Heart Disease Diagnostic Analysis

```
#Importing Libraries

import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
sns.set_style('whitegrid')
```

```
#Extracting CSV Dataset From System using Pandas Library

data=pd.read_csv('heart_disease_dataset.csv')
data
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	
0	63	1	1	145	233	1	2	150	0	2.3	3	
1	67	1	4	160	286	0	2	108	1	1.5	2	
2	67	1	4	120	229	0	2	129	1	2.6	2	
3	37	1	3	130	250	0	0	187	0	3.5	3	
4	41	0	2	130	204	0	2	172	0	1.4	1	
...	...	...	...	...	...	...	...	...	...	...	...	
298	45	1	1	110	264	0	0	132	0	1.2	2	
299	68	1	4	144	193	1	0	141	0	3.4	2	
300	57	1	4	130	131	0	0	115	1	1.2	2	
301	57	0	2	130	236	0	2	174	0	0.0	2	
302	38	1	3	138	175	0	0	173	0	0.0	1	-1000

303 rows × 14 columns

```
#All Columns in the Dataset

data.columns
```

```
Index(['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach',
       'exang', 'oldpeak', 'slope', 'ca', 'thal', 'num'],
      dtype='object')
```

There are thirteen features in Dataset

age: The person's age in years

sex: The person's sex (1 = male, 0 = female)

cp: The chest pain experienced (Value 1: typical angina, Value 2: atypical angina, Value 3: non-anginal pain, Value 4: asymptomatic)

trestbps: The person's resting blood pressure (mm Hg on admission to the hospital)

chol: The person's cholesterol measurement in mg/dl

fbs: The person's fasting blood sugar (> 120 mg/dl, 1 = true; 0 = false)

restecg: Resting electrocardiographic measurement (0 = normal, 1 = having ST-T wave abnormality, 2 = showing probable or definite left ventricular hypertrophy by Estes' criteria)

thalach: The person's maximum heart rate achieved

exang: Exercise induced angina (1 = yes; 0 = no)

oldpeak: ST depression induced by exercise relative to rest

slope: the slope of the peak exercise ST segment (Value 1: upsloping, Value 2: flat, Value 3: downsloping)

ca: The number of major vessels (0-3)

thal: A blood disorder called thalassemia (3 = normal; 6 = fixed defect; 7 = reversable defect)

num: Heart disease (0 = no, 1 = yes)

```
#Checking NULL Values
```

```
data.isnull().sum()
```

```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
num         0
dtype: int64
```

There is NO MISSING Values in our Dataset

Percentage of people having Heart Disease

```
num=data.groupby('num').size()
num
```

```
num
0    164
1    139
dtype: int64
```

```
#Converting Numerical Data into Categorical Data

def heart_disease(row):
    if row==0:
        return 'Absence'
    elif row==1:
        return 'Presence'
```

```
#Applying converted data into our dataset with new column - Heart_Disease

data['Heart_Disease']=data['num'].apply(heart_disease)
data.head()
```

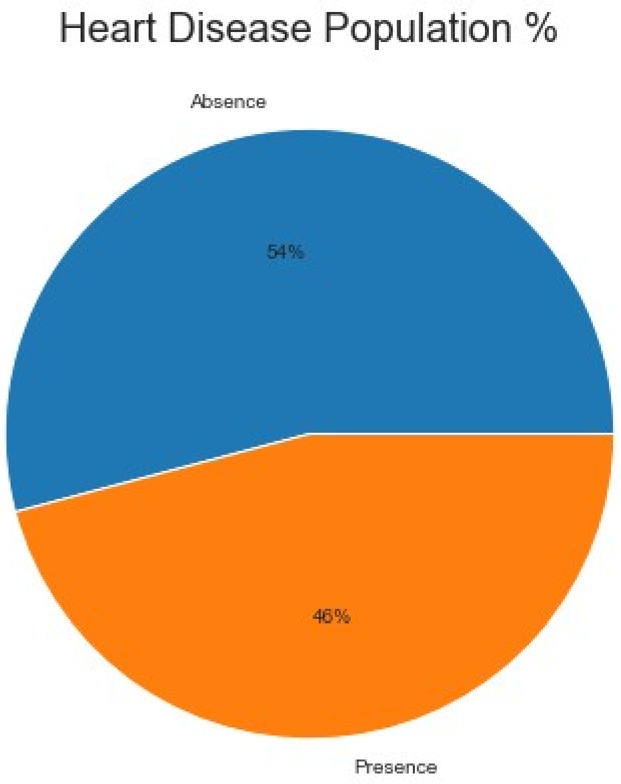
	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	tha
0	63	1	1	145	233	1	2	150	0	2.3	3	0	
1	67	1	4	160	286	0	2	108	1	1.5	2	3	

1	67	1	4	160	286	0	2	108	1	1.5	2	3
2	67	1	4	120	229	0	2	129	1	2.6	2	2
3	37	1	3	130	250	0	0	187	0	3.5	3	0
4	41	0	2	130	204	0	2	172	0	1.4	1	0

