Heart Disease Diagnostic Analysis

In [ ]:

VEDANT ADESH KALMEGH

In [132…
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

In [133…
```
data = pd.read_csv("Heart Disease data.csv")
```

In [134…
```
data
```

Out[134]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
1020	59	1	1	140	221	0	1	164	1	0.0	2	0	2	1
1021	60	1	0	125	258	0	0	141	1	2.8	1	1	3	0
1022	47	1	0	110	275	0	0	118	1	1.0	1	1	2	0
1023	50	0	0	110	254	0	0	159	0	0.0	2	0	2	1
1024	54	1	0	120	188	0	1	113	0	1.4	1	1	3	0

1025 rows × 14 columns

In [135…
```
data.head(20)   #Top 20
```

Out[135]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0
5	58	0	0	100	248	0	0	122	0	1.0	1	0	2	1
6	58	1	0	114	318	0	2	140	0	4.4	0	3	1	0
7	55	1	0	160	289	0	0	145	1	0.8	1	1	3	0
8	46	1	0	120	249	0	0	144	0	0.8	2	0	3	0
9	54	1	0	122	286	0	0	116	1	3.2	1	2	2	0
10	71	0	0	112	149	0	1	125	0	1.6	1	0	2	1
11	43	0	0	132	341	1	0	136	1	3.0	1	0	3	0
12	34	0	1	118	210	0	1	192	0	0.7	2	0	2	1
13	51	1	0	140	298	0	1	122	1	4.2	1	3	3	0
14	52	1	0	128	204	1	1	156	1	1.0	1	0	0	0
15	34	0	1	118	210	0	1	192	0	0.7	2	0	2	1
16	51	0	2	140	308	0	0	142	0	1.5	2	1	2	1
17	54	1	0	124	266	0	0	109	1	2.2	1	1	3	0
18	50	0	1	120	244	0	1	162	0	1.1	2	0	2	1
19	58	1	2	140	211	1	0	165	0	0.0	2	0	2	1

In [201…

```
data.info()          #Checking the numerical and categorical features
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 15 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   age             1025 non-null   int64  
 1   cp              528 non-null    object 
 2   trestbps        1025 non-null   int64  
 3   chol            1025 non-null   int64  
 4   fbs             1025 non-null   int64  
 5   restecg         1025 non-null   int64  
 6   thalach         1025 non-null   int64  
 7   exang           1025 non-null   int64  
 8   oldpeak         1025 non-null   float64
 9   slope           951 non-null    object 
 10  ca              1025 non-null   int64  
 11  thal            1025 non-null   object 
 12  Heart_Disease   1025 non-null   object 
 13  Sex             1025 non-null   object 
 14  Age_range       1025 non-null   object 
dtypes: float64(1), int64(8), object(6)
memory usage: 120.2+ KB
```

In [137…

```
data.describe()          ## Checking the statistical values
```

Out[137]:

	age	sex	cp	trestbps	chol	fbs	restecg
count	1025.000000	1025.000000	1025.000000	1025.000000	1025.00000	1025.000000	1025.000000
mean	54.434146	0.695610	0.942439	131.611707	246.00000	0.149268	0.529756
std	9.072290	0.460373	1.029641	17.516718	51.59251	0.356527	0.527878
min	29.000000	0.000000	0.000000	94.000000	126.00000	0.000000	0.000000
25%	48.000000	0.000000	0.000000	120.000000	211.00000	0.000000	0.000000
50%	56.000000	1.000000	1.000000	130.000000	240.00000	0.000000	1.000000
75%	61.000000	1.000000	2.000000	140.000000	275.00000	0.000000	1.000000
max	77.000000	1.000000	3.000000	200.000000	564.00000	1.000000	2.000000

In [138…

```
data.columns        #Full details about columns
```

Out[138]:

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

There are fourteen features in Dataset:

1) - age:The person's age in years

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

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

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

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

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

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

8) - thalach: The person's maximum heart rate achieved

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

10) - oldpeak: ST depression induced by exercise relative to rest

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

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

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

14) - target: Heart disease (0 = no, 1 = yes)

In [139…

```
## Checking the Missing Values as we have to fill them

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

Out[139]:
```
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
target      0
dtype: int64
```

Changing the numerical values to cartegorical values for a clear understanding of reports

In [140…
```
def cp(row):
    if row == 1:
        return ' typical angina'
    elif row == 2:
        return 'atypical angina'
    elif row == 3:
        return 'non-anginal pain'
    elif row == 4 :
        return 'asymptomatic'
```

In [141…
```
data['cp'] = data['cp'].apply(cp)
```

In [142…
```
data
```

Out[142]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	targe
0	52	1	None	125	212	0	1	168	0	1.0	2	2	3	
1	53	1	None	140	203	1	0	155	1	3.1	0	0	3	
2	70	1	None	145	174	0	1	125	1	2.6	0	0	3	
3	61	1	None	148	203	0	1	161	0	0.0	2	1	3	
4	62	0	None	138	294	1	1	106	0	1.9	1	3	2	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
1020	59	1	typical angina	140	221	0	1	164	1	0.0	2	0	2	
1021	60	1	None	125	258	0	0	141	1	2.8	1	1	3	
1022	47	1	None	110	275	0	0	118	1	1.0	1	1	2	
1023	50	0	None	110	254	0	0	159	0	0.0	2	0	2	
1024	54	1	None	120	188	0	1	113	0	1.4	1	1	3	

1025 rows × 14 columns

In [143…
```
def slope(row):
    if row == 1:
        return 'upsloping'
    elif row == 2:
        return 'flat'
```

```
    elif row == 3:
        return 'downsloping'
```

In [144…
```
data['slope'] = data['slope'].apply(slope)
```

In [145…
```
data
```

Out[145]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	ta
0	52	1	None	125	212	0	1	168	0	1.0	flat	2	3	
1	53	1	None	140	203	1	0	155	1	3.1	None	0	3	
2	70	1	None	145	174	0	1	125	1	2.6	None	0	3	
3	61	1	None	148	203	0	1	161	0	0.0	flat	1	3	
4	62	0	None	138	294	1	1	106	0	1.9	upsloping	3	2	
…	…	…	…	…	…	…	…	…	…	…	…	…	…	
1020	59	1	typical angina	140	221	0	1	164	1	0.0	flat	0	2	
1021	60	1	None	125	258	0	0	141	1	2.8	upsloping	1	3	
1022	47	1	None	110	275	0	0	118	1	1.0	upsloping	1	2	
1023	50	0	None	110	254	0	0	159	0	0.0	flat	0	2	
1024	54	1	None	120	188	0	1	113	0	1.4	upsloping	1	3	

1025 rows × 14 columns

In [146…
```
def thal(row):
    if row == 3:
        return 'normal'
    elif row == 6:
        return 'fixed defect'
    elif row == 7:
        return 'reversable defect'
```

In [147…
```
data['thal'] = data['thal'].apply(thal)
```

In [148…
```
data
```

Out[148]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	52	1	None	125	212	0	1	168	0	1.0	flat	2	normal
1	53	1	None	140	203	1	0	155	1	3.1	None	0	normal
2	70	1	None	145	174	0	1	125	1	2.6	None	0	normal
3	61	1	None	148	203	0	1	161	0	0.0	flat	1	normal
4	62	0	None	138	294	1	1	106	0	1.9	upsloping	3	None
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	1	typical angina	140	221	0	1	164	1	0.0	flat	0	None
1021	60	1	None	125	258	0	0	141	1	2.8	upsloping	1	normal
1022	47	1	None	110	275	0	0	118	1	1.0	upsloping	1	None
1023	50	0	None	110	254	0	0	159	0	0.0	flat	0	None
1024	54	1	None	120	188	0	1	113	0	1.4	upsloping	1	normal

1025 rows × 14 columns

Removing the outliers from the coumns

In [149…
```
data['thal'].unique()
```

Out[149]:
```
array(['normal', None], dtype=object)
```

In [150…
```
#Replacing the outliers (None with mode)

data['thal'].mode()[0]
```

Out[150]:
```
'normal'
```

In [151…
```
data['thal'] = data['thal'].fillna('normal')
```

In [152…
```
data['thal'].unique()
```

Out[152]:
```
array(['normal'], dtype=object)
```

In [153…
```
data['ca'].unique()
```

Out[153]:
```
array([2, 0, 1, 3, 4], dtype=int64)
```

In [154…
```
data['ca'] = data['ca'].replace(-100000, 0)
```

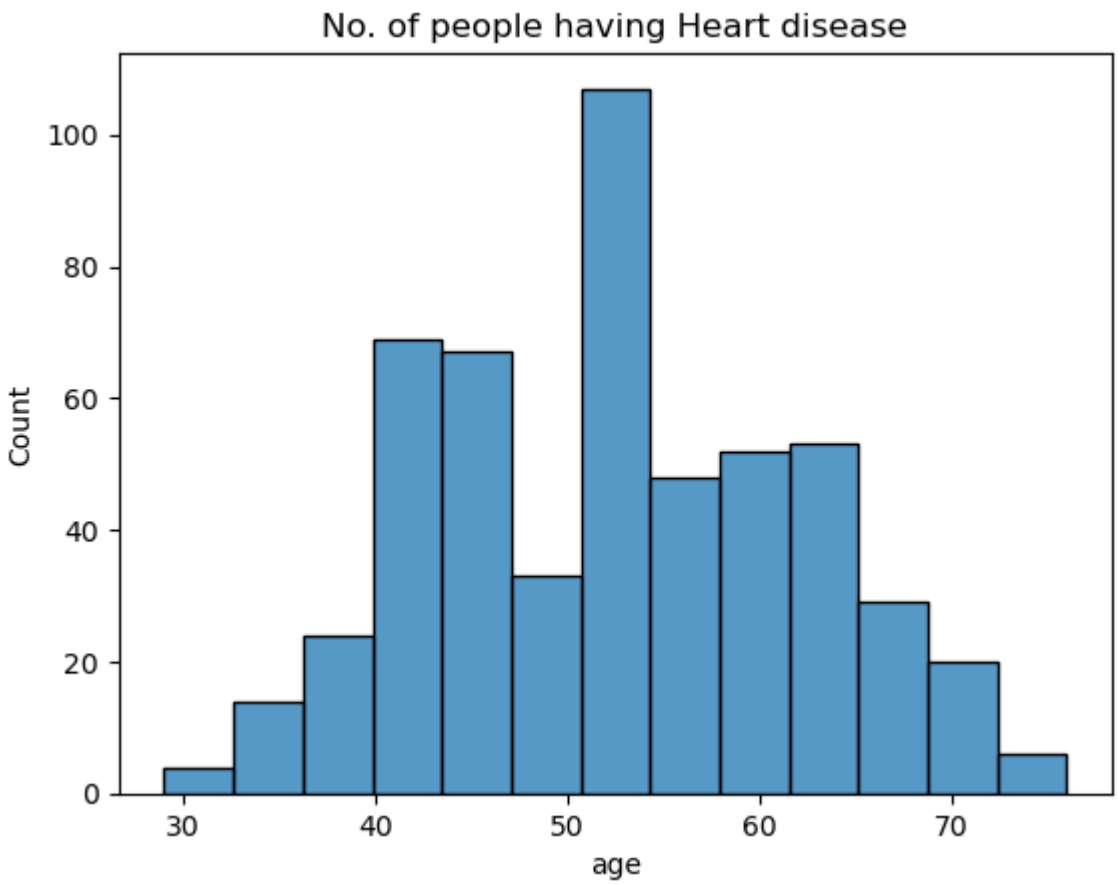
In [155…
```
data['ca'].unique()
```

Out[155]:
```
array([2, 0, 1, 3, 4], dtype=int64)
```

Now Our data is clear & simple so we can continue with E.D.A

In [156…
```
Person_having_Heart_Disease = data.age.where(data.target == 1)

