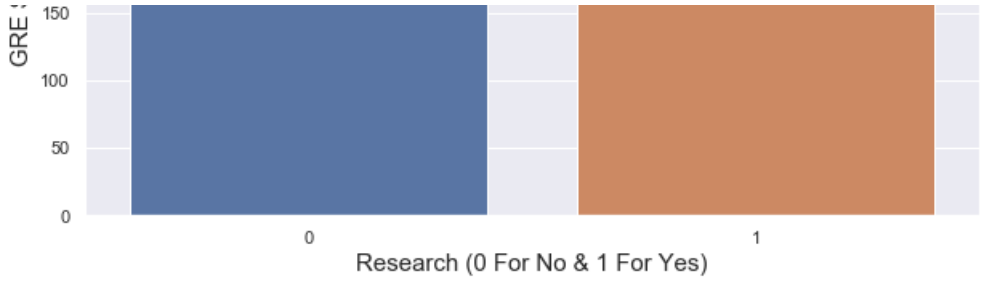
In [203]:

```
sns.barplot(x="Research", y="GRE Score", data=research_wrt_gre)
plt.xlabel('Research (0 For No & 1 For Yes)', fontsize=15)
plt.ylabel('GRE SCORES', fontsize=15)
```

Out[203]:

```
Text(0, 0.5, 'GRE SCORES')
```





In [204]:

```
#University Rating and Chance of Admission
uni_wrt_admission = clean_data[['University Rating', 'Chance of Admit ']].groupby(['University Rating'], as_index=False).mean()
uni_wrt_admission
```

Out[204]:

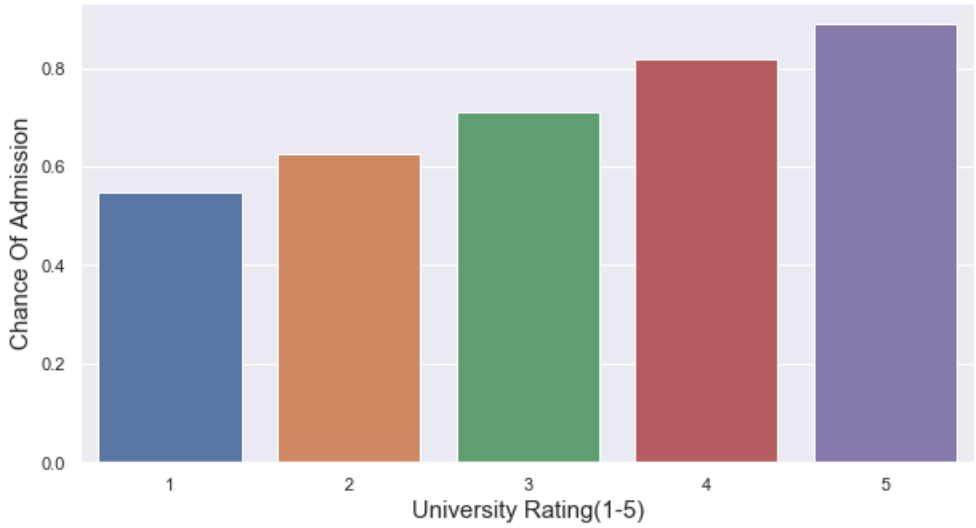
	University Rating	Chance of Admit
0	1	0.548077
1	2	0.625981
2	3	0.711880
3	4	0.818108
4	5	0.888167

In [205]:

```
#Student from better university have better chance for admission
sns.barplot(x="University Rating", y="Chance of Admit ", data=uni_wrt_admission)
plt.xlabel('University Rating(1-5)', fontsize=15)
plt.ylabel('Chance Of Admission', fontsize=15)
```

Out[205]:

```
Text(0, 0.5, 'Chance Of Admission')
```



In [206]:

```
#Gre Score and TOEFL SCORES and Research Comparision
gre_toefl_research = clean_data[['GRE Score', 'TOEFL Score', 'Research']].groupby(['Research'], as_index=False).mean()
gre_toefl_research
```

Out[206]:

	Research	GRE Score	TOEFL Score
0	0	309.491713	104.143646
1	1	322.853881	110.109589