```
hd=data.groupby('Heart_Disease')['num'].count()
hd
```

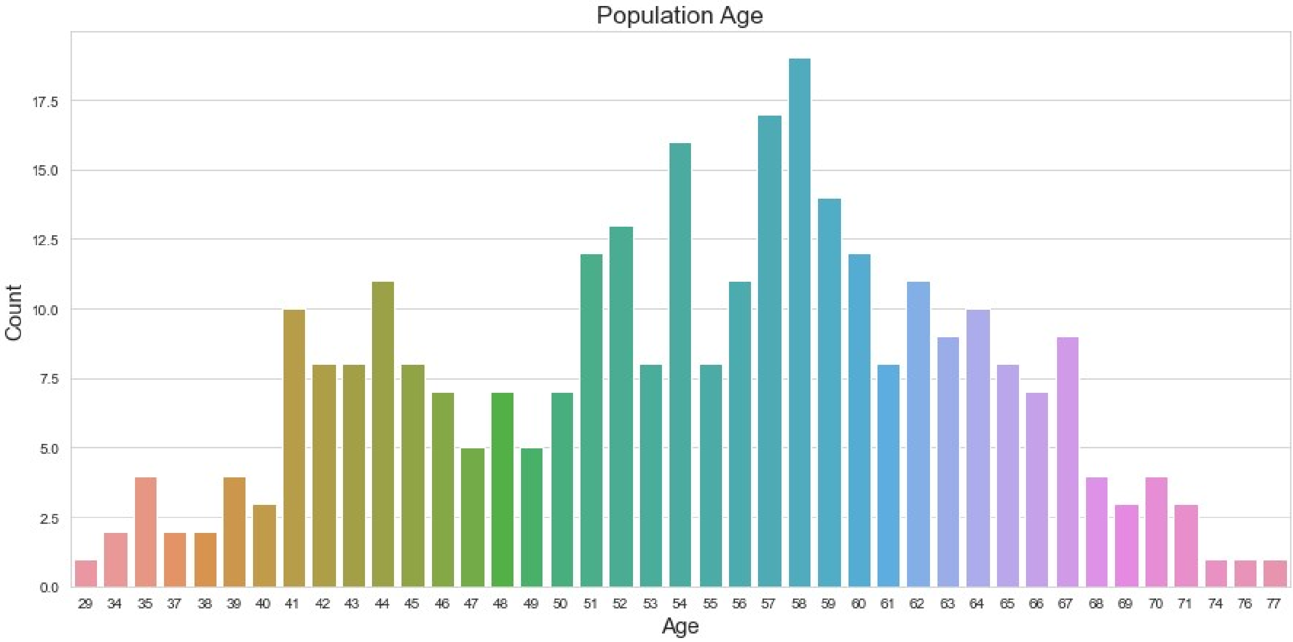
```
Heart_Disease
Absence     164
Presence    139
Name: num, dtype: int64
```

```
#Pie Chart Creation of Heart Disease Population % using MatplotLib

plt.figure(figsize=(10,7))
plt.pie(hd, labels=['Absence','Presence'], autopct='%0.0f%%')
plt.title('Heart Disease Population %', fontsize=20)
plt.show()
```



From the overall population, people having heart disease (46%) are lesser than those who have heart disease(56%)

```
#Countplot Creation of Population Age using MatplotLib and Seaborn

plt.figure(figsize=(15,7))
sns.countplot(x='age', data=data)
plt.title('Population Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Count', fontsize=15)
plt.show()
```



-> In this section, the best analysis can be divided into the elderly,middle-aged, young people by looking at the age ranges.

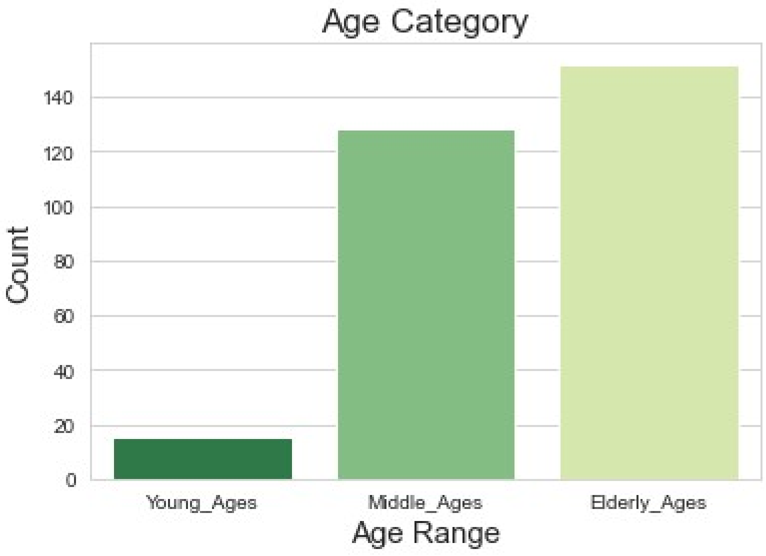
```
#Statistical Analysis

Min_Age=data['age'].min()
Max_Age=data['age'].max()
Mean_Age=data['age'].mean()
print("Minimum Age =",Min_Age)
print("Maximum Age =",Max_Age)
print("Mean Age =",Mean_Age)
```

```
Minimum Age = 29
Maximum Age = 77
Mean Age = 54.43894389438944
```

```
#Categorical Analysis

Young_Ages=data[(data['age']>=29) & (data['age']<40)]
Middle_Ages=data[(data['age']>=40) & (data['age']<55)]
Elderly_Ages=data[(data['age']>55)]
print('Young Ages =',len(Young_Ages))
print('Middle Ages =',len(Middle_Ages))
print('Elderly Ages =',len(Elderly_Ages))
```

```
Young Ages = 15
Middle Ages = 128
Elderly Ages = 152
```

```
#Bar Plot Creation of Age Category using MatplotLib and Seaborn

sns.barplot(x=['Young_Ages','Middle_Ages','Elderly_Ages'], y=[len(Young_Ages), len(Middle
plt.title('Age Category', fontsize=17)
plt.xlabel('Age Range', fontsize=15)
plt.ylabel('Count', fontsize=15)
plt.show()
```



```
#Converting Numerical Data into Categorical Data

def gender(row):
    if row==1:
        return 'Male'
    elif row==0:
        return 'Female'
```

