In [1]:

```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt # Data Visualization
import seaborn as sns # Data Visualization
```

In [2]:

```
import warnings
warnings.filterwarnings('ignore')
```

In [3]:

```
df = pd.read_csv('collegePlace.csv')
```

In [4]:

```
df.head()
```

Out[4]:

| | Age | Gender | Stream | Internships | CGPA | Hostel | HistoryOfBacklogs | PlacedOrNot |
|---|---|---|---|---|---|---|---|---|
| **0** | 22 | Male | Electronics And Communication | 1 | 8 | 1 | 1 | 1 |
| **1** | 21 | Female | Computer Science | 0 | 7 | 1 | 1 | 1 |
| **2** | 22 | Female | Information Technology | 1 | 6 | 0 | 0 | 1 |
| **3** | 21 | Male | Information Technology | 0 | 8 | 0 | 1 | 1 |
| **4** | 22 | Male | Mechanical | 0 | 8 | 1 | 0 | 1 |

In [5]:

```
df.tail()
```

Out[5]:

| | Age | Gender | Stream | Internships | CGPA | Hostel | HistoryOfBacklogs | PlacedOrNot |
|---|---|---|---|---|---|---|---|---|
| **2961** | 23 | Male | Information Technology | 0 | 7 | 0 | 0 | 0 |
| **2962** | 23 | Male | Mechanical | 1 | 7 | 1 | 0 | 0 |
| **2963** | 22 | Male | Information Technology | 1 | 7 | 0 | 0 | 0 |
| **2964** | 22 | Male | Computer Science | 1 | 7 | 0 | 0 | 0 |
| **2965** | 23 | Male | Civil | 0 | 8 | 0 | 0 | 1 |

In [6]:

```
df.shape
```

Out[6]:

```
(2966, 8)
```

In [7]:

```
df.columns
```

Out[7]:

```
Index(['Age', 'Gender', 'Stream', 'Internships', 'CGPA', 'Hostel',
       'HistoryOfBacklogs', 'PlacedOrNot'],
      dtype='object')
```

In [8]:

```
df.duplicated().sum()
```

Out[8]:

```
1829
```

In [9]:

```
df.isnull().sum()
```

Out[9]:

```
Age                 0
Gender              0
Stream              0
Internships         0
CGPA                0
Hostel              0
HistoryOfBacklogs   0
PlacedOrNot         0
dtype: int64
```

In [10]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2966 entries, 0 to 2965
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   Age                2966 non-null   int64 
 1   Gender             2966 non-null   object
 2   Stream             2966 non-null   object
 3   Internships        2966 non-null   int64 
 4   CGPA               2966 non-null   int64 
 5   Hostel             2966 non-null   int64 
 6   HistoryOfBacklogs  2966 non-null   int64 
 7   PlacedOrNot        2966 non-null   int64 
dtypes: int64(6), object(2)
memory usage: 185.5+ KB
```

In [11]:

```
df.describe()
```

Out[11]:

| | Age | Internships | CGPA | Hostel | HistoryOfBacklogs | PlacedOrNot |
|---|---|---|---|---|---|---|
| **count** | 2966.000000 | 2966.000000 | 2966.000000 | 2966.000000 | 2966.000000 | 2966.000000 |
| **mean** | 21.485840 | 0.703641 | 7.073837 | 0.269049 | 0.192178 | 0.552596 |
| **std** | 1.324933 | 0.740197 | 0.967748 | 0.443540 | 0.394079 | 0.497310 |
| **min** | 19.000000 | 0.000000 | 5.000000 | 0.000000 | 0.000000 | 0.000000 |
| **25%** | 21.000000 | 0.000000 | 6.000000 | 0.000000 | 0.000000 | 0.000000 |
| **50%** | 21.000000 | 1.000000 | 7.000000 | 0.000000 | 0.000000 | 1.000000 |
| **75%** | 22.000000 | 1.000000 | 8.000000 | 1.000000 | 0.000000 | 1.000000 |
| **max** | 30.000000 | 3.000000 | 9.000000 | 1.000000 | 1.000000 | 1.000000 |

In [12]:

```
df.nunique()
```

Out[12]:

```
Age                 11
Gender               2
Stream               6
Internships          4
CGPA                 5
Hostel               2
HistoryOfBacklogs    2
PlacedOrNot          2
dtype: int64
```

In [13]:

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

Out[13]:

```
array([22, 21, 23, 24, 28, 30, 25, 26, 20, 19, 29], dtype=int64)
```

In [14]:

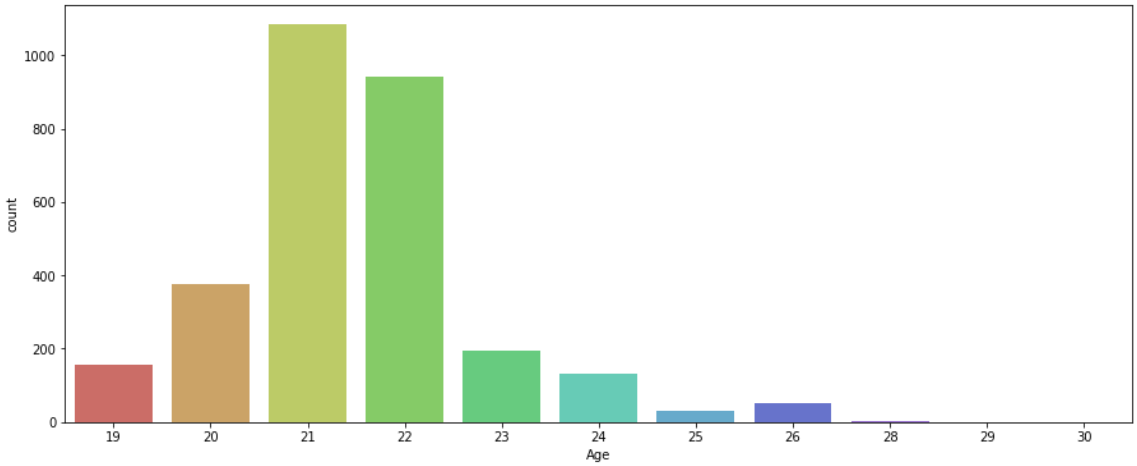
```
df['Age'].value_counts()
```

Out[14]:

```
21    1084
22     941
20     375
23     195
19     156
24     131
26      50
25      29
28       3
30       1
29       1
Name: Age, dtype: int64
```

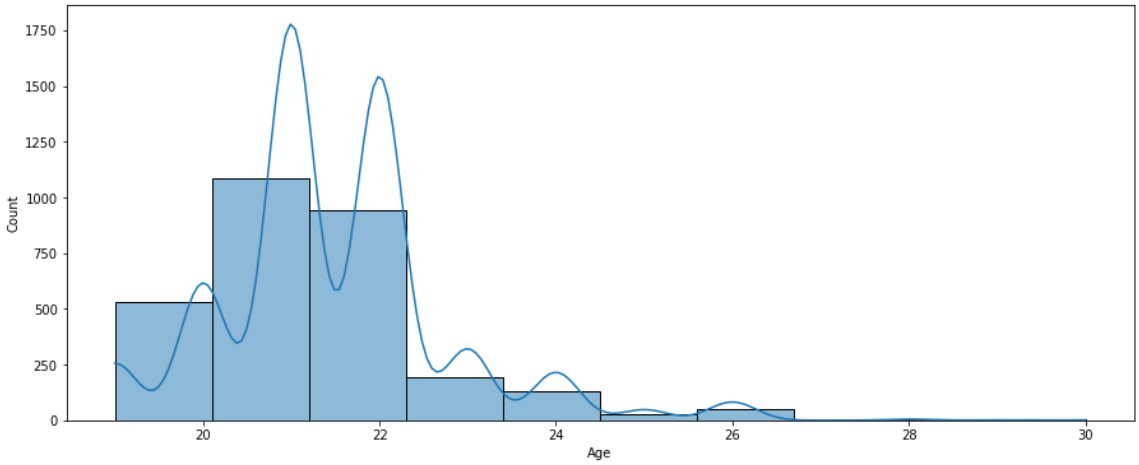
In [15]:

```
plt.figure(figsize=(15,6))
sns.countplot('Age', data = df, palette = 'hls')
plt.show()
```



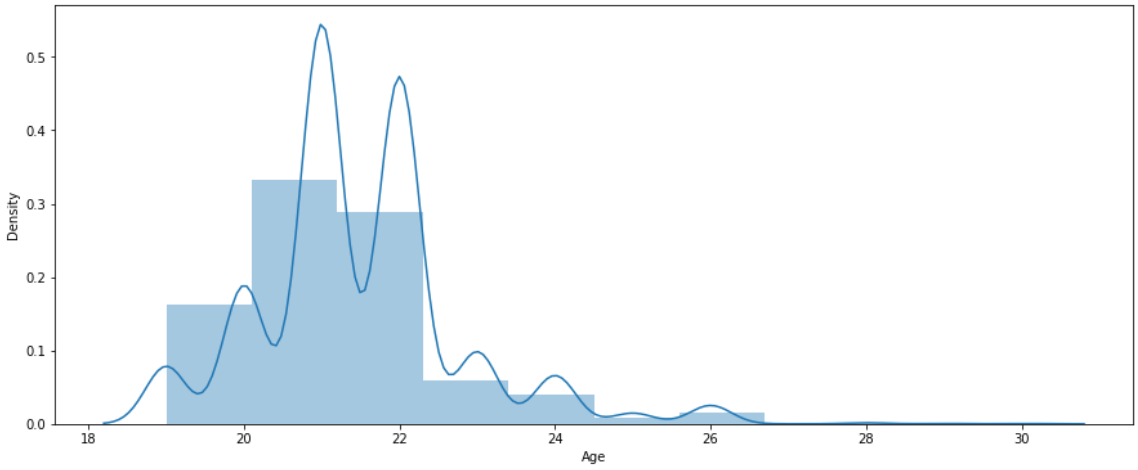
In [16]:

```
plt.figure(figsize=(15,6))
sns.histplot(df['Age'], kde = True, bins = 10, palette = 'hls')
plt.show()
```




In [17]:

```
plt.figure(figsize=(15,6))
sns.distplot(df['Age'], kde = True, bins = 10)
plt.show()
```




In [18]:

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

Out[18]:

```
array(['Male', 'Female'], dtype=object)
```

In [19]:

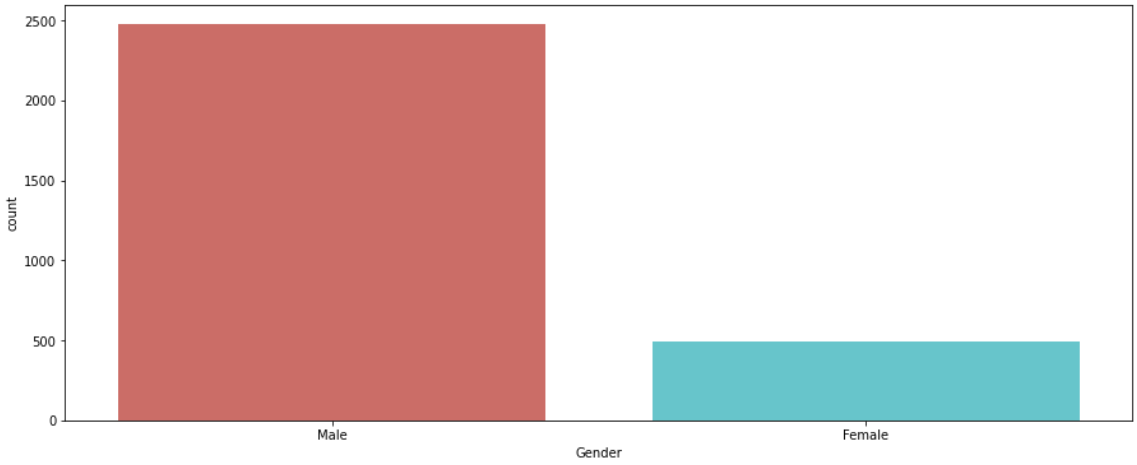
```
df['Gender'].value_counts()
```

Out[19]:

```
Male      2475
Female     491
Name: Gender, dtype: int64
```

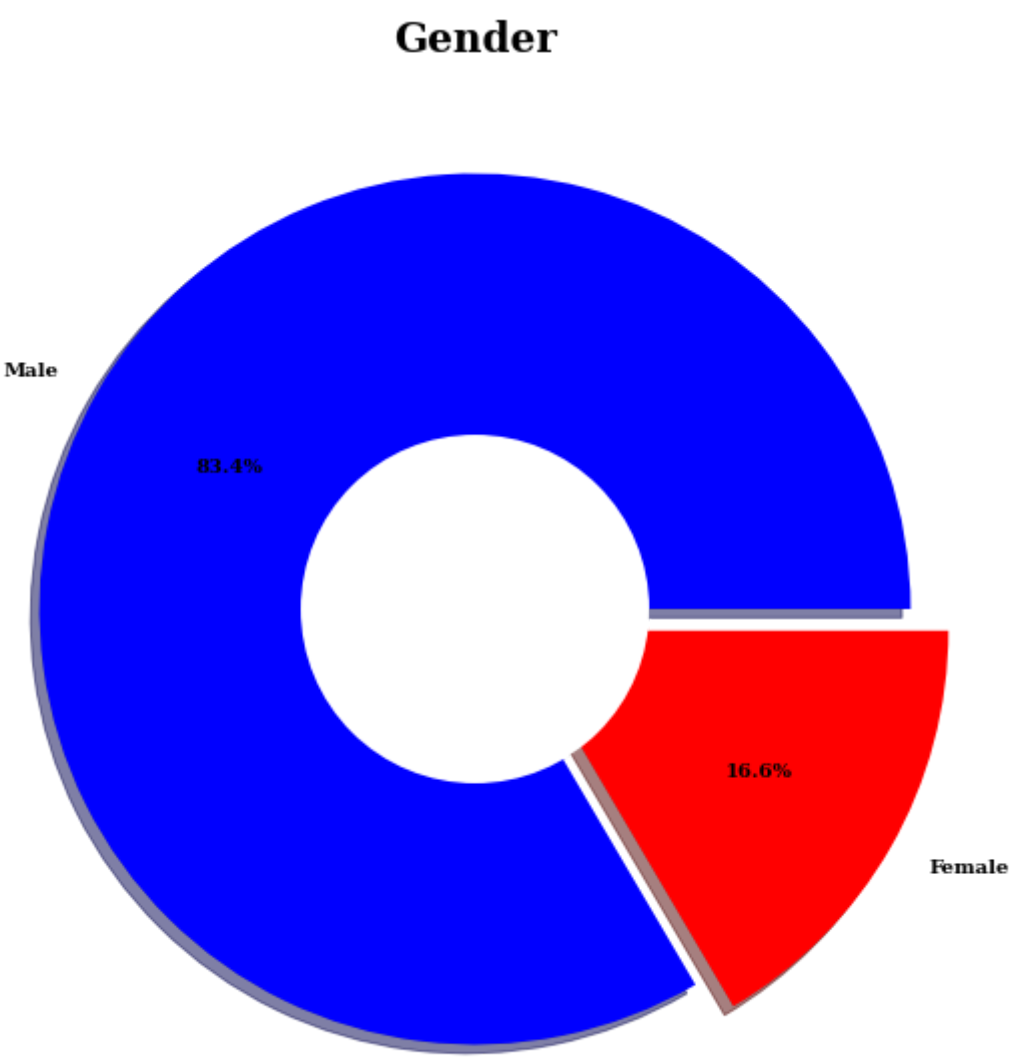
In [20]:

```
plt.figure(figsize=(15,6))
sns.countplot('Gender', data = df, palette = 'hls')
plt.show()
```



In [21]:

```
label_data = df['Gender'].value_counts()

explode = (0.0, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red'],
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('Gender', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```




In [22]:

```
df.Stream.unique()
```

Out[22]:

```
array(['Electronics And Communication', 'Computer Science',
       'Information Technology', 'Mechanical', 'Electrical', 'Civil'],
      dtype=object)
```

In [23]:

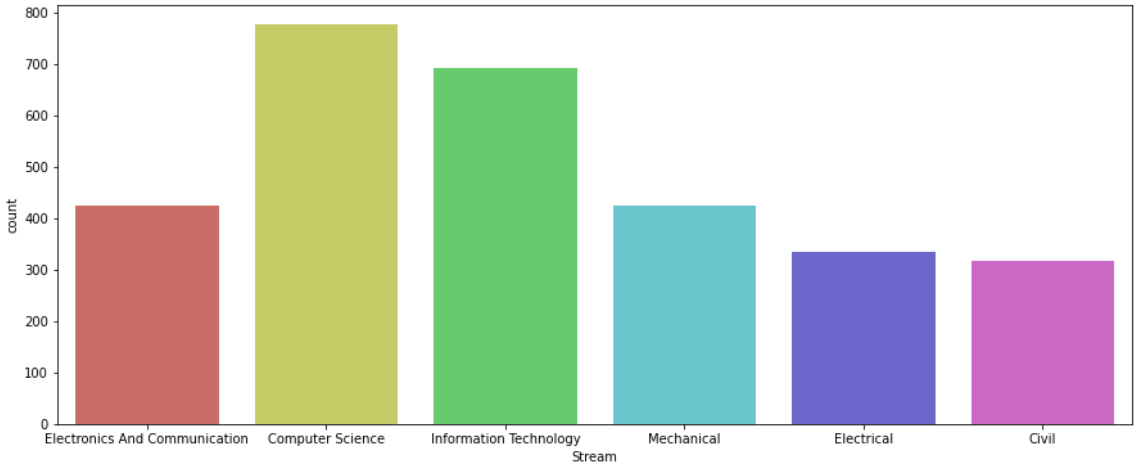
```
df.Stream.value_counts()
```

Out[23]:

```
Computer Science                776
Information Technology          691
Electronics And Communication   424
Mechanical                      424
Electrical                      334
Civil                           317
Name: Stream, dtype: int64
```

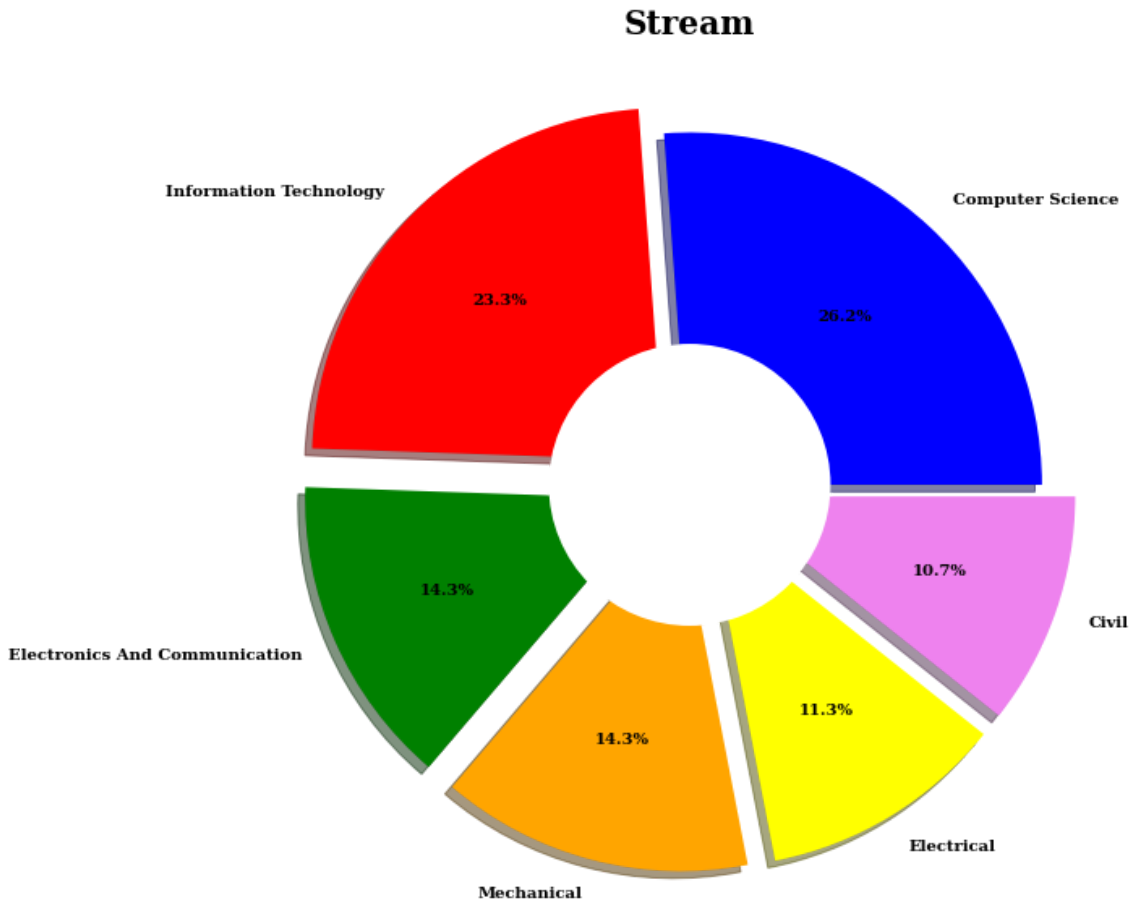
In [24]:

```
plt.figure(figsize=(15,6))
sns.countplot('Stream', data = df, palette = 'hls')
plt.show()
```



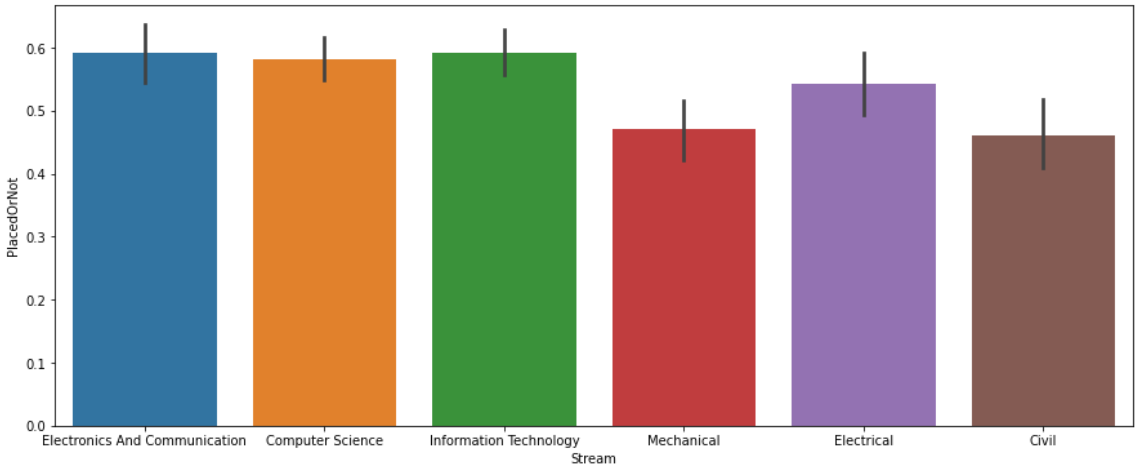
In [25]:

```
label_data = df['Stream'].value_counts()

explode = (0.0, 0.1, 0.1, 0.1, 0.1, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red', 'green', 'orange', 'yellow', 'vi
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('Stream', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```



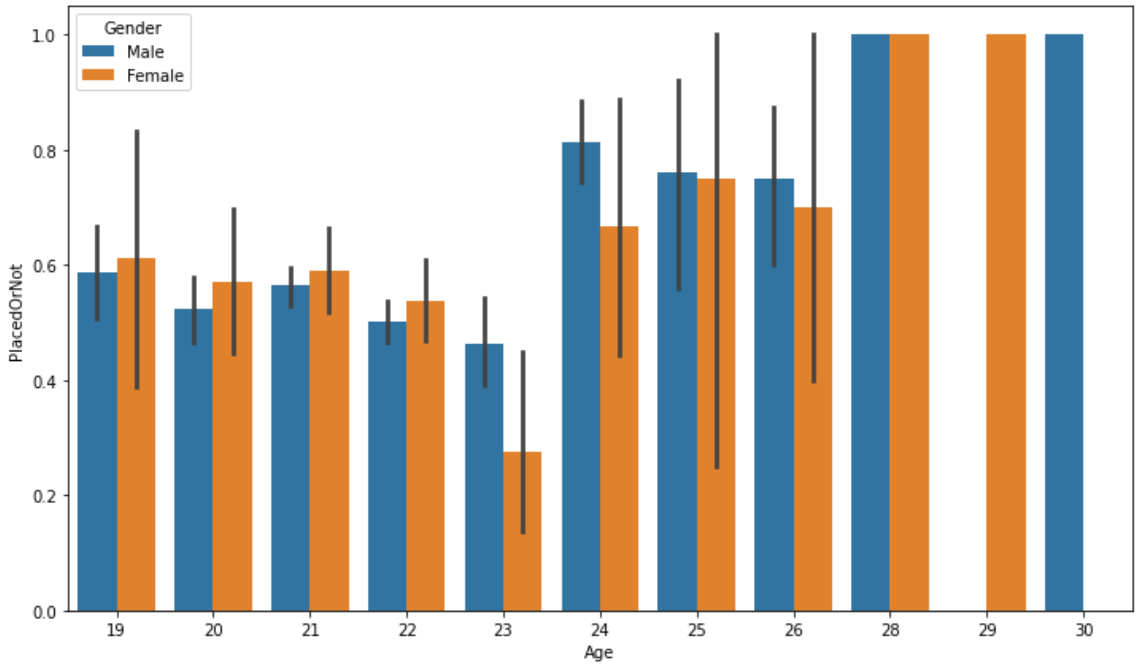
In [26]:

```
plt.figure(figsize=(15,6))
sns.barplot(x = df.Stream, y = df.PlacedOrNot)
plt.show()
```




In [27]:

```
plt.figure(figsize = (12,7))
sns.barplot(x = df.Age, y = df.PlacedOrNot, hue = df.Gender)
plt.show()
```




In [28]:

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

Out[28]:

```
array([1, 0, 2, 3], dtype=int64)
```

In [29]:

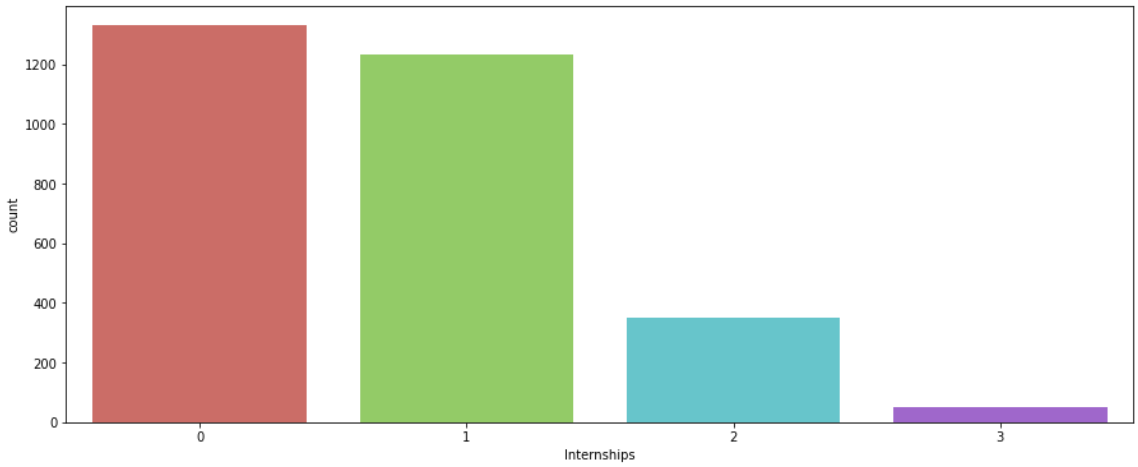
```
df['Internships'].value_counts()
```

Out[29]:

```
0    1331
1    1234
2     350
3      51
Name: Internships, dtype: int64
```

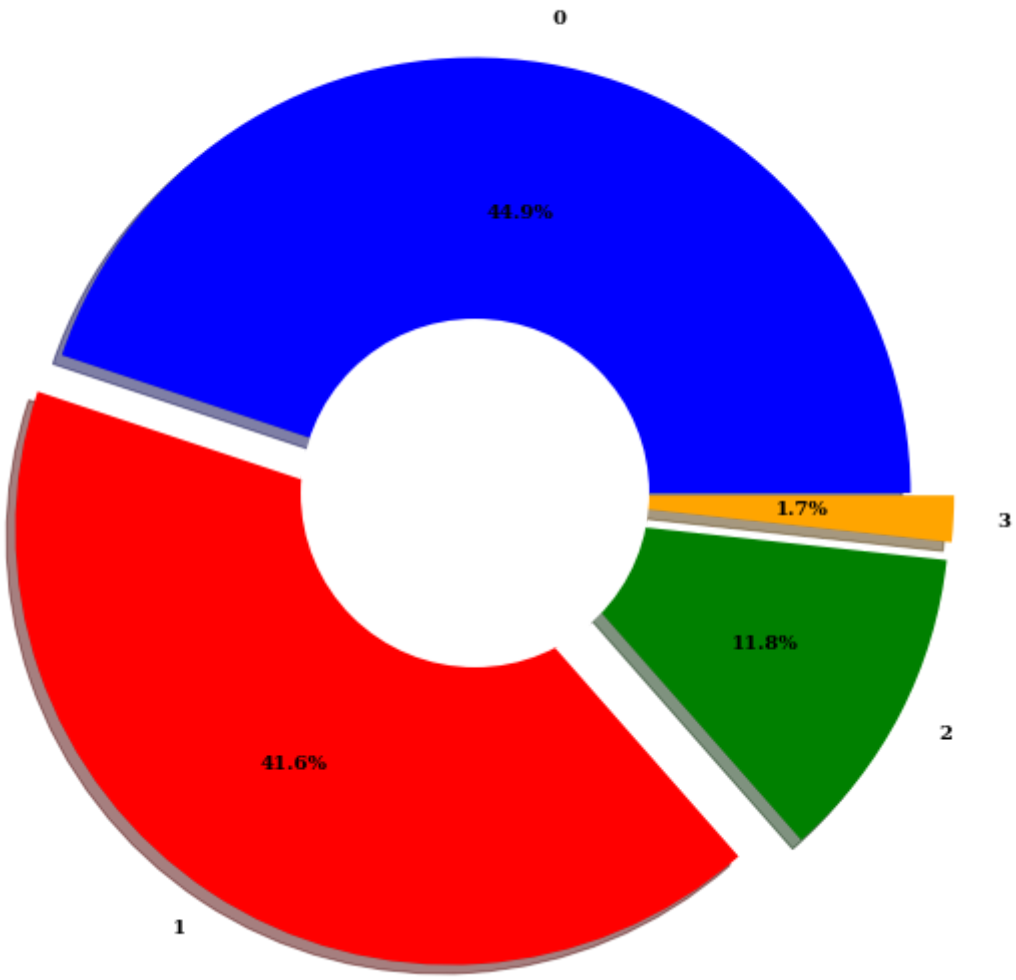
In [30]:

```
plt.figure(figsize=(15,6))
sns.countplot('Internships', data = df, palette = 'hls')
plt.show()
```



In [31]:

```
label_data = df['Internships'].value_counts()

explode = (0.0, 0.1, 0.1, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red', 'green', 'orange'],
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('Internships', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```




In [32]:

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

Out[32]:

```
array([8, 7, 6, 9, 5], dtype=int64)
```

In [33]:

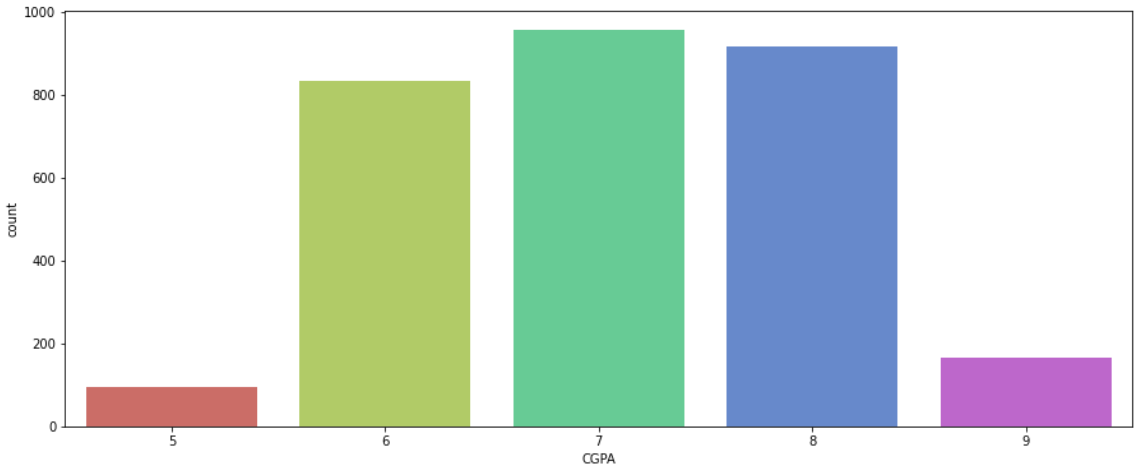
```
df['CGPA'].value_counts()
```

Out[33]:

```
7    956
8    915
6    834
9    165
5     96
Name: CGPA, dtype: int64
```