sns.histplot(Person_having_Heart_Disease)
plt.title('No. of people having Heart disease');
```

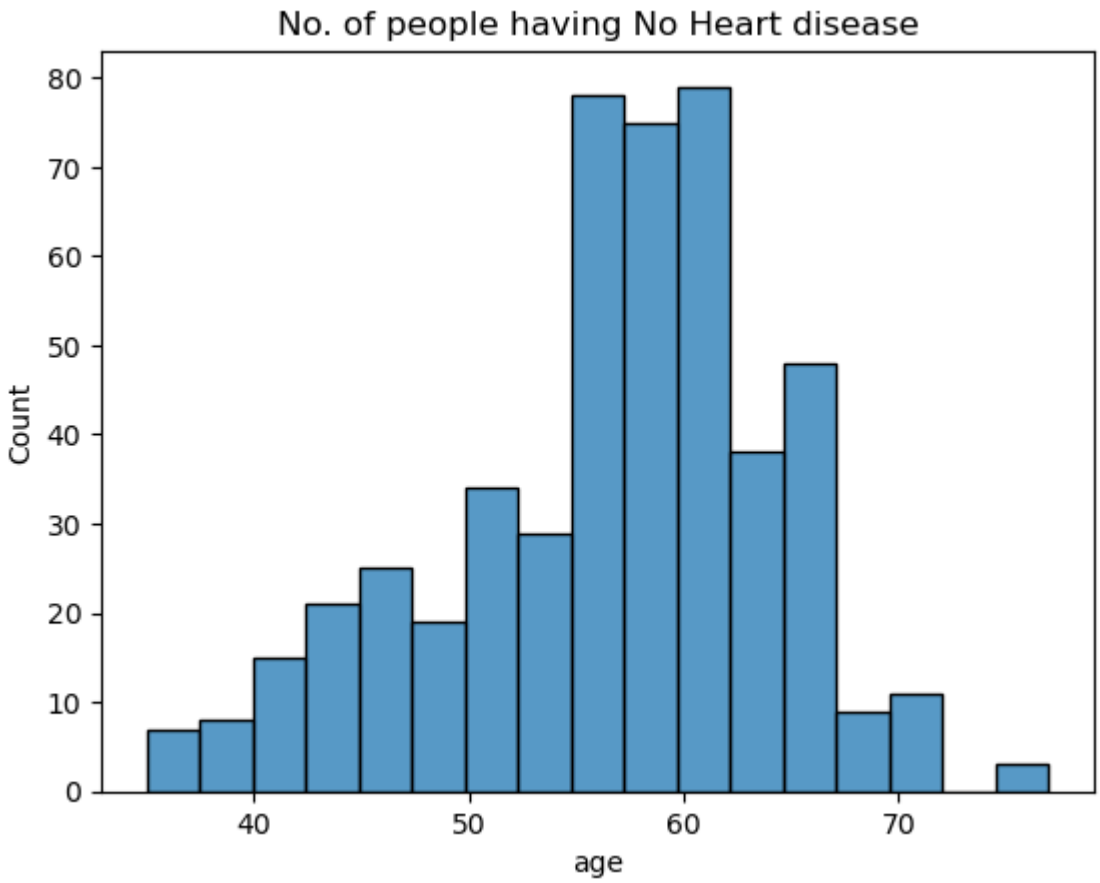


Above plot shows that count of people having Heart Disease at different age, and people with age between 50-55 has highest count.

In [157…

```
Healthy_Person = data.age.where(data.target == 0)

sns.histplot(Healthy_Person)
plt.title('No. of people having No Heart disease');
```



Above plot shows that count of people having No Heart Disease at different age, and people with age between 55-65 has highest count.

In [158…
```
def heart_disease(row):
    if row == 0:
        return 'Absence'
    elif row==1:
        return 'Presence'
```

In [159…
```
data.groupby('target').size()
```

Out[159]:
```
target
0    499
1    526
dtype: int64
```

In [160…
```
data['Heart_Disease'] = data['target'].apply(heart_disease)
```

Here we have created a column named Heart_Disease for a better Visulisation

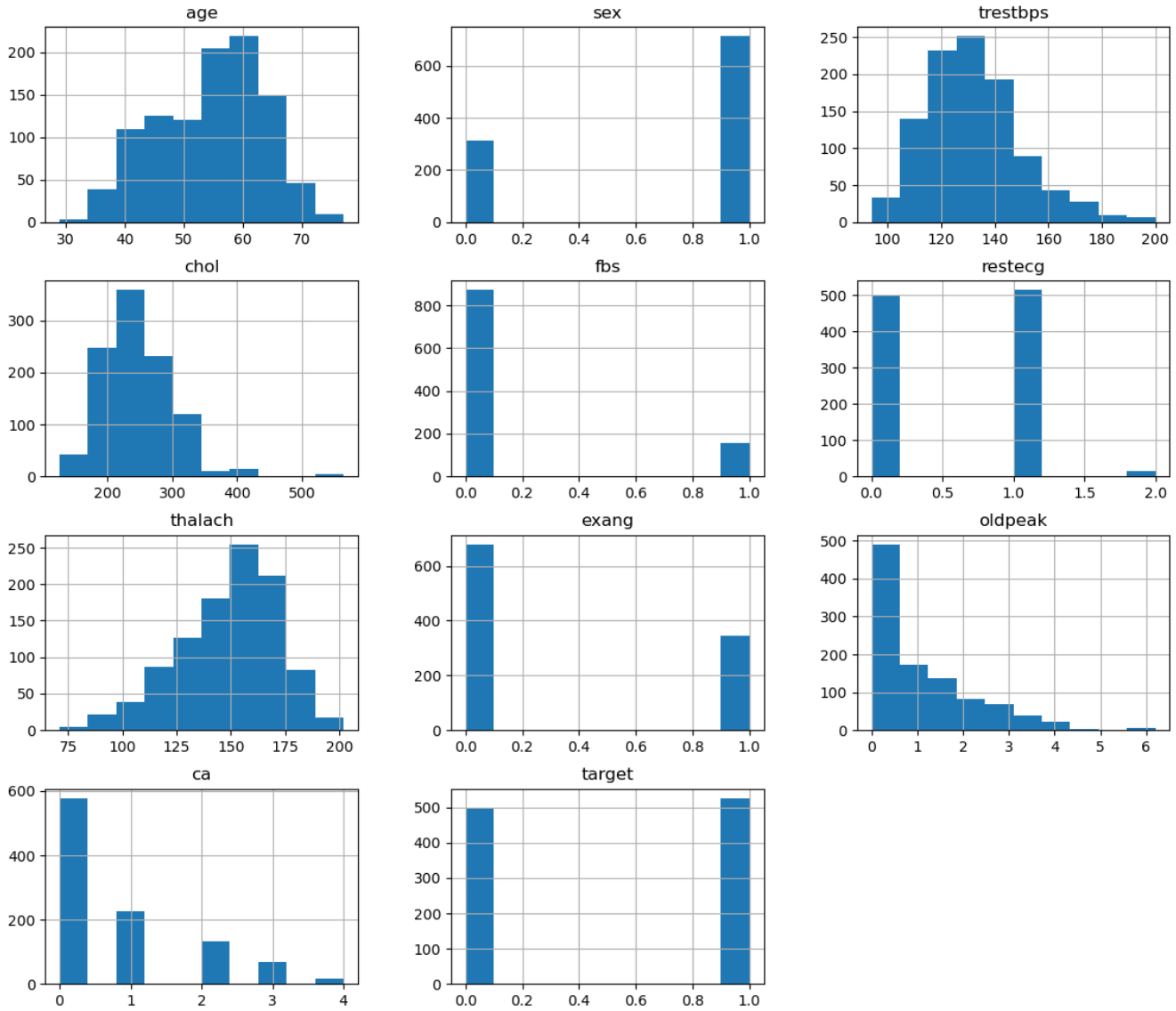
In [161…
```
data.head()
```

Out[161]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	targ
0	52	1	None	125	212	0	1	168	0	1.0	flat	2	normal	
1	53	1	None	140	203	1	0	155	1	3.1	None	0	normal	
2	70	1	None	145	174	0	1	125	1	2.6	None	0	normal	
3	61	1	None	148	203	0	1	161	0	0.0	flat	1	normal	
4	62	0	None	138	294	1	1	106	0	1.9	upsloping	3	normal	

In [162…
```
data.hist(figsize = (14,12))
```

Out[162]:
```
array([[<AxesSubplot:title={'center':'age'}>,
        <AxesSubplot:title={'center':'sex'}>,
        <AxesSubplot:title={'center':'trestbps'}>],
       [<AxesSubplot:title={'center':'chol'}>,
        <AxesSubplot:title={'center':'fbs'}>,
        <AxesSubplot:title={'center':'restecg'}>],
       [<AxesSubplot:title={'center':'thalach'}>,
        <AxesSubplot:title={'center':'exang'}>,
        <AxesSubplot:title={'center':'oldpeak'}>],
       [<AxesSubplot:title={'center':'ca'}>,
        <AxesSubplot:title={'center':'target'}>, <AxesSubplot:>]],
      dtype=object)
```



In [163…
```
data.shape
```

Out[163]: (1025, 15)

In [164…
```
##Dropping the num column as we have Heart_Disease column

data.drop('target',axis=1,inplace=True)
```

In [165…
```
data
```

Out[165]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	52	1	None	125	212	0	1	168	0	1.0	flat	2	normal
1	53	1	None	140	203	1	0	155	1	3.1	None	0	normal
2	70	1	None	145	174	0	1	125	1	2.6	None	0	normal
3	61	1	None	148	203	0	1	161	0	0.0	flat	1	normal
4	62	0	None	138	294	1	1	106	0	1.9	upsloping	3	normal
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	1	typical angina	140	221	0	1	164	1	0.0	flat	0	normal
1021	60	1	None	125	258	0	0	141	1	2.8	upsloping	1	normal
1022	47	1	None	110	275	0	0	118	1	1.0	upsloping	1	normal
1023	50	0	None	110	254	0	0	159	0	0.0	flat	0	normal
1024	54	1	None	120	188	0	1	113	0	1.4	upsloping	1	normal

1025 rows × 14 columns

Calculating How Many People Have Heart Disease, And How Many Don't Have Heart Disease In This Dataset

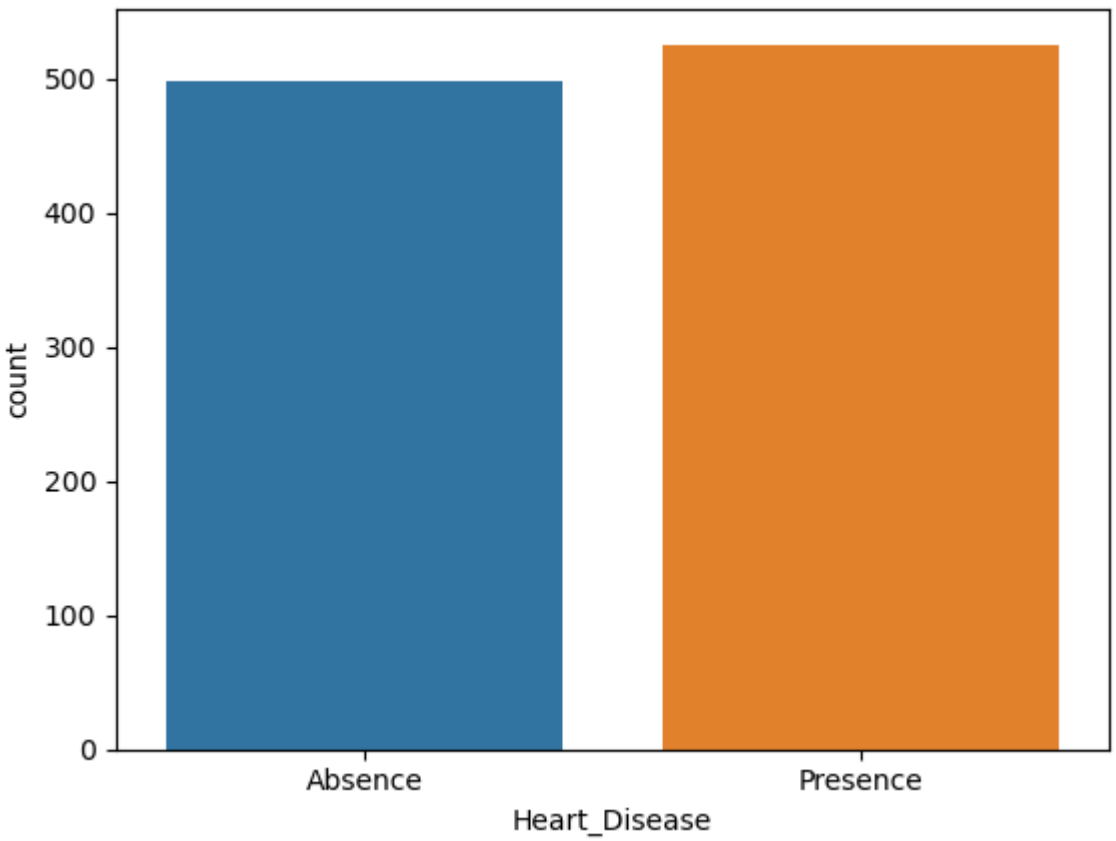
In [166…