```
#Applying converted data into our dataset with new column - sex1
```

```
data['sex1']=data['sex'].apply(gender)
data.head()
```

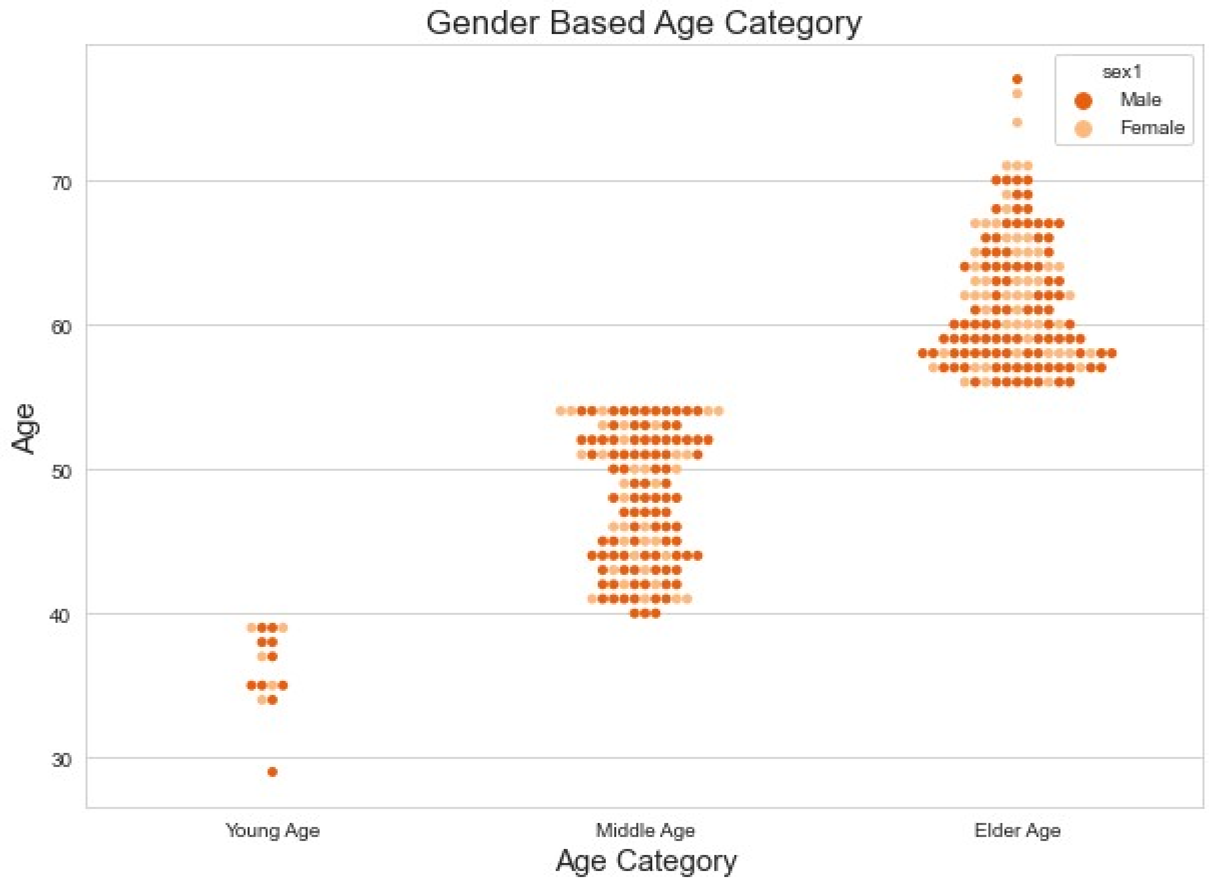
```
   age  sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  slope  ca  tha
0   63    1   1       145   233    1        2      150      0      2.3      3   0
1   67    1   4       160   286    0        2      108      1      1.5      2   3
2   67    1   4       120   229    0        2      129      1      2.6      2   2
3   37    1   3       130   250    0        0      187      0      3.5      3   0
4   41    0   2       130   204    0        2      172      0      1.4      1   0
```

```
#Converting Numerical Data into Categorical Data

def age_range(row):
    if row>=29 and row<40:
        return 'Young Age'
    elif row>=40 and row<55:
        return 'Middle Age'
    elif row>55:
        return 'Elder Age'
```

```
#Applying converted data into our dataset with new column - Age_Range

data['Age_Range']=data['age'].apply(age_range)
data.head()
```

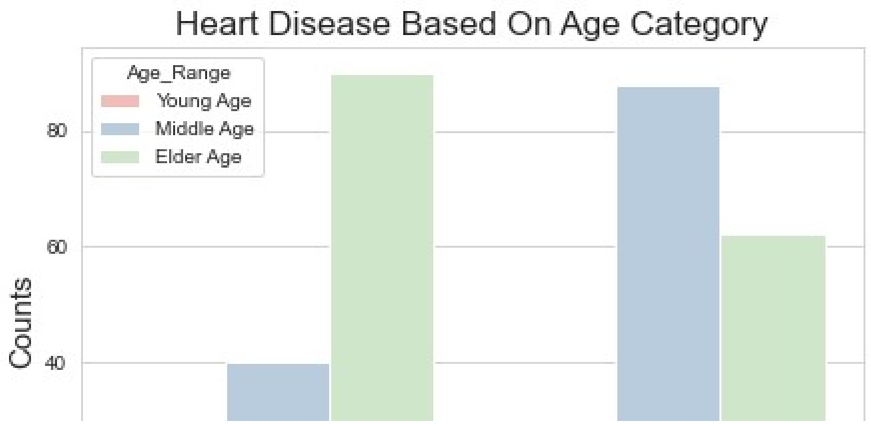
```
   age  sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  slope  ca  tha
0   63    1   1       145   233    1        2      150      0      2.3      3   0
1   67    1   4       160   286    0        2      108      1      1.5      2   3
2   67    1   4       120   229    0        2      129      1      2.6      2   2
3   37    1   3       130   250    0        0      187      0      3.5      3   0
4   41    0   2       130   204    0        2      172      0      1.4      1   0
```

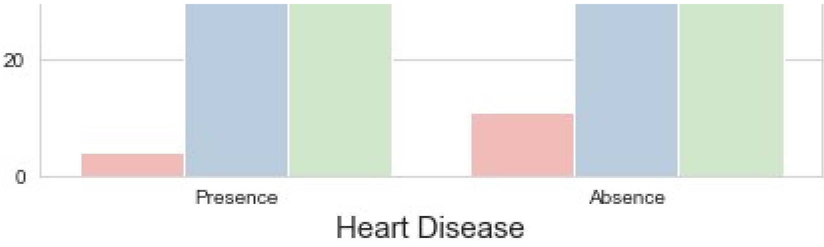
```
#Swarm Plot Creation of Gender Based Age Category using MatplotLib and Seaborn