In [207]:

```
pd.isnull(clean_data).sum()
```

Out[207]:

```
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
CGPA_CATEGORY        0
dtype: int64
```

In [208]:

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

In [209]:

```
clean_data['CGPA_CATEGORY'].unique()
```

Out[209]:

```
[OUTSTANDING, EXCELLENT, GOOD, AVERAGE]
Categories (4, object): [AVERAGE < GOOD < EXCELLENT < OUTSTANDING]
```

In [210]:

```
cgpa_category_mapping = {
    "FAIL": 0,
    "PASS": 1,
    "AVERAGE": 2,
    "GOOD": 3,
    "EXCELLENT": 4,
    "OUTSTANDING": 5
}
```

In [211]:

```
clean_data['CGPA_CATEGORY'] = clean_data['CGPA_CATEGORY'].map(cgpa_category_mapping)
```

In [212]:

```
#Check if any data is null
print(pd.isnull(clean_data).sum())
```

```
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
CGPA_CATEGORY        0
dtype: int64
```

In [411]:

```
final_data = clean_data
```

In [412]:

```
final_data = final_data.drop(['CGPA_CATEGORY'], axis=1)
```

In [413]:

```
y = final_data['Chance of Admit ']
```

In [414]:

```
X = final_data.drop(['Chance of Admit '], axis=1)
```

In [415]:

```
from sklearn.preprocessing import MinMaxScaler
```

In [416]:

```
sc = MinMaxScaler()
X = sc.fit_transform(X)
```

```
C:\Users\aaa\Anaconda3\lib\site-packages\sklearn\preprocessing\data.py:334: DataConversionWarning:
Data with input dtype int64, float64 were all converted to float64 by MinMaxScaler.
  return self.partial_fit(X, y)
```

In [417]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=100)
```

In [418]:

```
#Linear Regression
from sklearn.linear_model import LinearRegression
```

In [419]:

```
model = LinearRegression()
model.fit(X_train, y_train)
```

Out[419]:

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None,
         normalize=False)
```

In [427]:

```
linear_reg = model.score(X_test, y_test)
linear_reg
```

Out[427]:

```
0.8003159611553717
```

In [428]:

```
from sklearn.tree import DecisionTreeRegressor
```

In [429]:

```
decision_tree_model = DecisionTreeRegressor(random_state=100)
decision_tree_model.fit(X_train, y_train)
```

Out[429]:

```
DecisionTreeRegressor(criterion='mse', max_depth=None, max_features=None,
           max_leaf_nodes=None, min_impurity_decrease=0.0,
           min_impurity_split=None, min_samples_leaf=1,
           min_samples_split=2, min_weight_fraction_leaf=0.0,
           presort=False, random_state=100, splitter='best')
```

In [430]:

```
decision_tree_reg = decision_tree_model.score(X_test, y_test)
decision_tree_reg
```

Out[430]:

```
0.5587069851991924
```

In [431]:

```
from sklearn.ensemble import RandomForestRegressor
```

In [432]:

```
random_forest_model = RandomForestRegressor(n_estimators=100, random_state=0)
random_forest_model.fit(X_train, y_train)
```

Out[432]:

```
RandomForestRegressor(bootstrap=True, criterion='mse', max_depth=None,
           max_features='auto', max_leaf_nodes=None,
           min_impurity_decrease=0.0, min_impurity_split=None,
           min_samples_leaf=1, min_samples_split=2,
           min_weight_fraction_leaf=0.0, n_estimators=100, n_jobs=None,
           oob_score=False, random_state=0, verbose=0, warm_start=False)
```

In [441]:

```
random_forest_reg = random_forest_model.score(X_test, y_test)
random_forest_reg
```

Out[441]:

```
0.7649522783274212
```

In [442]:

```
collective_models = pd.DataFrame({
    'Model': ['Linear Regression','Decision Tree Regression' ,'Random Forest Regression'],
    'Score': [linear_reg, decision_tree_reg, random_forest_reg]
})
```

In [446]:

```
collective_models.sort_values(by='Score', ascending=False)
```

Out[446]:

	Model	Score
0	Linear Regression	0.800316
2	Random Forest Regression	0.764952
1	Decision Tree Regression	0.558707

In [ ]:

```

```