```
sns.countplot(data['Heart_Disease'])
```

```
C:\Users\91883\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning:
Pass the following variable as a keyword arg: x. From version 0.12, the only valid p
ositional argument will be `data`, and passing other arguments without an explicit k
eyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[166]:

```
<AxesSubplot:xlabel='Heart_Disease', ylabel='count'>
```

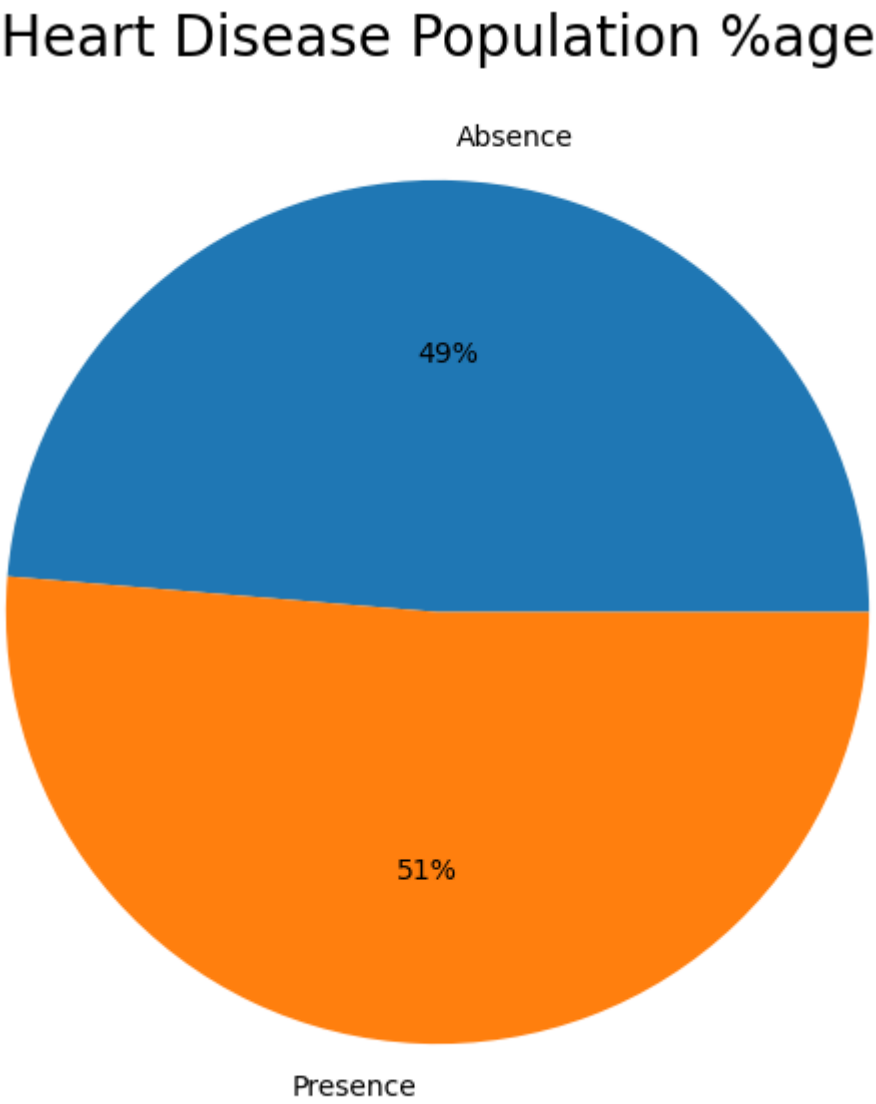


In [167…
```
hd = data.groupby('Heart_Disease').size()
```

In [168…
```
hd
```

Out[168]:
```
Heart_Disease
Absence     499
Presence    526
dtype: int64
```

In [169…
```
plt.figure(figsize=(10,7))
plt.pie(hd,labels=['Absence','Presence'],autopct='%0.0f%%')
plt.title("Heart Disease Population %age",fontsize=20)
plt.show()
```



From the overall population, people having heart disease are 49% and those who doesn't have heart disease are 51%

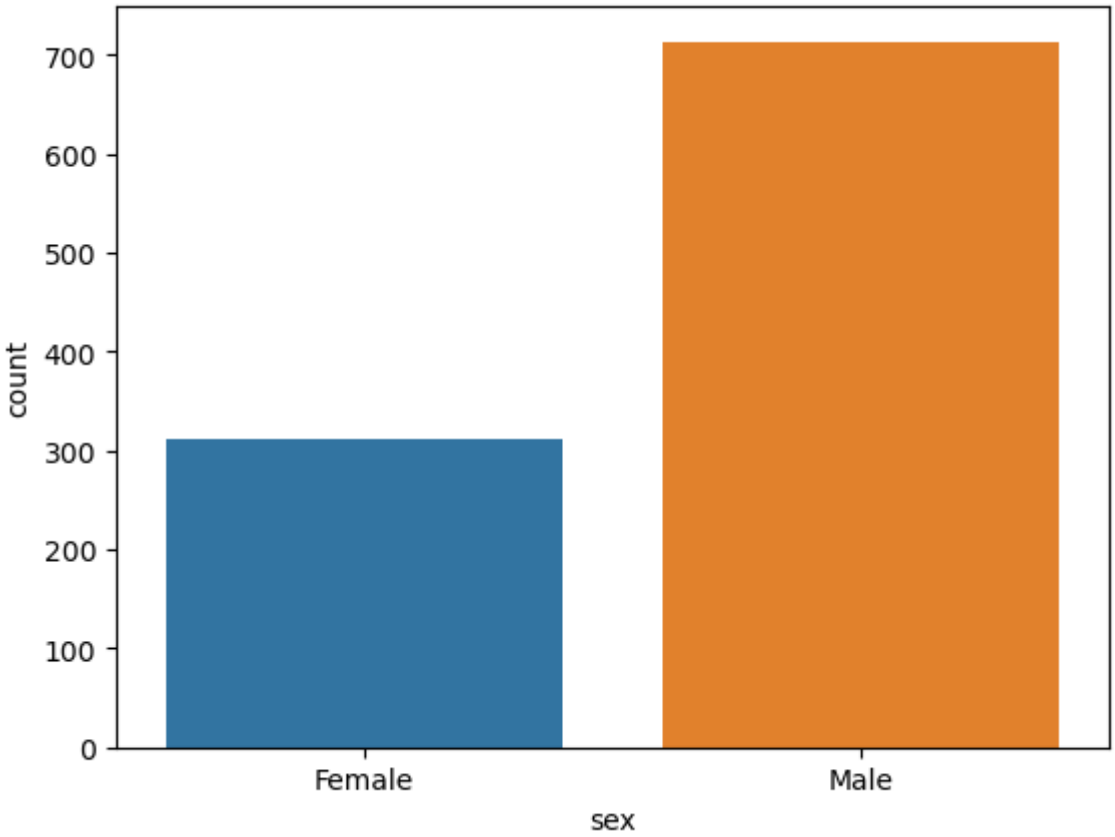
Finding the Count of Male & Female in this Dataset

In [170…
```
data['sex'].value_counts()
```

Out[170]:
```
1    713
0    312
Name: sex, dtype: int64
```

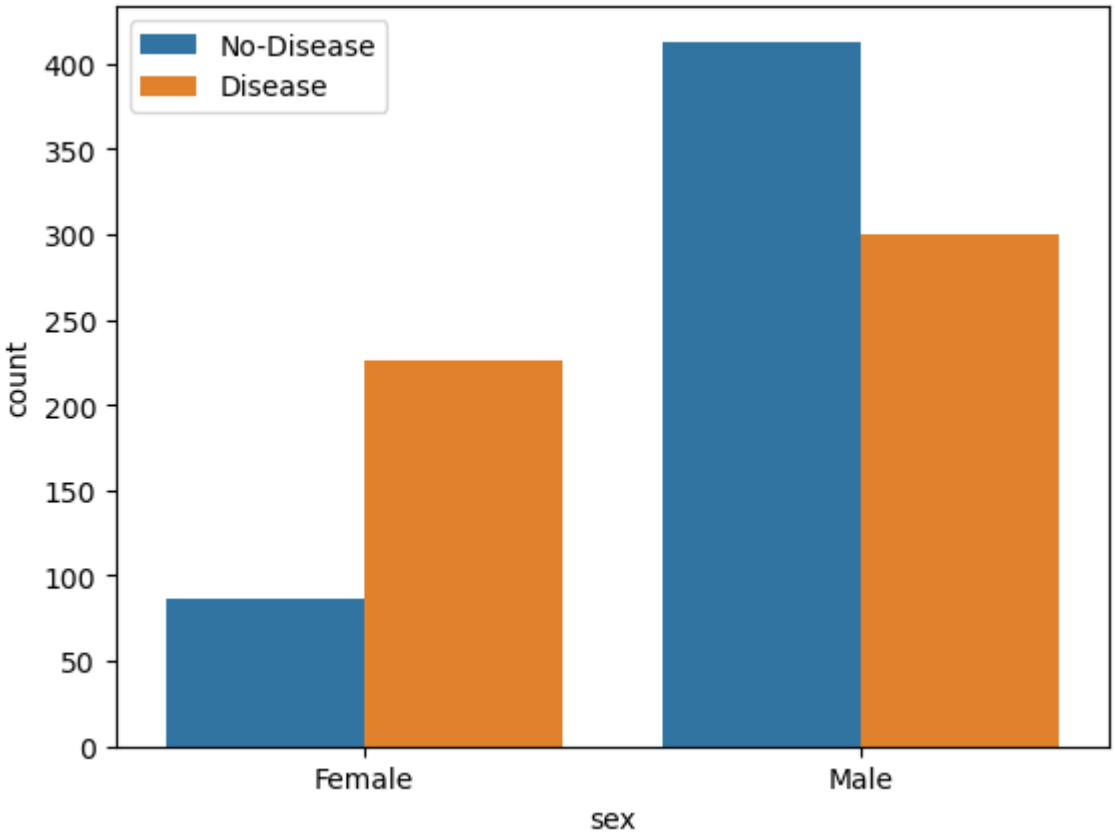
In [171…
```
sns.countplot(data['sex'])
plt.xticks([0,1],['Female', 'Male'])
plt.show()
```

```
C:\Users\91883\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning:
Pass the following variable as a keyword arg: x. From version 0.12, the only valid p
ositional argument will be `data`, and passing other arguments without an explicit k
eyword will result in an error or misinterpretation.
  warnings.warn(
```