plt.figure(figsize=(10,7))
sns.swarmplot(x='Age_Range', y='age', hue='sex1', data=data, order=['Young Age','Middle A
plt.title('Gender Based Age Category', fontsize=17)
plt.xlabel('Age Category', fontsize=15)
plt.ylabel('Age', fontsize=15)
plt.show()
```



-> In Our Population Number Of Males are more in Middle Age Category and Females are more in Elder Age Category

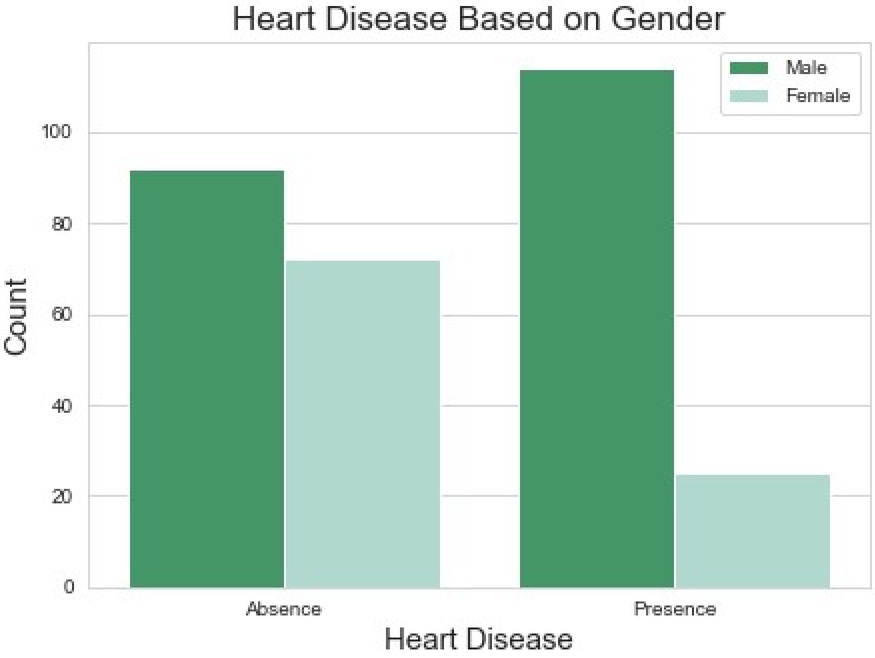
```
#Count Plot Creation of Heart Disease Based On Age Category using MatplotLib and Seaborn

plt.figure(figsize=(7,5))
hue_order=['Young Age', 'Middle Age', 'Elder Age']
sns.countplot(x='Heart_Disease', hue='Age_Range', data=data, order=['Presence','Absence']
plt.title('Heart Disease Based On Age Category', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Counts', fontsize=15)
plt.show()
```





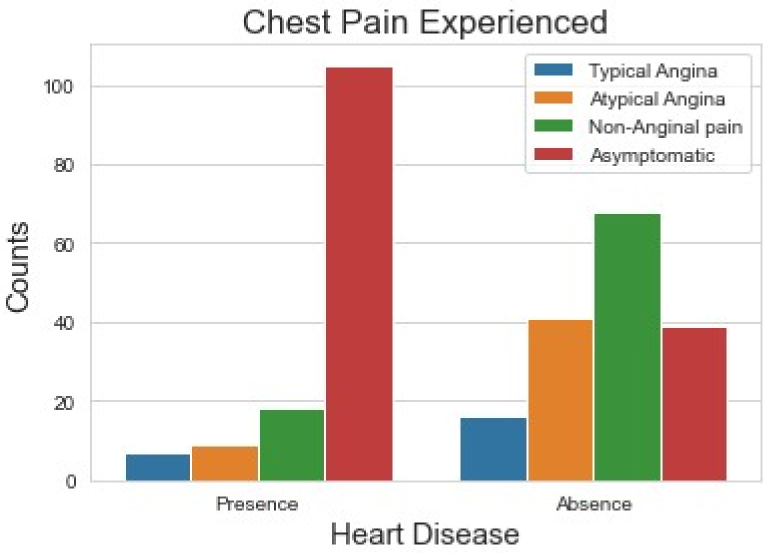
-> Elder Age People are most affected by Heart Disease AND Middle Age People are mostly FREE from any kind of Heart Disease

```
#Count Plot Creation of Heart Disease Based on Gender using MatplotLib and Seaborn

plt.figure(figsize=(7,5))
sns.countplot(x=data['Heart_Disease'], hue='sex1', data=data, palette='BuGn_r')
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Count',fontsize=15)
plt.legend(labels=['Male','Female'])
plt.title('Heart Disease Based on Gender',fontsize=17)
plt.show()
```



-> We can see that Males are more prone to Heart Disease

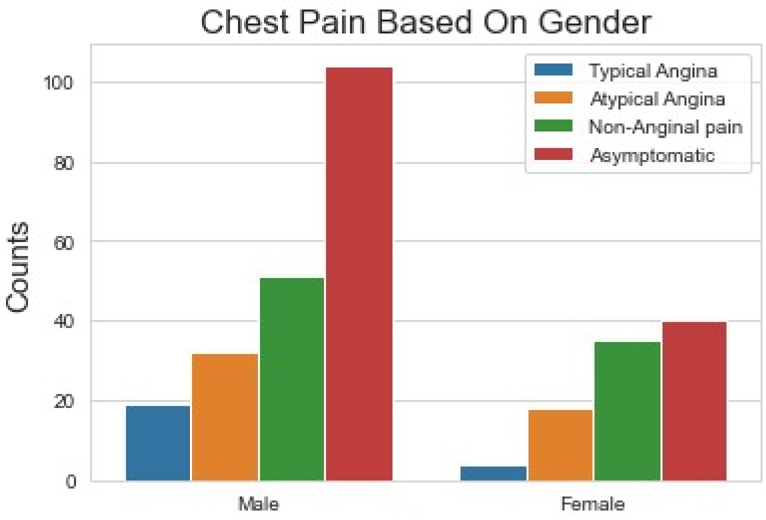
```
#Count Plot Creation of Chest Pain Experienced using MatplotLib and Seaborn