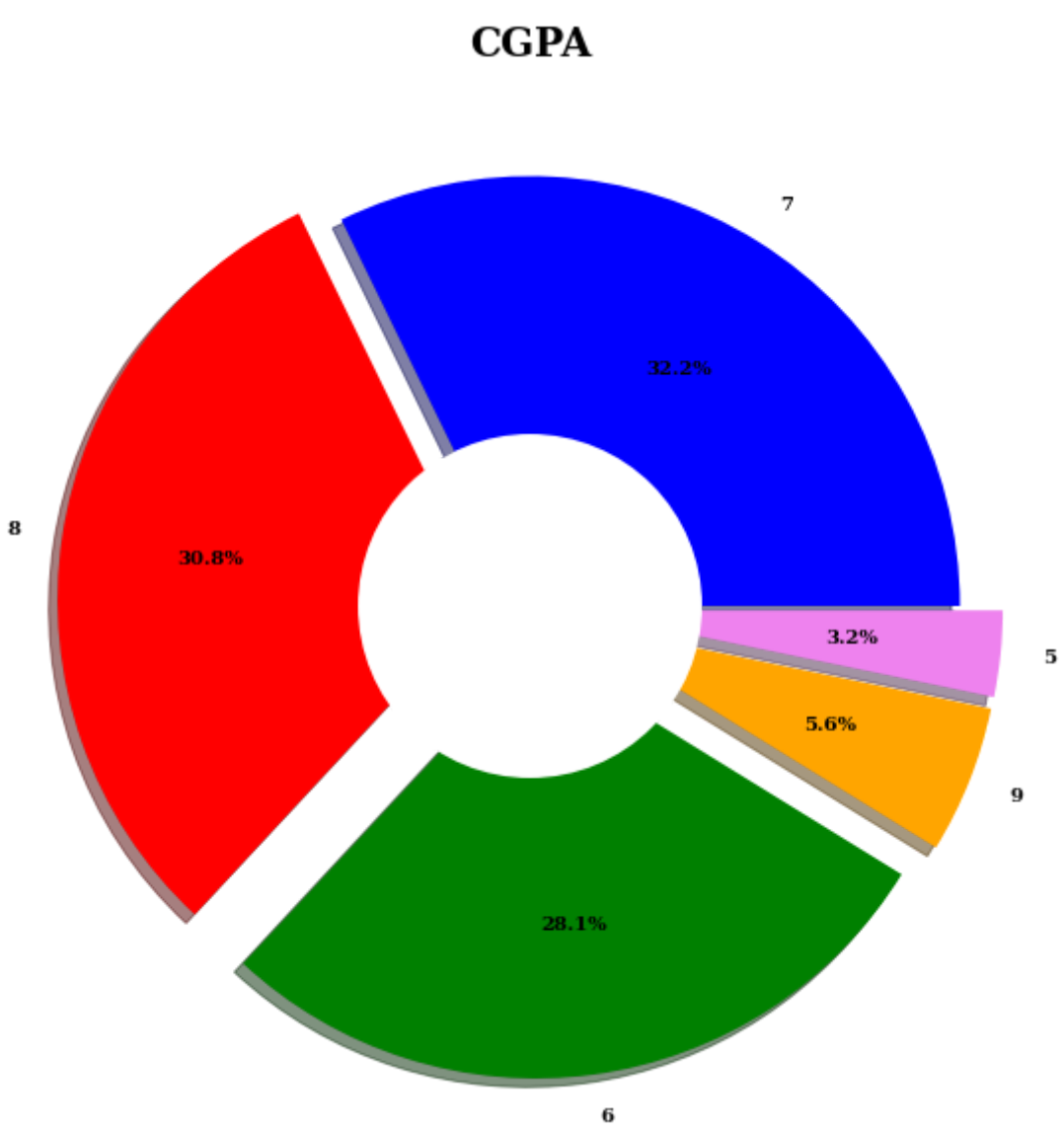
In [34]:

```
plt.figure(figsize=(15,6))
sns.countplot('CGPA', data = df, palette = 'hls')
plt.show()
```



In [35]:

```
label_data = df['CGPA'].value_counts()

explode = (0.0, 0.1, 0.1, 0.1, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red', 'green', 'orange', 'violet'],
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('CGPA', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```




In [36]:

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

Out[36]:

```
array([1, 0], dtype=int64)
```

In [37]:

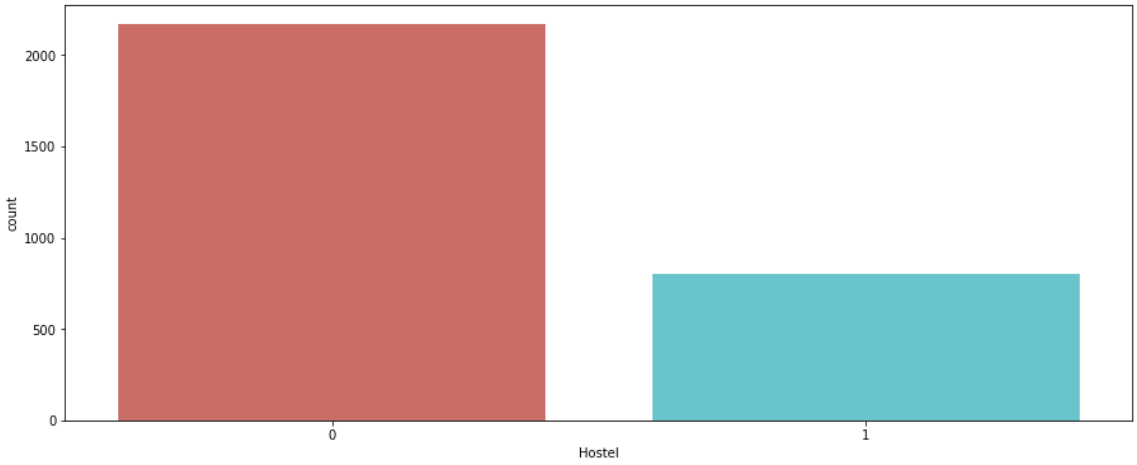
```
df['Hostel'].value_counts()
```

Out[37]:

```
0    2168
1     798
Name: Hostel, dtype: int64
```

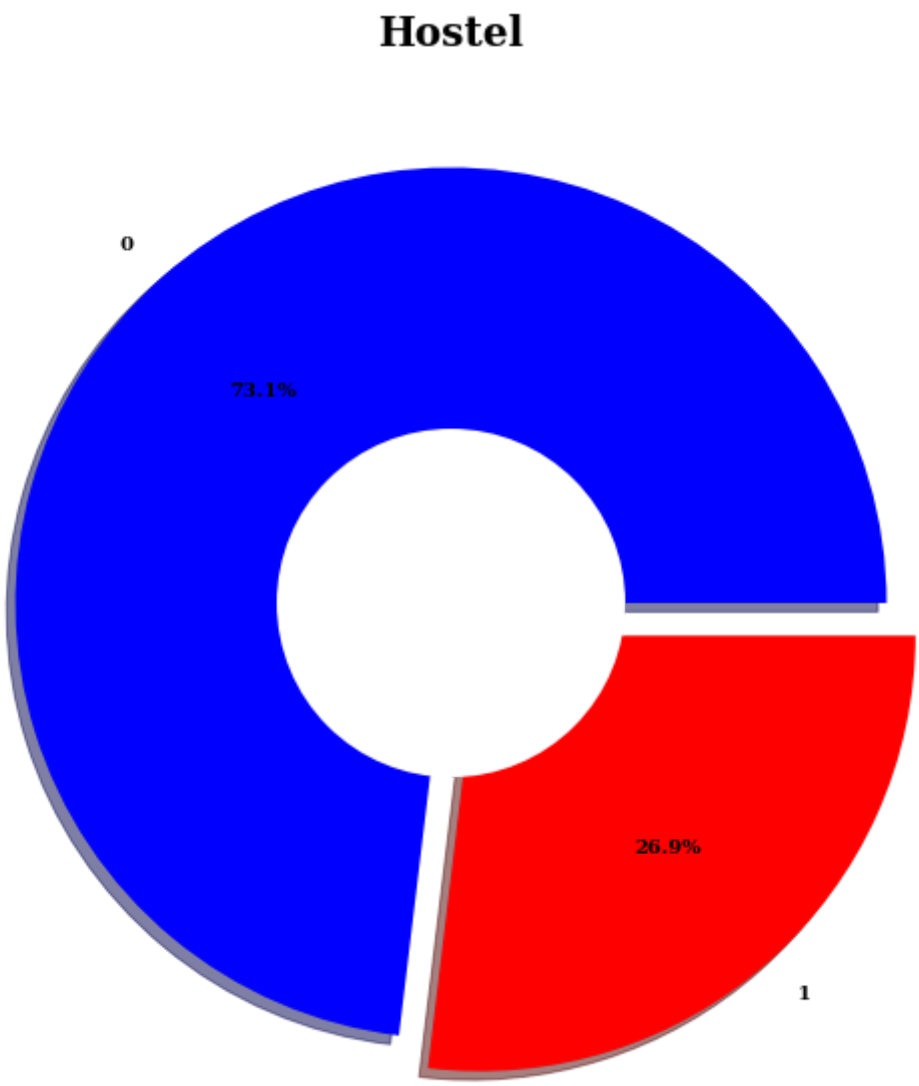
In [38]:

```
plt.figure(figsize=(15,6))
sns.countplot('Hostel', data = df, palette = 'hls')
plt.show()
```



In [39]:

```
label_data = df['Hostel'].value_counts()

explode = (0.0, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red'],
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('Hostel', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```




In [40]:

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

Out[40]:

```
array([1, 0], dtype=int64)
```

In [41]:

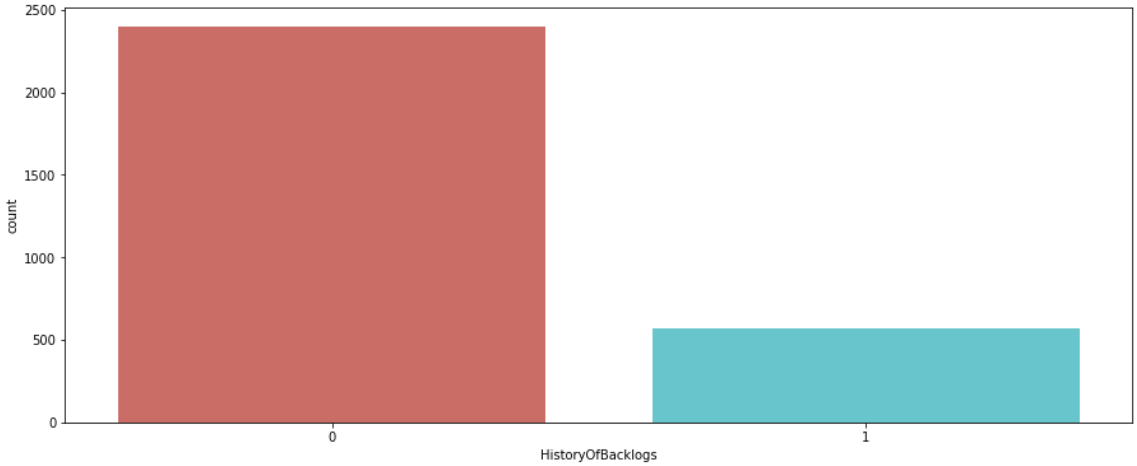
```
df['HistoryOfBacklogs'].value_counts()
```

Out[41]:

```
0    2396
1     570
Name: HistoryOfBacklogs, dtype: int64
```

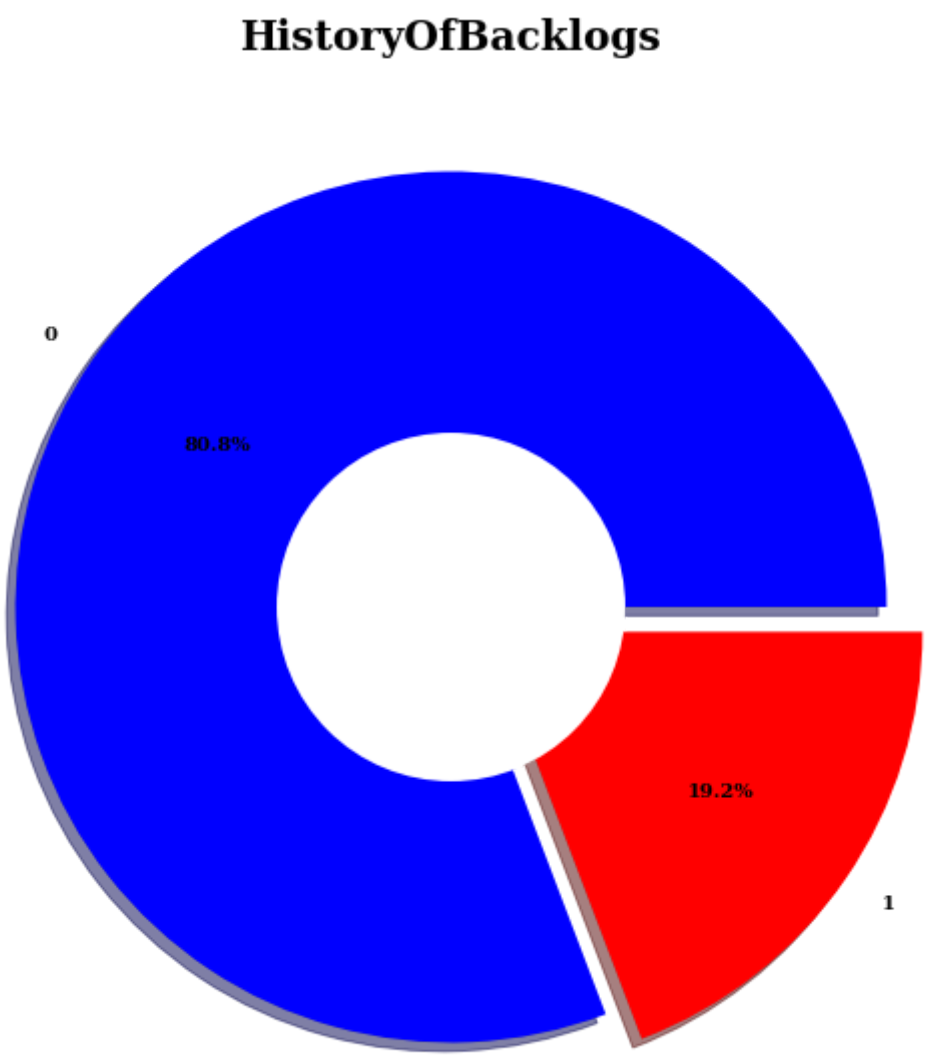
In [42]:

```
plt.figure(figsize=(15,6))
sns.countplot('HistoryOfBacklogs', data = df, palette = 'hls')
plt.show()
```



In [43]:

```
label_data = df['HistoryOfBacklogs'].value_counts()

explode = (0.0, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red'],
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('HistoryOfBacklogs', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```




In [44]:

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

Out[44]:

```
array([1, 0], dtype=int64)
```

In [45]:

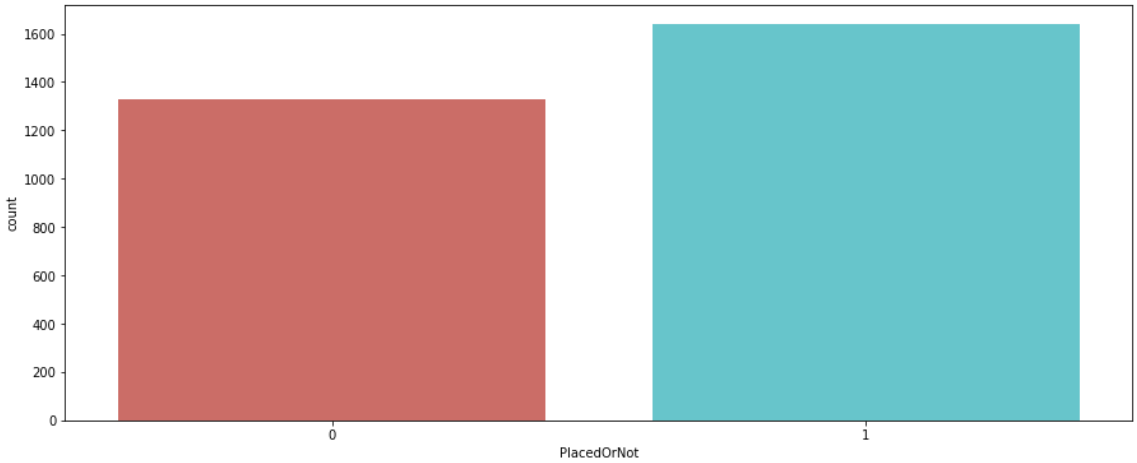
```
df['PlacedOrNot'].value_counts()
```

Out[45]:

```
1    1639
0    1327
Name: PlacedOrNot, dtype: int64
```

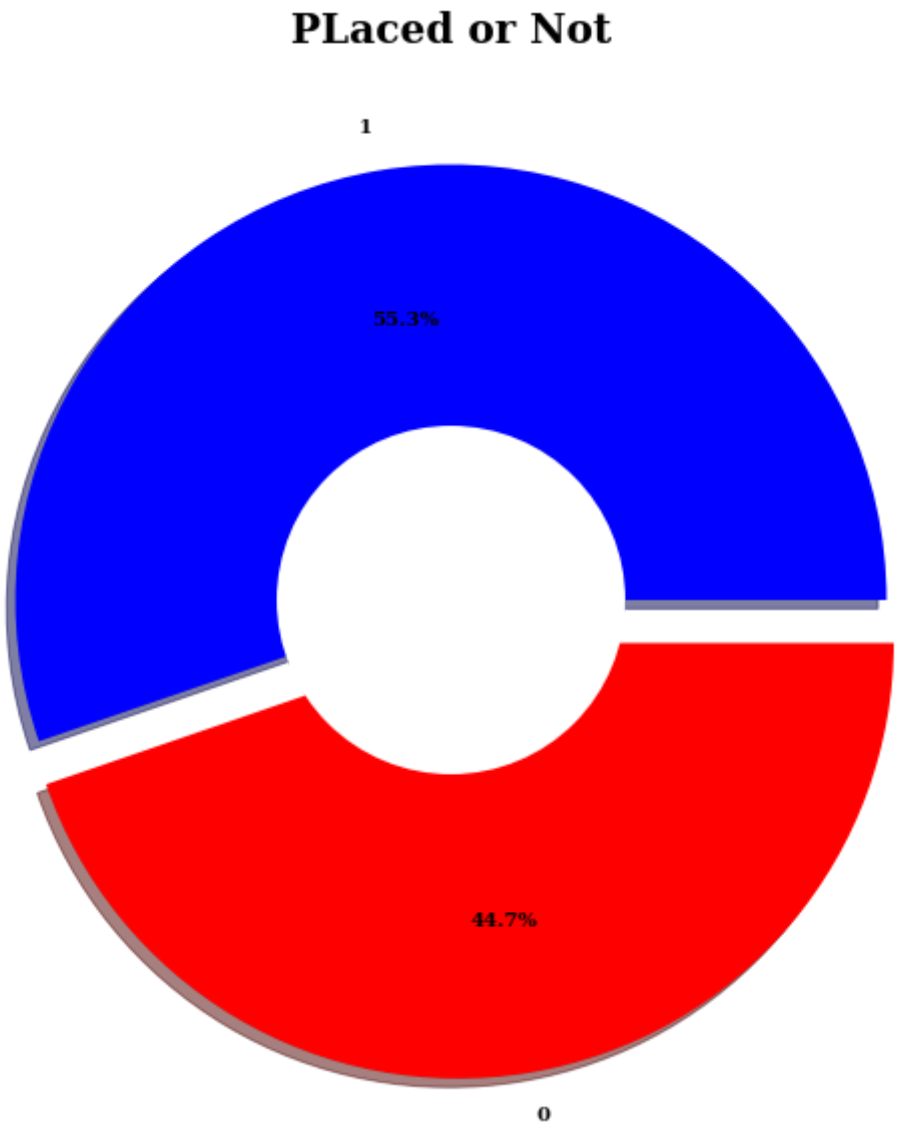
In [46]:

```
plt.figure(figsize=(15,6))
sns.countplot('PlacedOrNot', data = df, palette = 'hls')
plt.show()
```



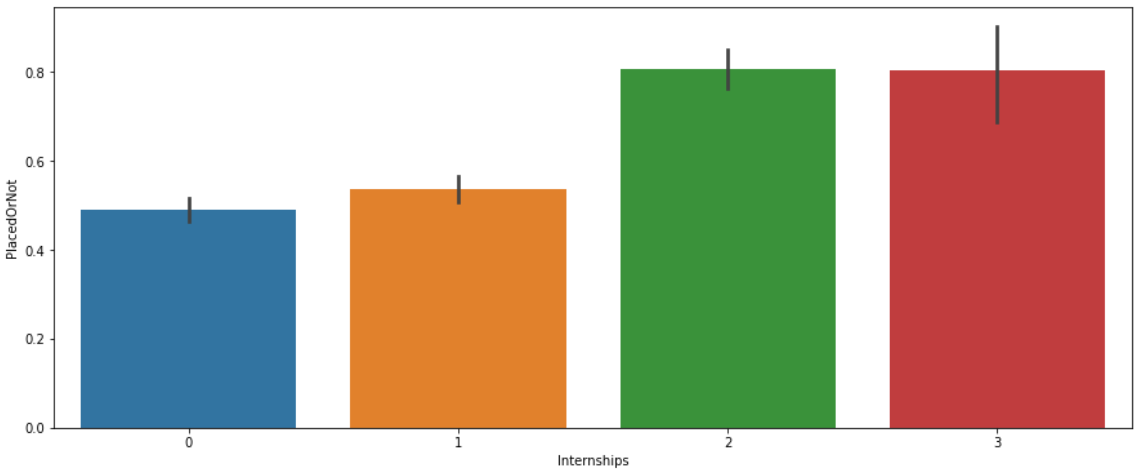
In [47]:

```
label_data = df['PlacedOrNot'].value_counts()

explode = (0.0, 0.1)
plt.figure(figsize=(20, 10))
patches, texts, pcts = plt.pie(label_data,
                               labels = label_data.index,
                               colors = ['blue', 'red'],
                               pctdistance = 0.65,
                               shadow = True,
                               startangle = 0,
                               explode = explode,
                               autopct = '%1.1f%%',
                               textprops={ 'fontsize': 10,
                                           'color': 'black',
                                           'weight': 'bold',
                                           'family': 'serif' })
plt.setp(pcts, color='black')

hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('PLaced or Not', size=20, **hfont)

centre_circle = plt.Circle((0,0),0.40,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)
plt.show()
```



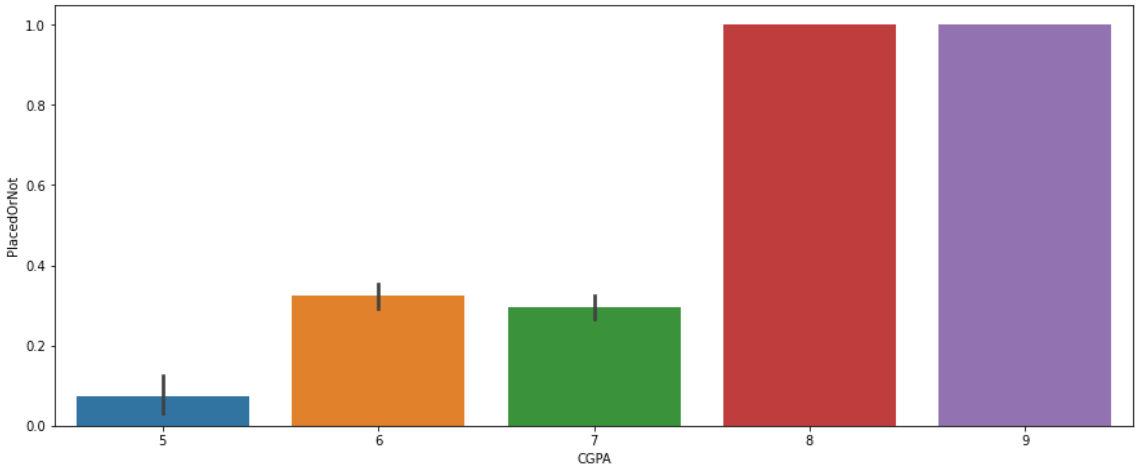

In [48]:

```
plt.figure(figsize=(15,6))
sns.barplot(x = df.Internships, y = df.PlacedOrNot)
plt.show()
```



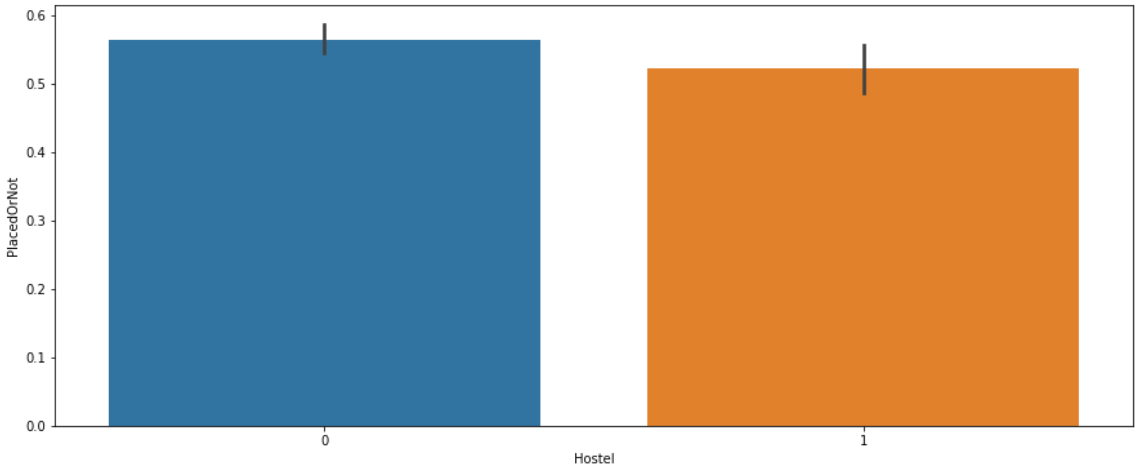
In [49]:

```
plt.figure(figsize=(15,6))
sns.barplot(x = df.CGPA, y = df.PlacedOrNot)
plt.show()
```



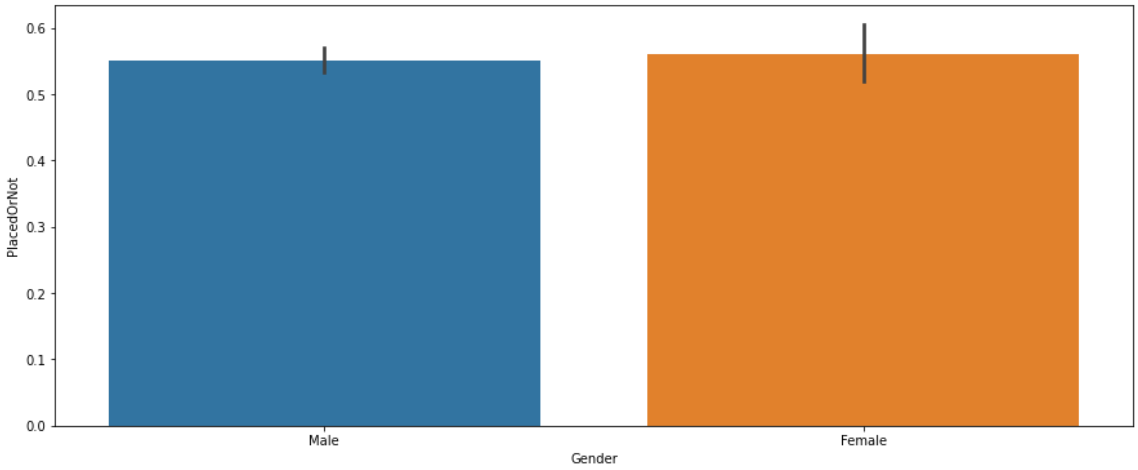

In [50]:

```
plt.figure(figsize=(15,6))
sns.barplot(x = df.Hostel, y = df.PlacedOrNot)
plt.show()
```



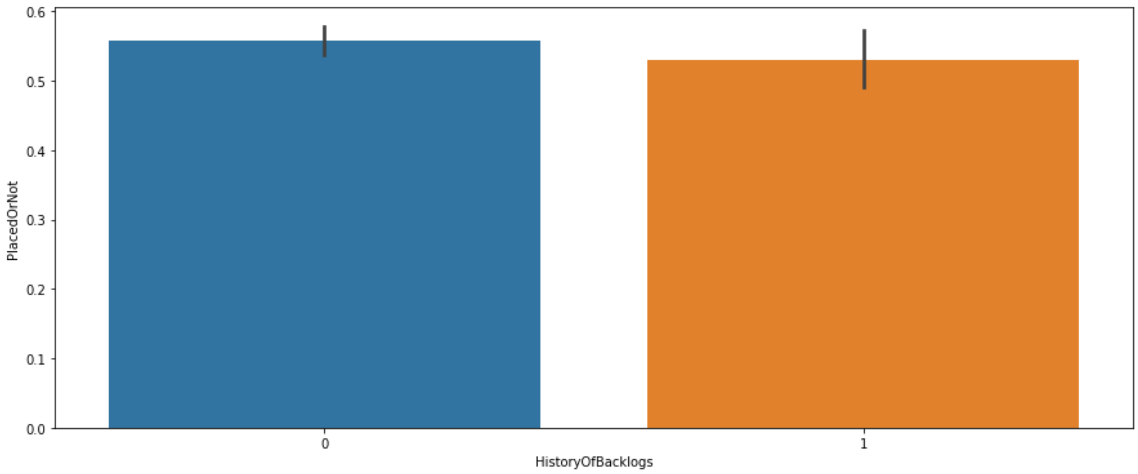
In [51]:

```
plt.figure(figsize=(15,6))
sns.barplot(x = df.Gender, y = df.PlacedOrNot)
plt.show()
```




In [52]:

```
plt.figure(figsize=(15,6))
sns.barplot(x = df.HistoryOfBacklogs, y = df.PlacedOrNot)
plt.show()
```




In [53]:

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
```

In [54]:

```
df.Gender = le.fit_transform(df.Gender)
df.Stream = le.fit_transform(df.Stream)
```

In [55]:

```
df.head()
```

Out[55]:

| | Age | Gender | Stream | Internships | CGPA | Hostel | HistoryOfBacklogs | PlacedOrNot |
|---|---|---|---|---|---|---|---|---|
| **0** | 22 | 1 | 3 | 1 | 8 | 1 | 1 | 1 |
| **1** | 21 | 0 | 1 | 0 | 7 | 1 | 1 | 1 |
| **2** | 22 | 0 | 4 | 1 | 6 | 0 | 0 | 1 |
| **3** | 21 | 1 | 4 | 0 | 8 | 0 | 1 | 1 |
| **4** | 22 | 1 | 5 | 0 | 8 | 1 | 0 | 1 |

In [56]:

```
x = df.drop(['PlacedOrNot'], axis = 1)
```

In [57]:

```
y = df.PlacedOrNot
```

In [58]:

```
from sklearn import preprocessing
scaler = preprocessing.MinMaxScaler()
x = scaler.fit_transform(x)
```

In [59]:

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

In [60]:

```
from sklearn.model_selection import cross_val_score
```

In [61]:

```
cross_val_score(SVC(),x, y, cv = 3)
```

Out[61]:

```
array([0.80384226, 0.82305359, 0.90384615])
```

In [62]:

```
cross_val_score(DecisionTreeClassifier(), x, y, cv = 3)
```

Out[62]:

```
array([0.84428716, 0.84529828, 0.91497976])
```

In [63]:

```
cross_val_score(LogisticRegression(), x, y, cv = 3)
```

Out[63]:

```
array([0.71587462, 0.74418605, 0.83097166])
```

In [64]:

```
cross_val_score(RandomForestClassifier(n_estimators=50), x, y, cv = 3)
```

Out[64]:

```
array([0.84732053, 0.85237614, 0.8917004 ])
```

In [65]:

```
cross_val_score(KNeighborsClassifier(),x, y ,cv = 3)
```

Out[65]:

```
array([0.80788675, 0.80687563, 0.88461538])
```

In [66]:

```
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)
```

In [67]:

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

Out[67]:

▾ DecisionTreeClassifier

DecisionTreeClassifier()

In [68]:

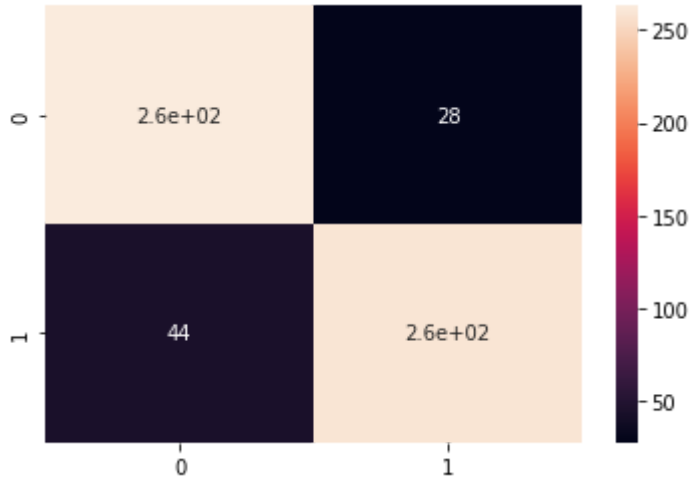
```
y_pred = model.predict(X_test)
```

In [69]:

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
```

In [70]:

```
sns.heatmap(cm, annot = True)
plt.show()
```




In [71]:

```
print("Training Accuracy :", model.score(X_train, y_train))
print("Testing Accuracy :", model.score(X_test, y_test))
```

```
Training Accuracy : 0.924114671163575
Testing Accuracy : 0.8787878787878788
```