Finding the Gender distribution accoding to the Heart_Disease

In [172…
```
sns.countplot(x='sex',hue="Heart_Disease",data=data)
plt.xticks([1,0],['Male','Female'])
plt.legend(labels = ['No-Disease','Disease'])
plt.show()
```



Check Chest Pain Type

Value 1: typical angina

Value 2: atypical angina

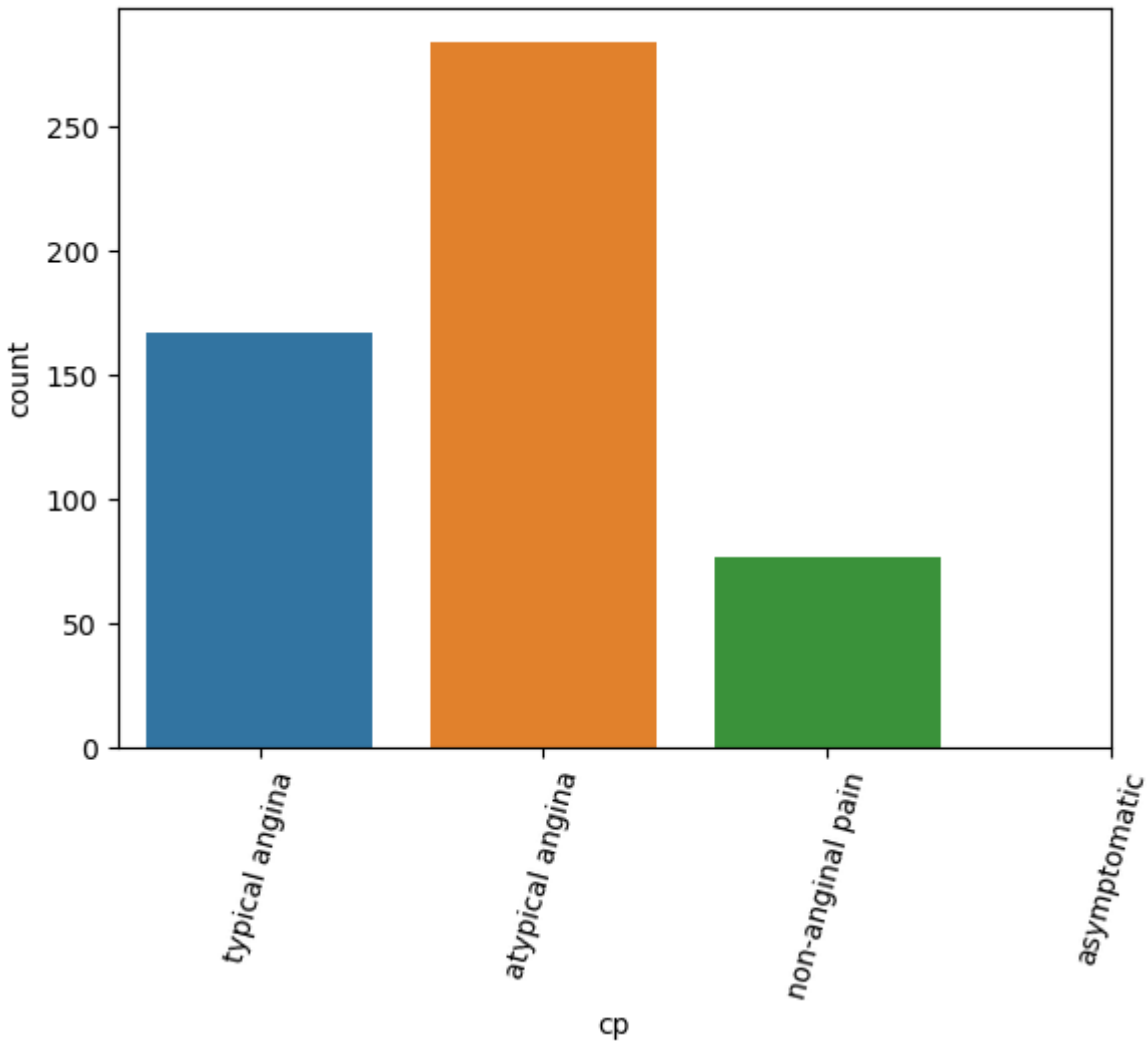
Value 3: non-anginal pain

Value 4: asymptomatic

In [173…

```
sns.countplot(data['cp'])
plt.xticks([0,1,2,3],["typical angina","atypical angina","non-anginal pain","asympto
plt.xticks(rotation=75)
plt.show()
```

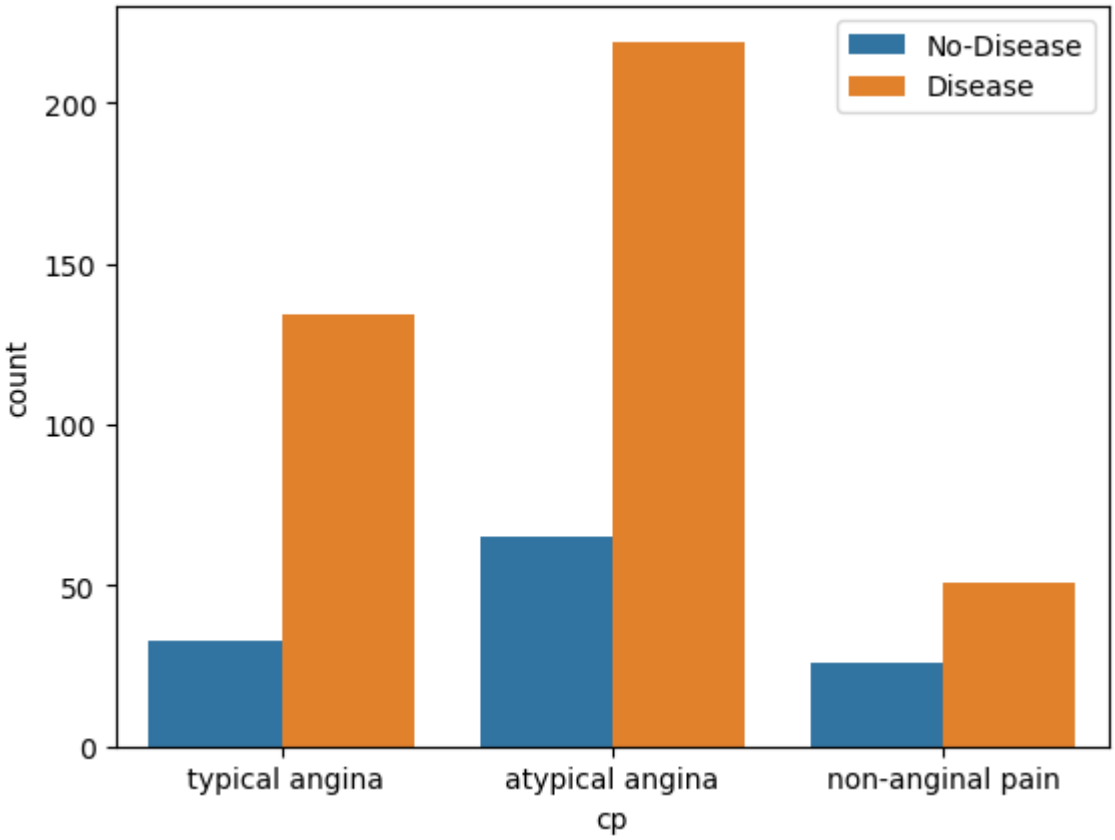
```
C:\Users\91883\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning:
Pass the following variable as a keyword arg: x. From version 0.12, the only valid p
ositional argument will be `data`, and passing other arguments without an explicit k
eyword will result in an error or misinterpretation.
  warnings.warn(
```



Showing The Chest Pain Distribution As Per the Heart_Disease

In [174…

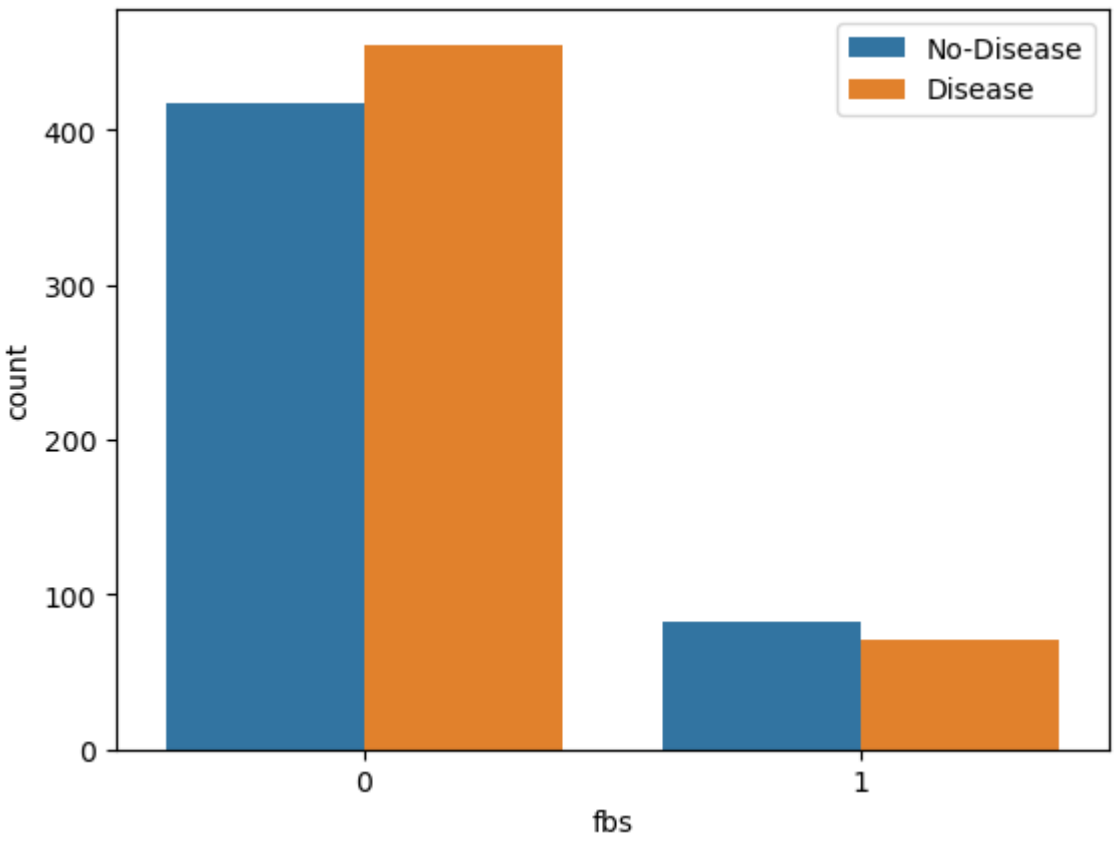
```
sns.countplot(x="cp", hue="Heart_Disease", data=data)
plt.legend(labels = ['No-Disease','Disease'])
plt.show()
```