sns.countplot(x=data['Heart_Disease'], hue='cp', data=data, order=['Presence','Absence'])
plt.title('Chest Pain Experienced', fontsize=17)
plt.xlabel('Heart Disease',fontsize=15)
plt.ylabel('Counts',fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptomatic'])
plt.show()
```



-> It seems people having asymptomatic chest pain have a higher chance of heart disease

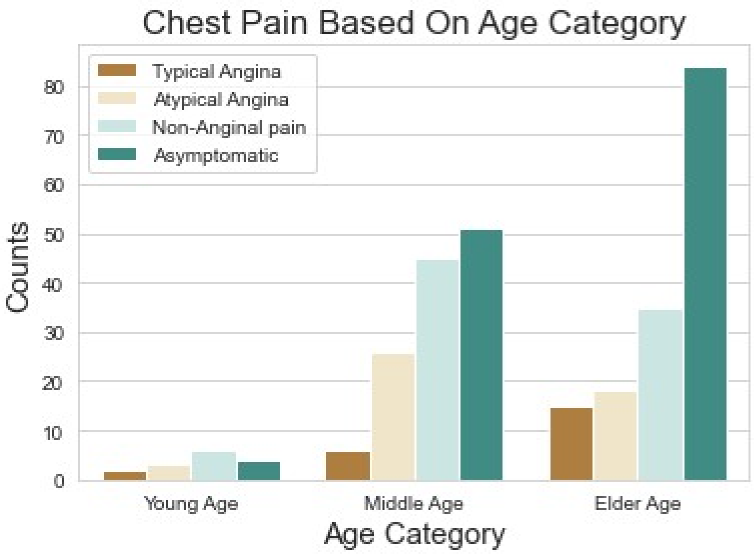
-> Asymptomatic Chest pain means neither causing nor exhibiting symptoms of Heart disease.

```
#Count Plot Creation of Chest Pain Based On Gender using MatplotLib and Seaborn

sns.countplot(x=data['sex1'], hue='cp', data=data)
plt.title('Chest Pain Based On Gender', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('Counts', fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptomatic'])
plt.show()
```



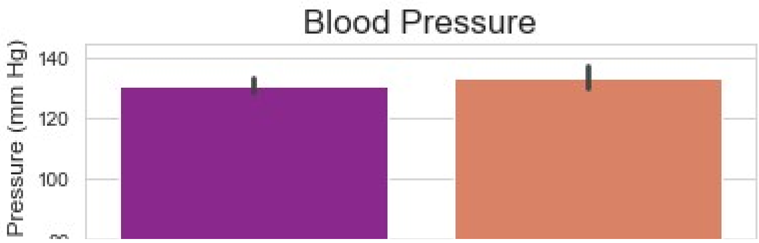
-> We can see that a higher number of men are suffering from Asymptomatic type of Chest Pain

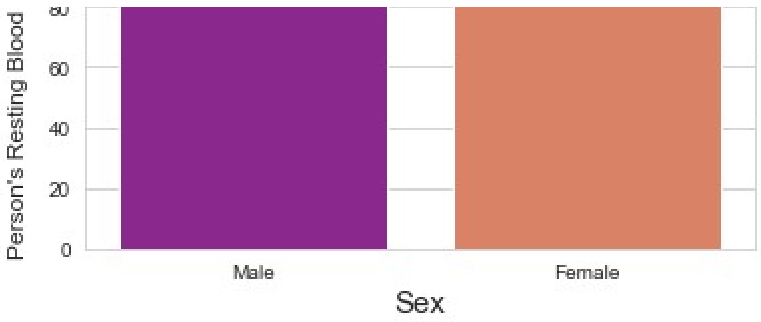
```
#Count Plot Creation of Chest Pain Based On Age Category using MatplotLib and Seaborn

sns.countplot(x=data['Age_Range'], hue='cp', data=data, order=['Young Age', 'Middle Age',
plt.title('Chest Pain Based On Age Category', fontsize=17)
plt.xlabel('Age Category', fontsize=15)
plt.ylabel('Counts', fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptomatic'])
plt.show()
```



-> There is very high number of Asymptomatic Pain in Elderly age Category

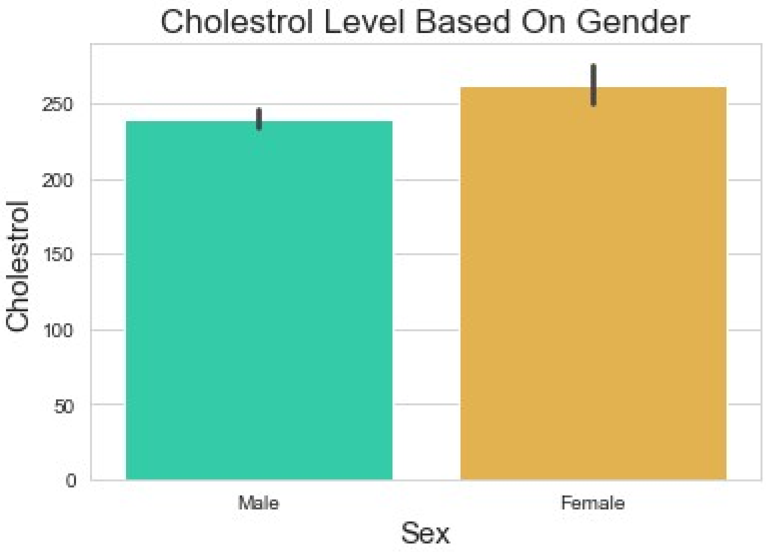
```
#Bar Plot Creation of Person's Resting Blood Pressure (mm Hg) using MatplotLib and Seabor

sns.barplot(x='sex1', y='trestbps', data=data, palette='plasma')
plt.title("Blood Pressure", fontsize=17)
plt.xlabel('Sex',fontsize=15)
plt.ylabel("Person's Resting Blood Pressure (mm Hg)", fontsize=12)
plt.show()
```





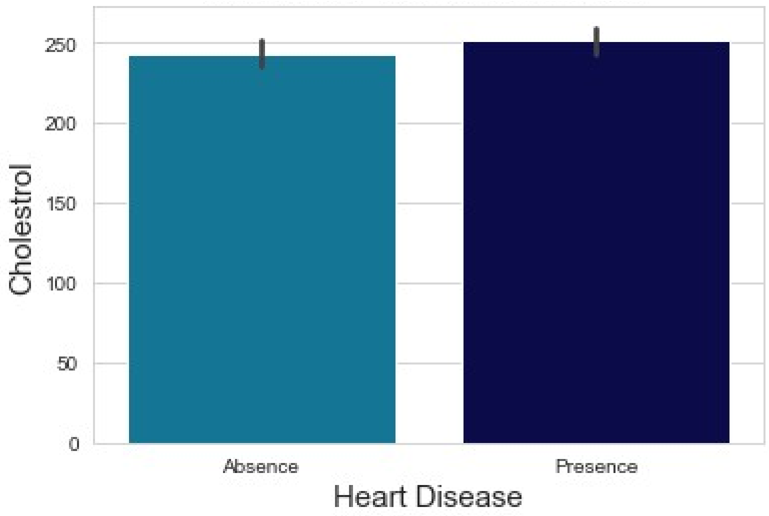
-> Blood Pressure Rate is almost equal in Males and Females