Show Fasting Blood Sugar Level Distribution According To Heart_Disease

In [175…

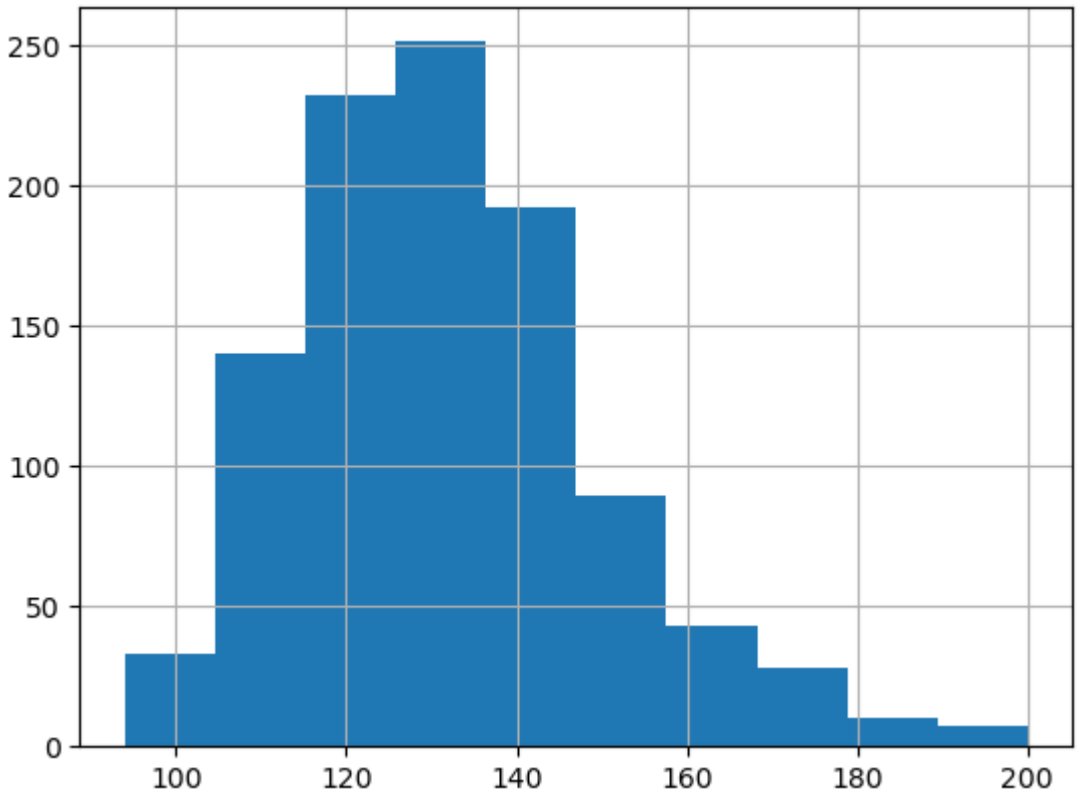
```
sns.countplot(x="fbs", hue="Heart_Disease", data=data)
plt.legend(labels = ['No-Disease','Disease'])
plt.show()
```



Checking Resting Blood Pressure Distribution

In [176…
```
data['trestbps'].hist()
```

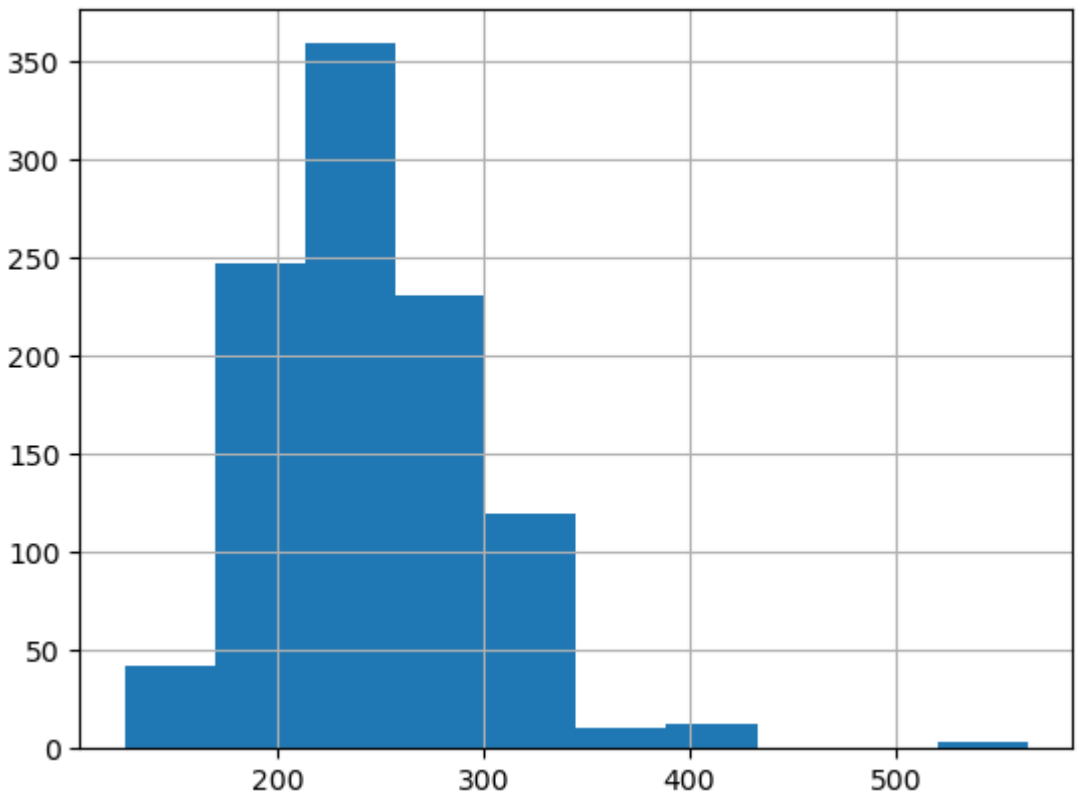
Out[176]:
```
<AxesSubplot:>
```



Checking cholesterol measurement Distribution

In [177…
```
data['chol'].hist()
```

Out[177]:
```
<AxesSubplot:>
```



Basic stats of the dataset

In [178…
```
Min_age = data['age'].min()
Max_age = data['age'].max()
Mean_age = data['age'].mean()
print("Minimum age is: {0}\nMaximum age is: {1}\nMean of Age is: {2}".format(Min_age
```

```
Minimum age is: 29
Maximum age is: 77
Mean of Age is: 54.43414634146342
```

Converting the age column into three subclass

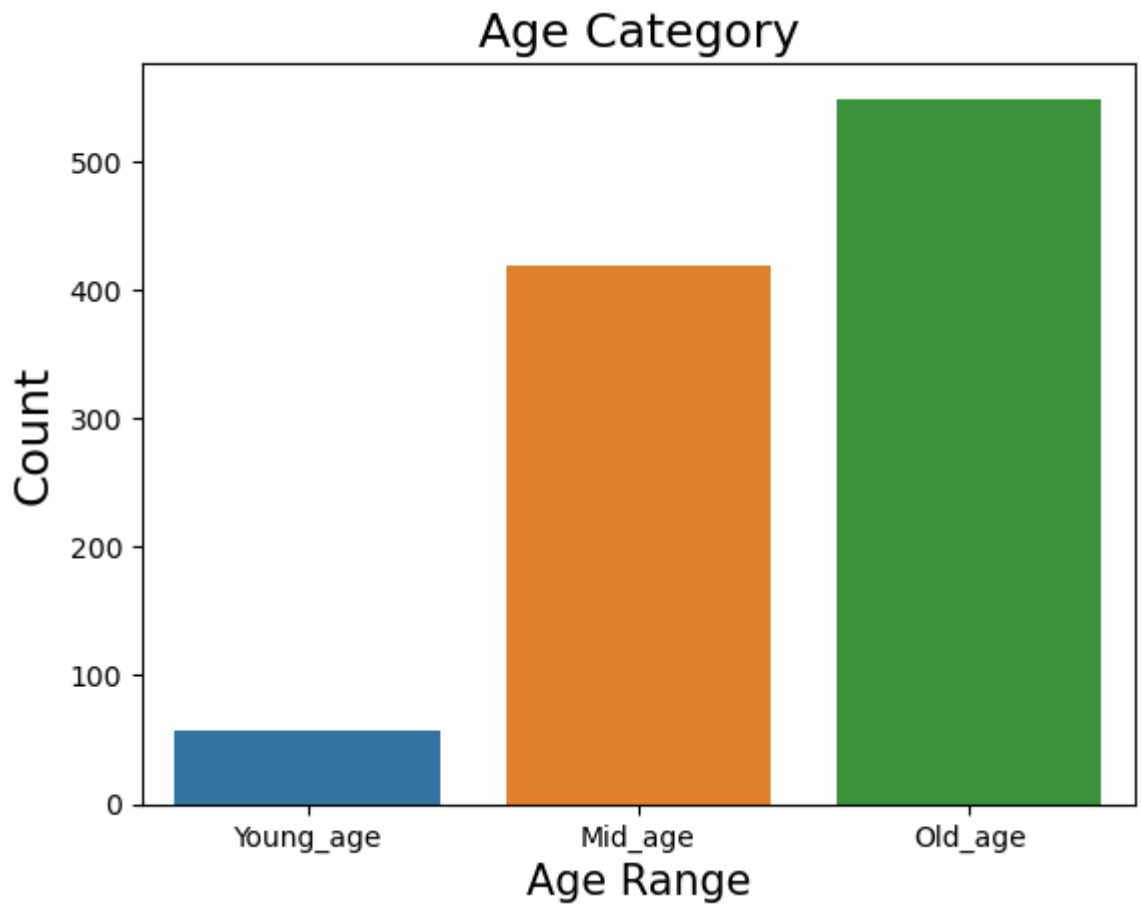
In [179…
```
Young_age = data[(data['age']>=29) & (data['age']<40)]
Mid_age = data[(data['age']>=40) & (data['age'] <55)]
Old_age = data[(data['age']>=55)]
```

In [180…
```
print("Number of Young age people are: {0}\nNumber of Middly age people are: {1}\nNu
```

```
Number of Young age people are: 57
Number of Middly age people are: 419
Number of Elder age People are: 549
```

Showing the count of age distribution According To Heart_Disease

In [181…
```
sns.barplot(x=['Young_age','Mid_age','Old_age'],y=[len(Young_age),len(Mid_age),len(O
plt.title('Age Category',fontsize=17)
plt.xlabel(xlabel='Age Range',fontsize=15)
plt.ylabel(ylabel='Count',fontsize=17)
plt.show()
```



In [182…
```
#Converting Numerical Data into Categorical Data
# Male = 1 and female = 0

def Sex(row):
    if (row==1):
        return 'Male'
```

```
    elif (row==0):
        return 'Female'
```

In [183…
```
data['Sex']=data['sex'].apply(Sex)
```

In [184…
```
data
```

Out[184]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	52	1	None	125	212	0	1	168	0	1.0	flat	2	normal
1	53	1	None	140	203	1	0	155	1	3.1	None	0	normal
2	70	1	None	145	174	0	1	125	1	2.6	None	0	normal
3	61	1	None	148	203	0	1	161	0	0.0	flat	1	normal
4	62	0	None	138	294	1	1	106	0	1.9	upsloping	3	normal
…	…	…	…	…	…	…	…	…	…	…	…	…	…
1020	59	1	typical angina	140	221	0	1	164	1	0.0	flat	0	normal
1021	60	1	None	125	258	0	0	141	1	2.8	upsloping	1	normal
1022	47	1	None	110	275	0	0	118	1	1.0	upsloping	1	normal
1023	50	0	None	110	254	0	0	159	0	0.0	flat	0	normal
1024	54	1	None	120	188	0	1	113	0	1.4	upsloping	1	normal

1025 rows × 15 columns

In [185…
```
#Dropping the sex column
data.drop('sex',axis=1,inplace=True)
```

In [186…
```
data.head()
```

Out[186]:

	age	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	Heart_Di
0	52	None	125	212	0	1	168	0	1.0	flat	2	normal	Ab
1	53	None	140	203	1	0	155	1	3.1	None	0	normal	Ab
2	70	None	145	174	0	1	125	1	2.6	None	0	normal	Ab
3	61	None	148	203	0	1	161	0	0.0	flat	1	normal	Ab
4	62	None	138	294	1	1	106	0	1.9	upsloping	3	normal	Ab