```
#Bar Plot Creation of Cholestrol Level Based On Gender using MatplotLib and Seaborn

sns.barplot(x='sex1', y='chol', data=data, palette='turbo')
plt.title("Cholestrol Level Based On Gender", fontsize=17)
plt.xlabel('Sex',fontsize=15)
plt.ylabel("Cholestrol", fontsize=15)
plt.show()
```



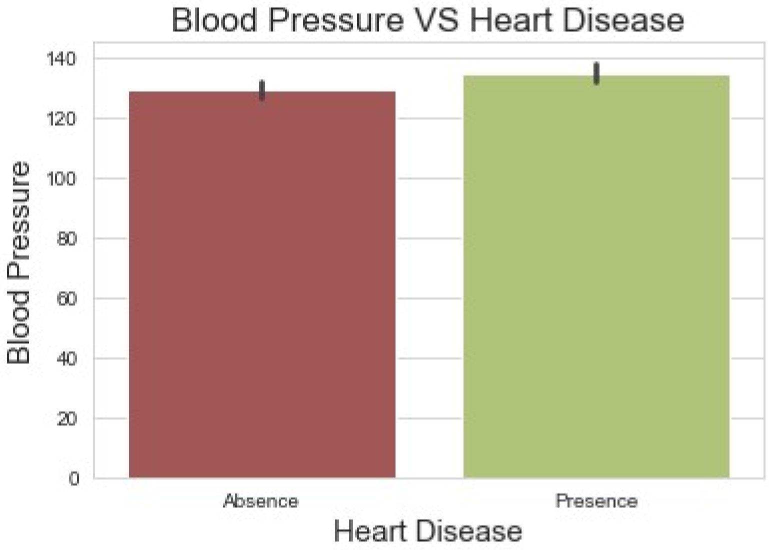
-> females have little bit of higher cholesterol than males

```
#Bar Plot Creation of Cholestrol VS Heart Disease using MatplotLib and Seaborn

sns.barplot(x='Heart_Disease', y='chol', data=data, palette='ocean_r')
plt.title('Cholestrol VS Heart Disease', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Cholestrol', fontsize=15)
plt.show()
```



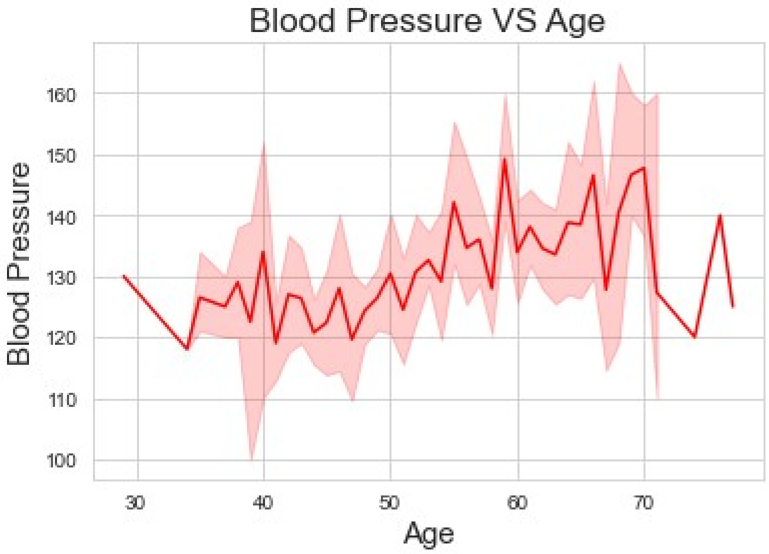
-> Higher Cholestrol Level results Chances Of Heart Disease

```
#Bar Plot Creation of Blood Pressure VS Heart Disease using MatplotLib and Seaborn

sns.barplot(x='Heart_Disease', y='trestbps', data=data, palette='tab20b_r')
plt.title('Blood Pressure VS Heart Disease', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Blood Pressure', fontsize=15)
plt.show()
```



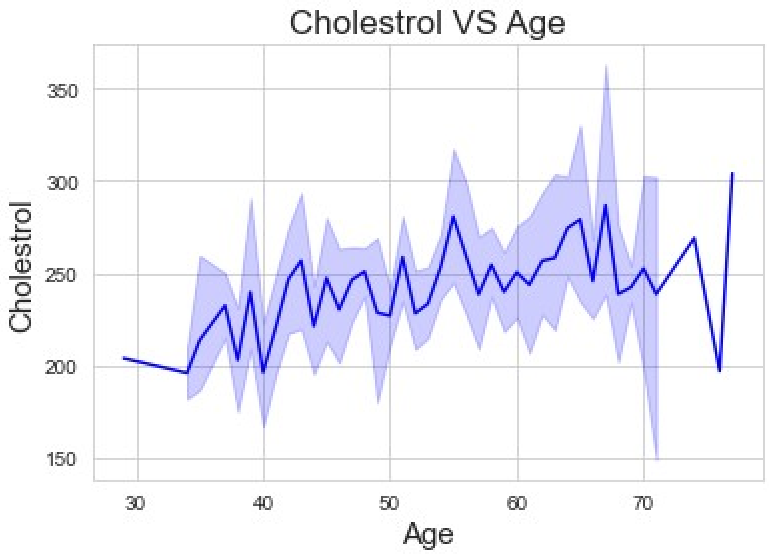
-> Higher Blood Pressure Level results Chances Of Heart Disease

```
#Line Plot Creation of Blood Pressure VS Age using MatplotLib and Seaborn

sns.lineplot(x='age', y='trestbps', data=data, color='r')
plt.title('Blood Pressure VS Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Blood Pressure', fontsize=15)
plt.show()
```



-> Here we can observe that Blood Pressure increases between age of 50 to 60 and somehow continue the pattern till 70

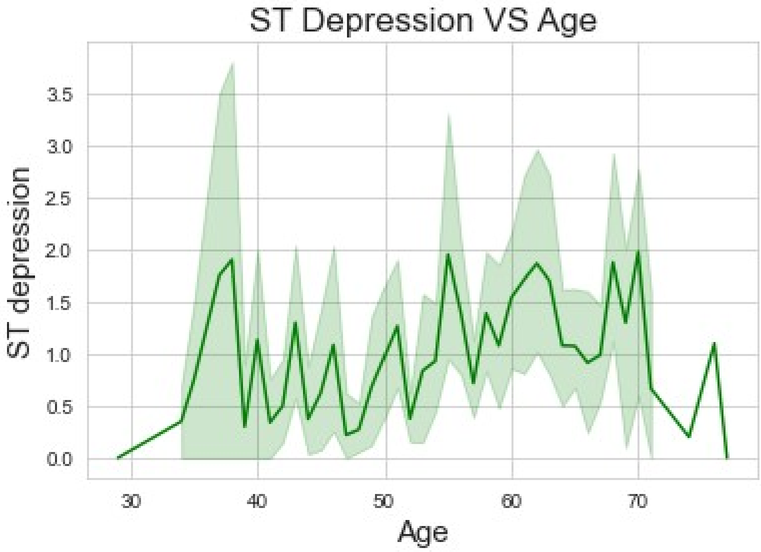
```
#Line Plot Creation of Cholestrol VS Age using MatplotLib and Seaborn

sns.lineplot(x='age', y='chol', data=data, color='b')
plt.title('Cholestrol VS Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Cholestrol', fontsize=15)
plt.show()
```



-> Similarly Cholestrol Increasing in the age group of 50-60

-> Similarly Cholestrol increasing in the age group of 50-60

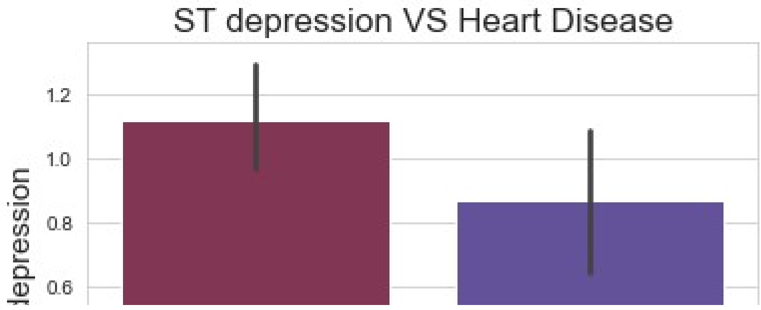
```
#Line Plot Creation of ST Depression VS Age using MatplotLib and Seaborn

sns.lineplot(x='age', y='oldpeak', data=data, color='g')
plt.title('ST Depression VS Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('ST depression', fontsize=15)
plt.show()
```

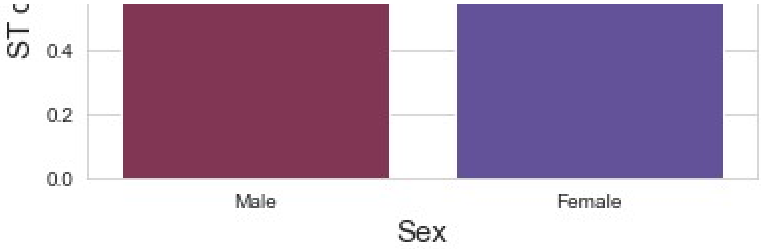


-> we can observe from here that ST depression mostly increases bw the age group of 30-40

-> ST depression refers to a finding on an electrocardiogram, wherein the trace in the ST segment is abnormally low below the baseline.

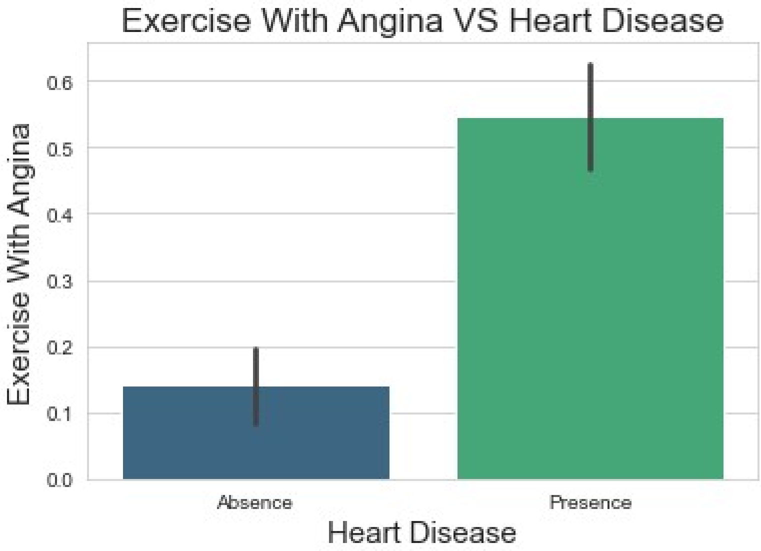
```
#Bar Plot Creation of ST depression VS Heart Disease using MatplotLib and Seaborn

sns.barplot(x='sex1', y='oldpeak', data=data, palette='twilight_r')
plt.title('ST depression VS Heart Disease', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('ST depression', fontsize=15)
plt.show()
```





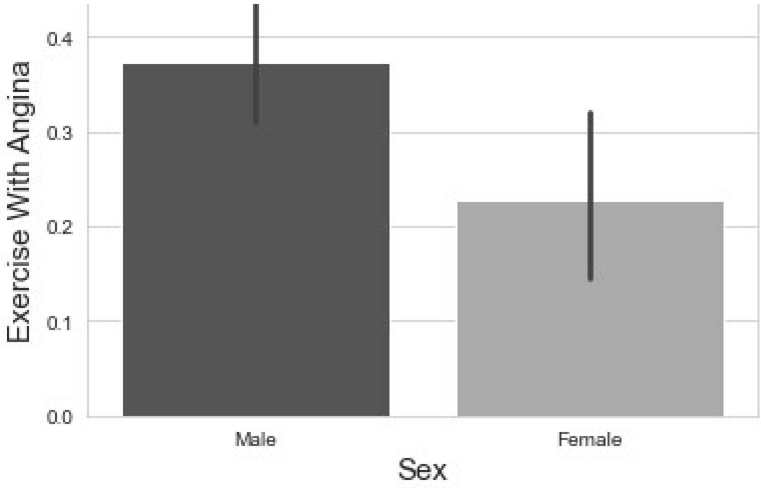
-> More Males are prone to ST depression as compare to females

```
#Bar Plot Creation of Exercise With Angina VS Heart Disease using MatplotLib and Seaborn

sns.barplot(x='Heart_Disease', y='exang', data=data, palette='viridis')
plt.title('Exercise With Angina VS Heart Disease', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Exercise With Angina', fontsize=15)
plt.show()
```



-> If you suffer from Angina, you may be concerned that exercise will make your symptoms worse.

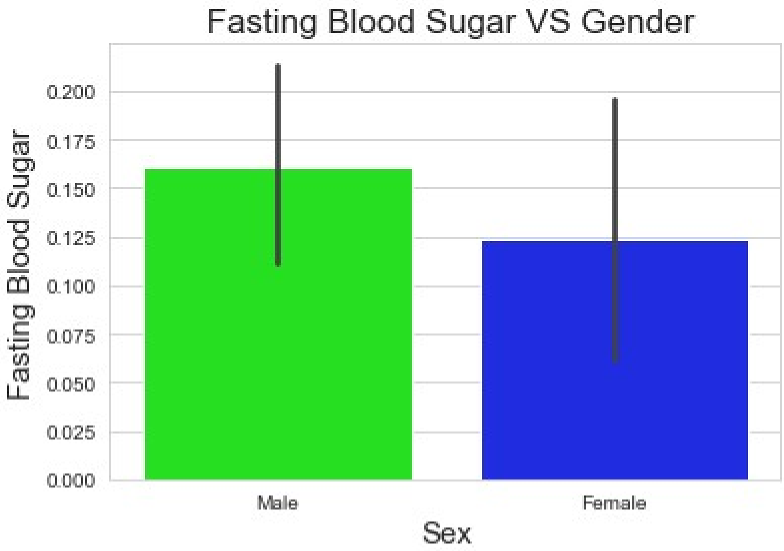
```
#Bar Plot Creation of Exercise With Angina VS Gender using MatplotLib and Seaborn

sns.barplot(x='sex1', y='exang', data=data, palette='binary_r')
plt.title('Exercise With Angina VS Gender', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('Exercise With Angina', fontsize=15)
plt.show()
```



-> Males have have high Exercise Angina

-> A type of chest pain caused by reduced blood flow to the heart.

```
#Bar Plot Creation of Fasting Blood Sugar VS Gender using MatplotLib and Seaborn

sns.barplot(y='fbs', x='sex1', data=data, palette='hsv')
plt.title(' Fasting Blood Sugar VS Gender', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('Fasting Blood Sugar', fontsize=15)
plt.show()
```

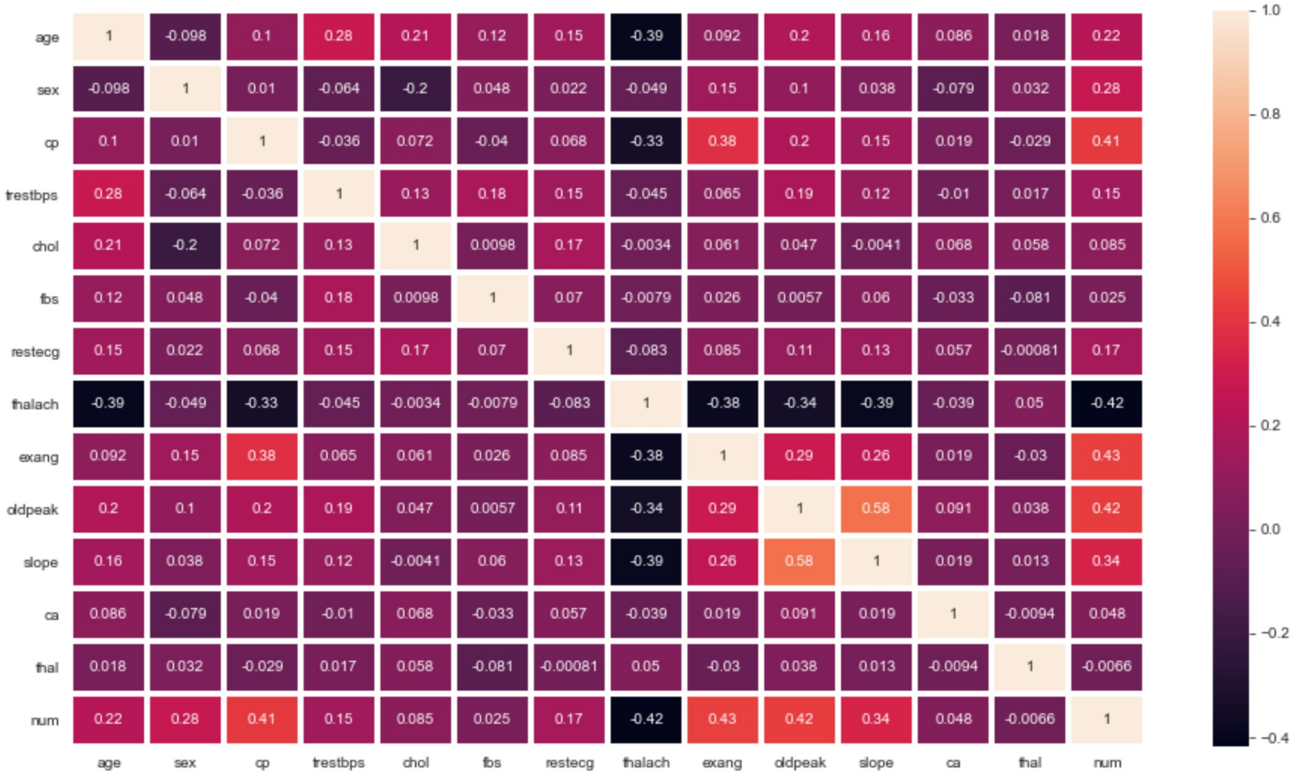


-> Males have high no of Fasting Blood Sugar over 120

```
#Heatmap Creation using Seaborn
```

```
plt.figure(figsize=(16,9))
sns.heatmap(data.corr(), annot=True, linewidth=3)
```

```
<AxesSubplot:>
```



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