In [187…
```
def Age_range(row):
    if (row>=29 and row <40):
        return 'Young age'
    elif(row >=40 and row <55):
        return 'Mid age'
    elif (row >= 55 and row <78):
        return 'Old age'
```

In [188…
```
data['Age_range']=data['age'].apply(Age_range)
```

In [189…
```
data.head()
```

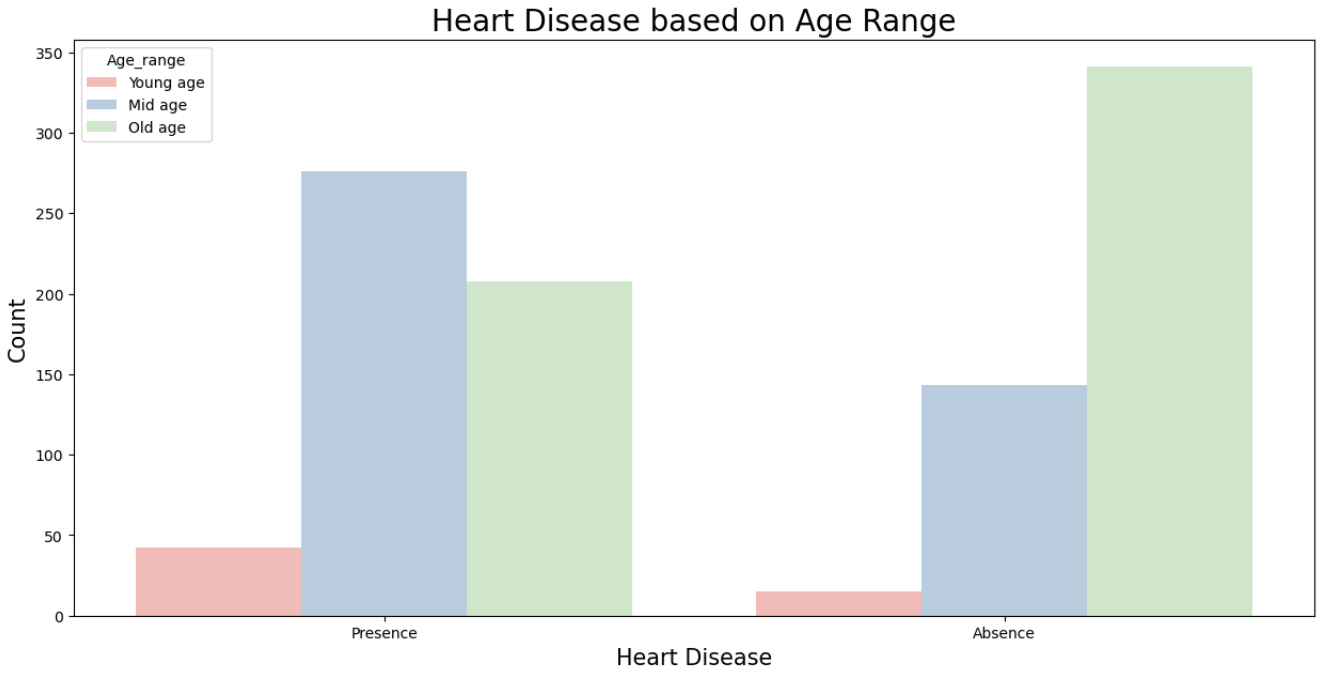
Out[189]:

	age	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	Heart_Di
0	52	None	125	212	0	1	168	0	1.0	flat	2	normal	Ab
1	53	None	140	203	1	0	155	1	3.1	None	0	normal	Ab
2	70	None	145	174	0	1	125	1	2.6	None	0	normal	Ab
3	61	None	148	203	0	1	161	0	0.0	flat	1	normal	Ab
4	62	None	138	294	1	1	106	0	1.9	upsloping	3	normal	Ab

Checking the Heart Disease based on age range

In [190…

```
plt.figure(figsize=(15,7))
sns.countplot(x='Heart_Disease',hue='Age_range',data=data,order=['Presence','Absence
plt.title("Heart Disease based on Age Range",fontsize=20)
plt.xlabel(xlabel='Heart Disease',fontsize=15)
plt.ylabel(ylabel='Count',fontsize=15)
plt.show()
```

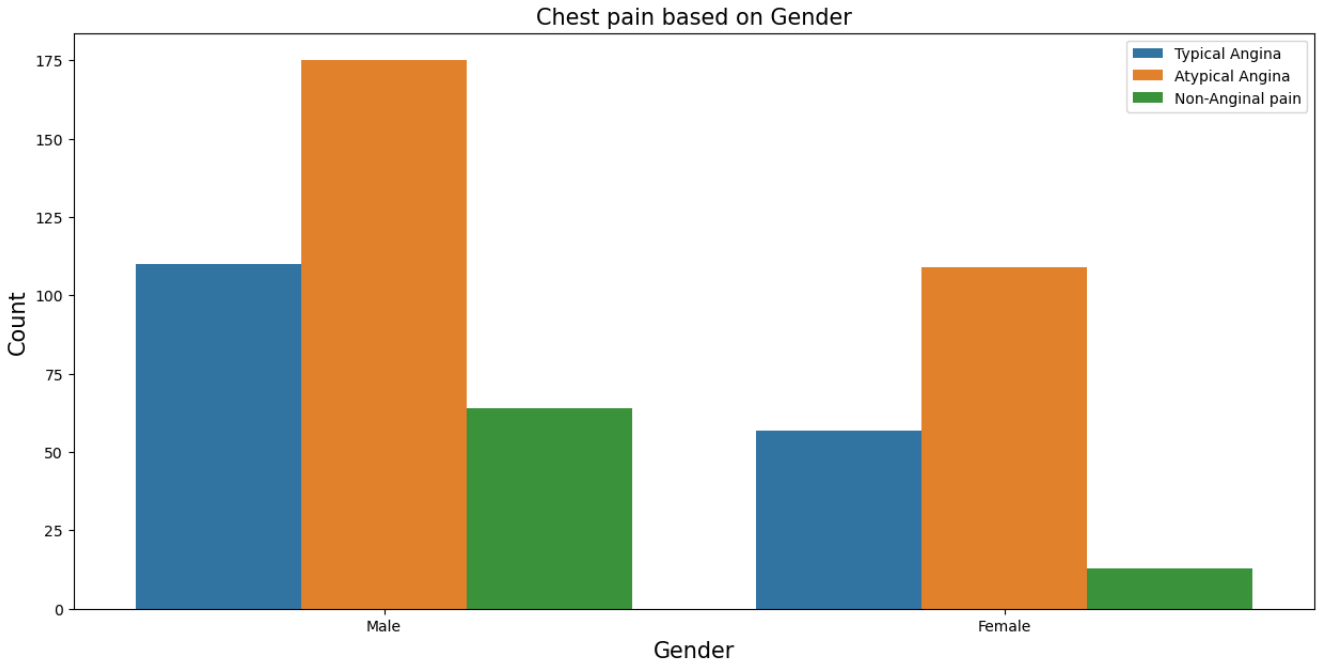


Mid age people are more affected by Heart Disease compared to other ages and Old aged people are more free from Heart Disease compared to other ages

Chest pain based on gender

In [191…

```
plt.figure(figsize=(15,7))
sns.countplot(x='Sex',hue='cp',data=data)
plt.title("Chest pain based on Gender",fontsize=15)
plt.xlabel(xlabel='Gender',fontsize=15)
plt.ylabel(ylabel='Count',fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptomat
plt.show()
```

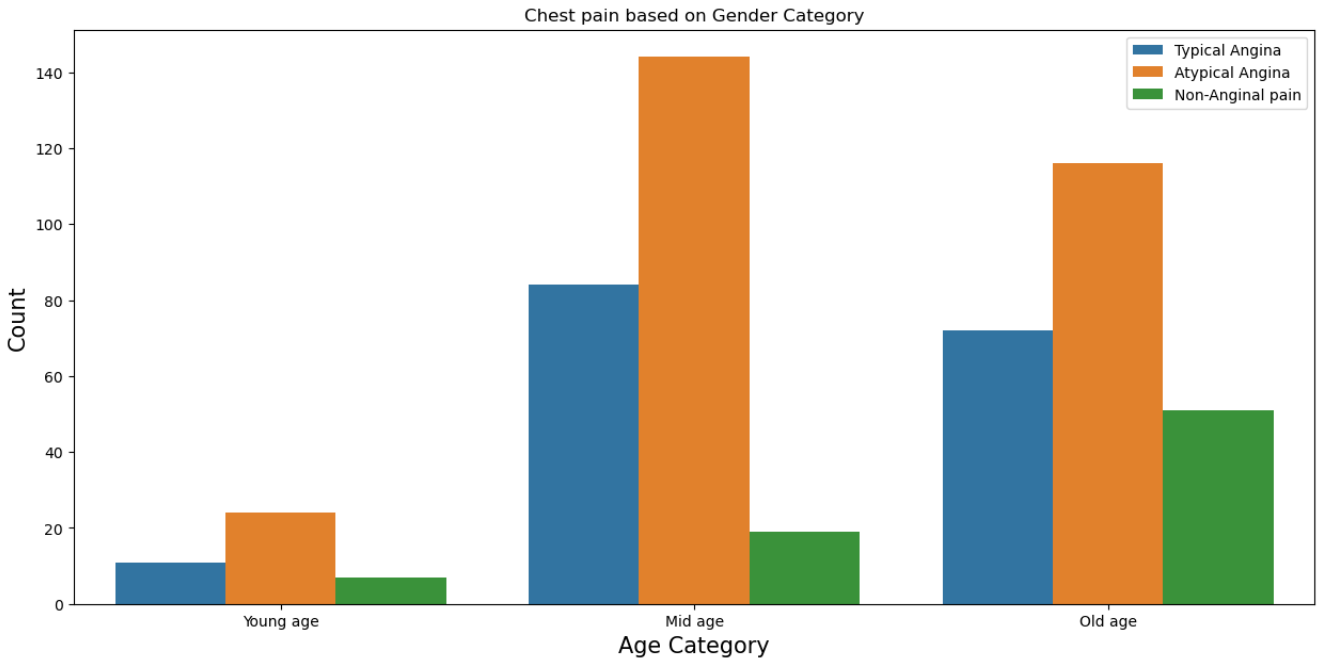


We can see that a higher number of men are suffering from Asymptomatic type of Chest Pain

Checking the Chest pain based on Gender Category

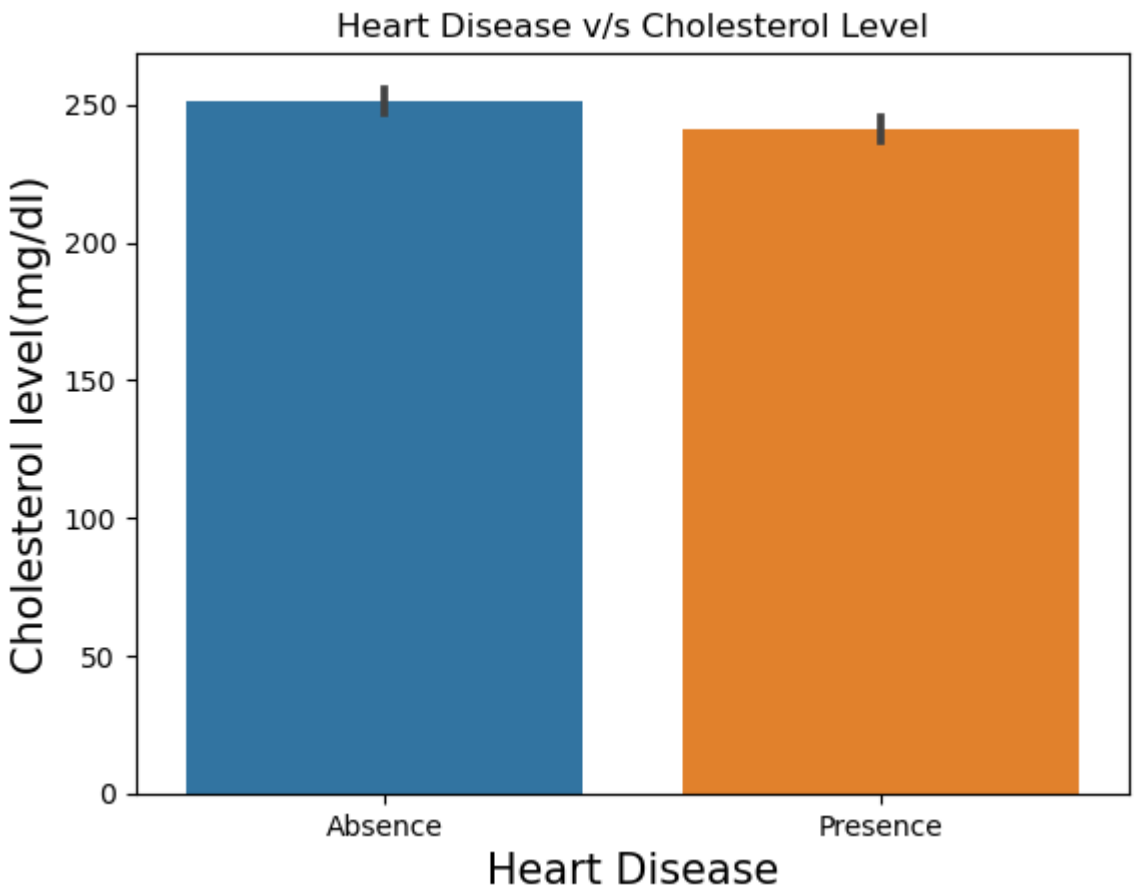
In [192…

```
plt.figure(figsize=(15,7),frameon=True)
sns.countplot(x='Age_range',hue='cp',data=data,order=['Young age','Mid age','Old age
plt.xlabel(xlabel='Age Category',fontsize=15)
plt.ylabel(ylabel='Count',fontsize=15)
plt.title("Chest pain based on Gender Category")
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptomat
plt.show()
```



In [193…

```
plt.figure()
sns.barplot(x='Heart_Disease',y='chol',data=data)
plt.xlabel(xlabel='Heart Disease',fontsize=15)
plt.ylabel(ylabel='Cholesterol level(mg/dl)',fontsize=15)
plt.title("Heart Disease v/s Cholesterol Level")
plt.show()
```

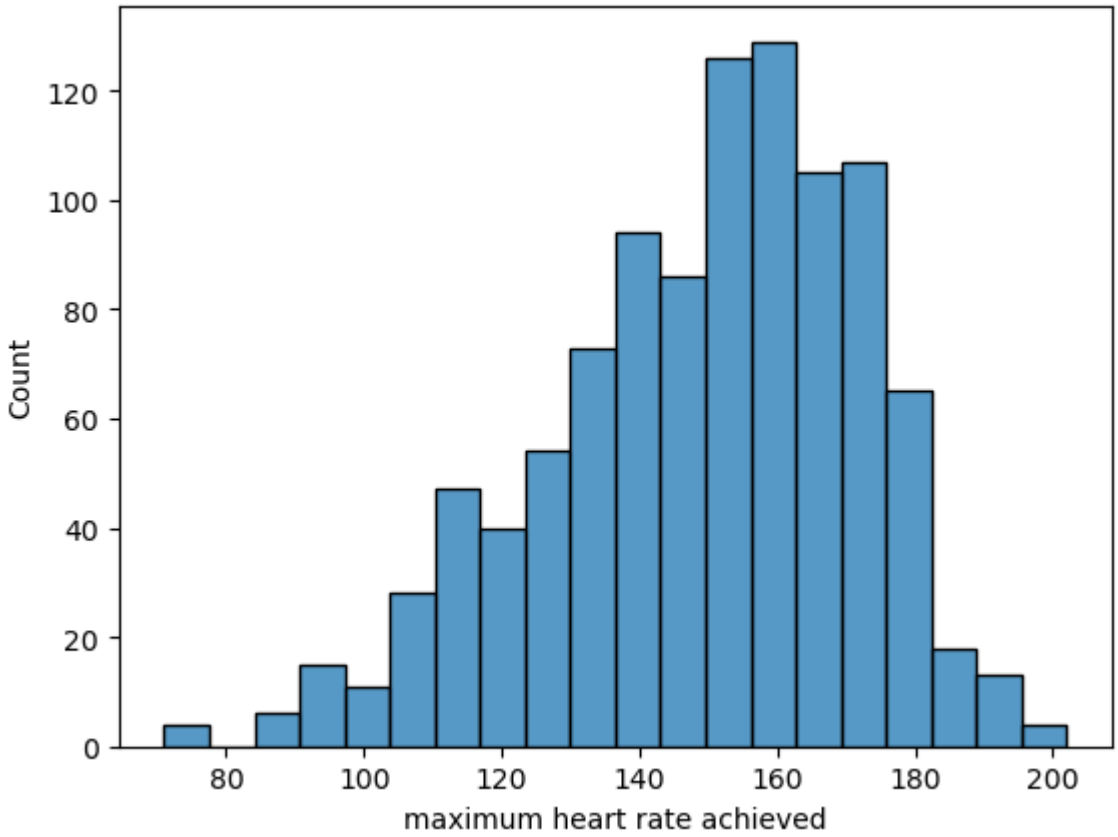


More Cholesterol means More chance of Heart Disease

Checking maximum Heart rate achived

In [194…
```
fig = sns.histplot(data['thalach'], bins= 20)
fig.set(xlabel = 'maximum heart rate achieved')
```

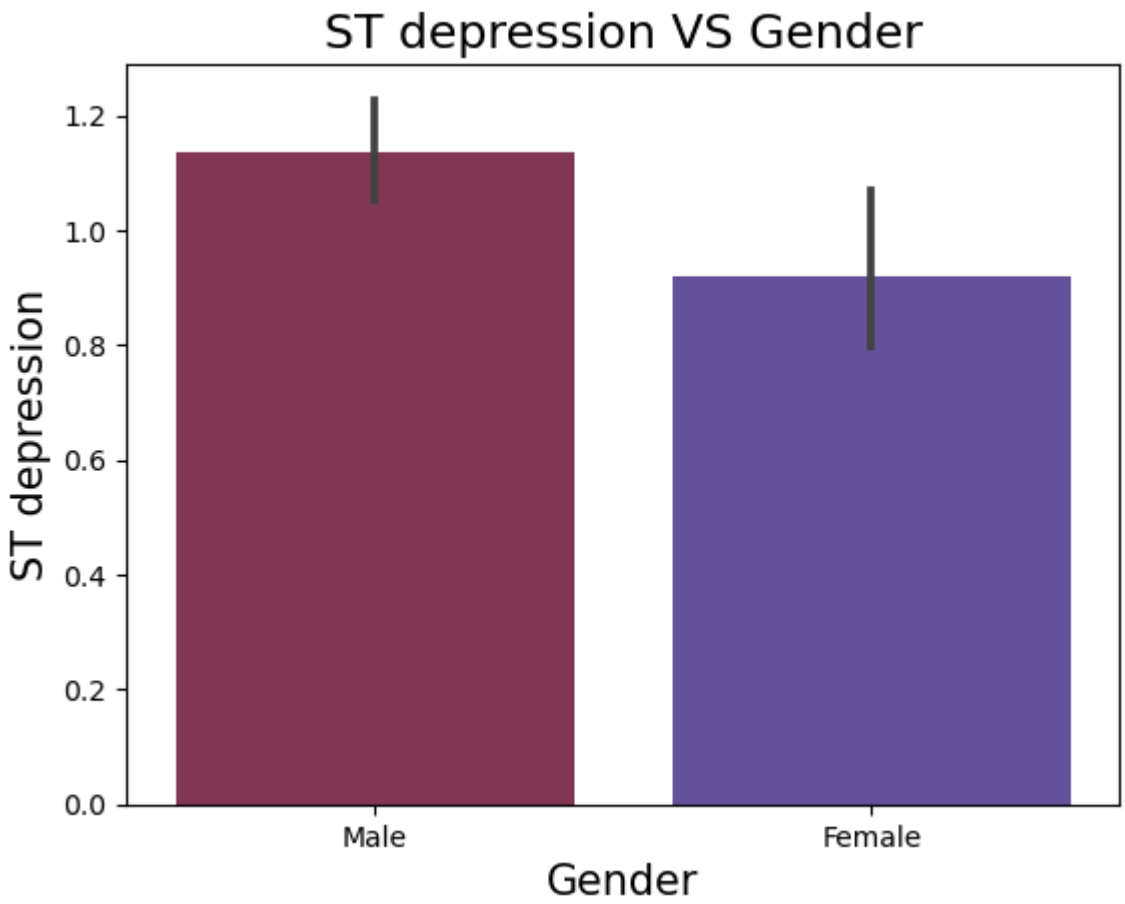
Out[194]:
```
[Text(0.5, 0, 'maximum heart rate achieved')]
```



The maximum heart rate achieved seems to be between 150 - 170.

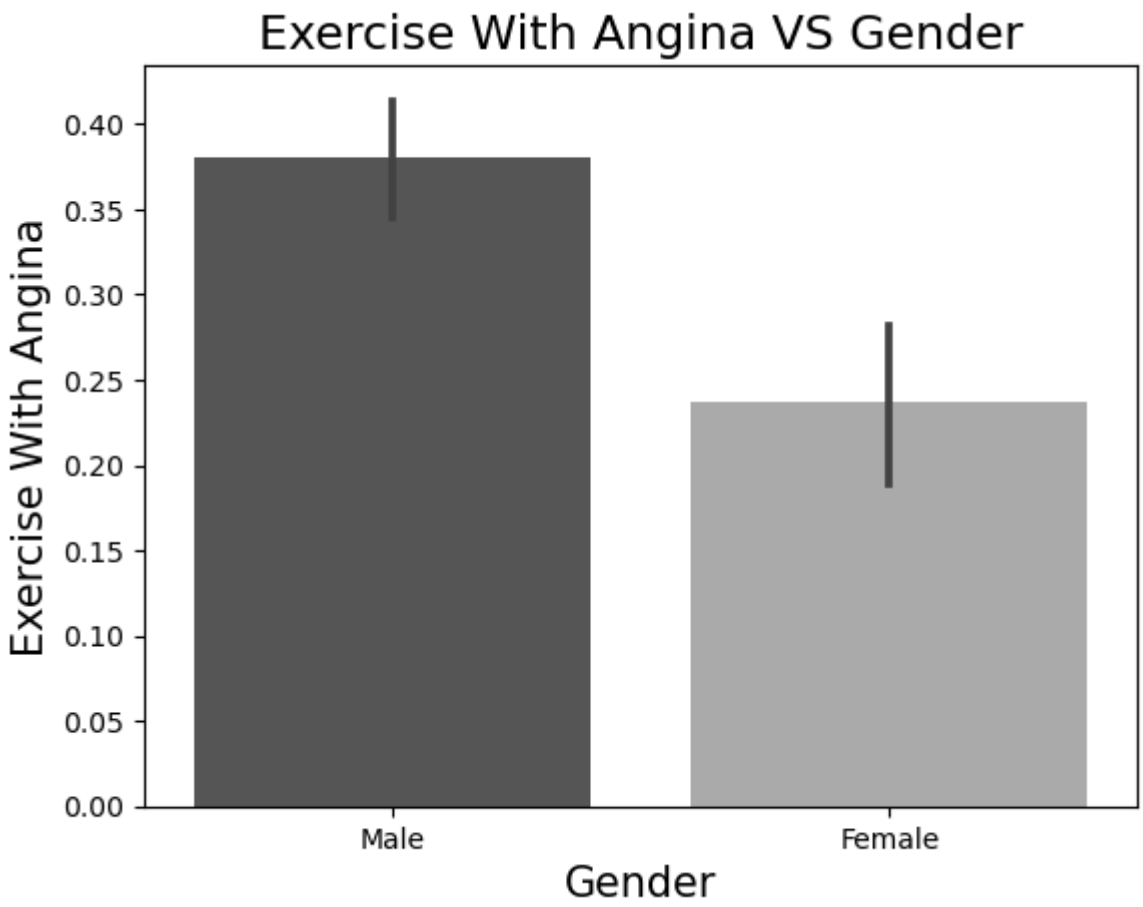
In [195…

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



Males are more prone to ST dipression

In [196…
```
sns.barplot(x='Sex', y='exang', data=data, palette='binary_r')
plt.title('Exercise With Angina VS Gender', fontsize=17)
plt.xlabel('Gender', fontsize=15)
plt.ylabel('Exercise With Angina', fontsize=15)
plt.show()
```



Males have have high Exercise Angina

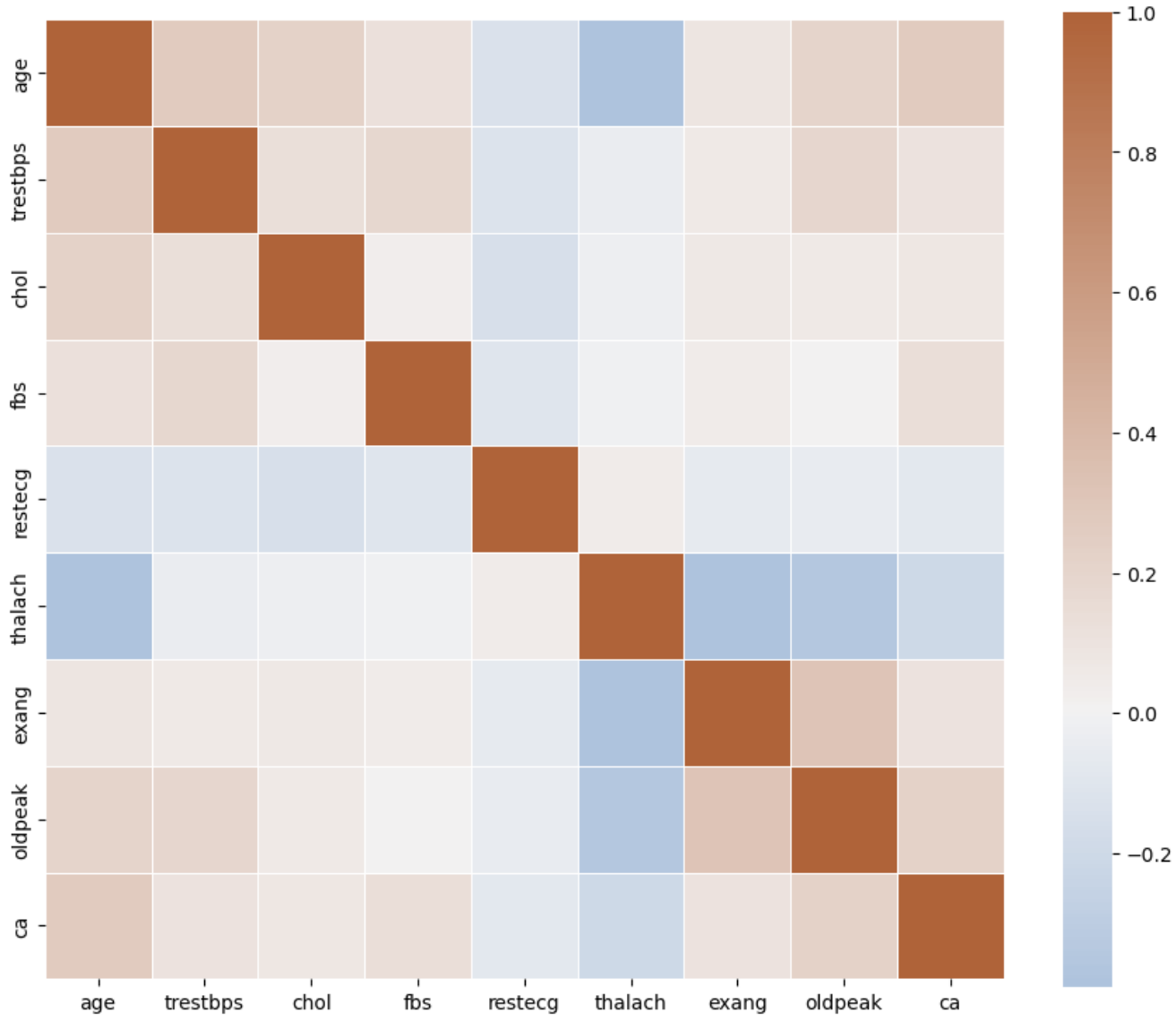
Angina is a type of chest pain caused by reduced blood flow to the heart.

Correlations

Now that we analyzed all the factors, let's see what the corrolation heatmap gives us:

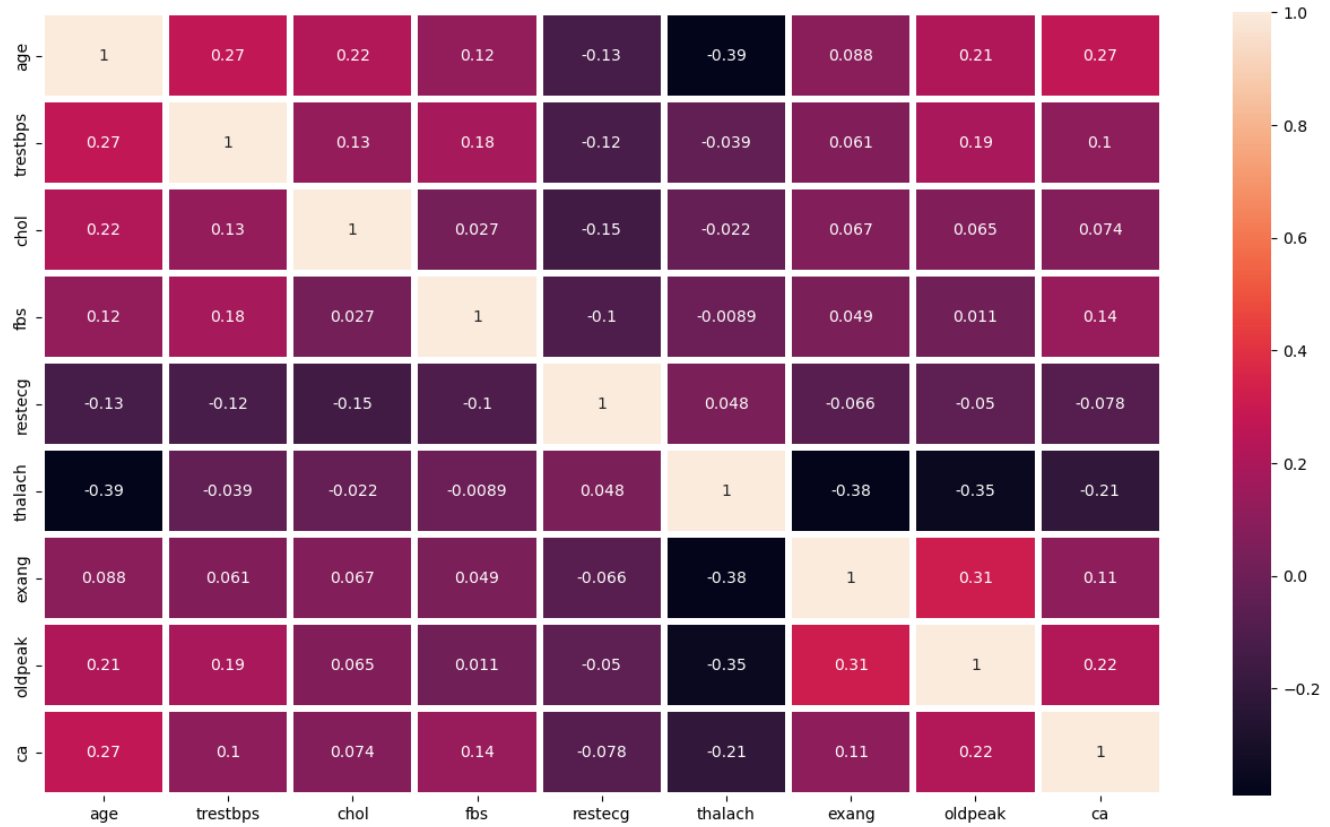
In [197…
```
corr = data.corr()
plt.subplots(figsize=(11, 9))
cmap = sns.diverging_palette(250, 30, as_cmap=True)
sns.heatmap(corr, cmap=cmap, center=0, square=True, linewidths=.5)
```

Out[197]: <AxesSubplot:>



In [198…
```
plt.figure(figsize=(16,9))
sns.heatmap(data.corr(), annot=True, linewidth=3)
```

Out[198]: <AxesSubplot:>



Checking the dataset to check un-wanted values

In [199…
```
data
```

Out[199]:

	age	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	Hea
0	52	None	125	212	0	1	168	0	1.0	flat	2	normal	
1	53	None	140	203	1	0	155	1	3.1	None	0	normal	
2	70	None	145	174	0	1	125	1	2.6	None	0	normal	
3	61	None	148	203	0	1	161	0	0.0	flat	1	normal	
4	62	None	138	294	1	1	106	0	1.9	upsloping	3	normal	
…	…	…	…	…	…	…	…	…	…	…	…	…	
1020	59	typical angina	140	221	0	1	164	1	0.0	flat	0	normal	
1021	60	None	125	258	0	0	141	1	2.8	upsloping	1	normal	
1022	47	None	110	275	0	0	118	1	1.0	upsloping	1	normal	
1023	50	None	110	254	0	0	159	0	0.0	flat	0	normal	
1024	54	None	120	188	0	1	113	0	1.4	upsloping	1	normal	

1025 rows × 15 columns

In [200…
```
data.to_csv('Heart Disease Final dataset.csv', index=False)
```

Conclusions:

1) From target value we can say that our dataset is amost balanced with 49% of patients having no heart disease and 51 % of patients having heart disease.

2) Males have higher chances of having heart disease than females.

3) Patients with age >55 years and having resting blood suger(i.e in diastolic state) in range 121-140 mm Hg have higher chances of heart disease. patients with age group 40 to 45 have little chances and age below 40 has negligiable cgances of having a heart disease.

4) Patients suffering from heart disease are mostly in age group of 50-55 years.

5) Higher cholesterol means higher chances of heart disease. it plays an important role in determining heart problems. With age cholesterol increases and level 200- 350 mg/dl are of concern.

6) Patients showing definite left ventricular hypertrophy in Resting electrocardiographic measurement are more likely to suffer from a heart disease.

7) Patients who are likely to suffer from heart disease have higher maximum heart rates(rate between 140-160) whereas patients who are not likely to suffer from heart disease are having lower maximum heart rates.

8) Exercise induced anginal pain slightly higher chances of getting heart disease than without exercise induced pain.

9) Patients having no thalassaemia can also suffer from heart disease, but patients having reversable effect thalassaemia have greater chances of suffering from heart disease. So thalassaemia plays an important role in detecting heart disease.

10) St_depression >0.5 mm in ECG indicates abnormality. Therefore the slope of the peak exercise ST segment showing downslope with st_depression>0.5 mm has greater chances of heart disease.

thank you !!

In [ ]:

In [ ]: