ML-MINOR-DEC
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DATE OF EXERCISE GIVEN : 22/1/2021
DATE OF SUBMISSION : 22/1/2021
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```
import pandas as pd
df=pd.read_csv('heart.csv')
df.head()
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2
3	56	1	1	120	236	0	1	178	0	0.8	2	0	2
4	57	0	0	120	354	0	1	163	1	0.6	2	0	2

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Double-click (or enter) to edit

ML-MINOR-DEC

```
df.tail()
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	tha
298	57	0	0	140	241	0	1	123	1	0.2	1	0	
299	45	1	3	110	264	0	1	132	0	1.2	1	0	
300	68	1	0	144	193	1	1	141	0	3.4	1	2	
301	57	1	0	130	131	0	1	115	1	1.2	1	1	
302	57	0	1	130	236	0	0	174	0	0.0	1	1	

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       303 non-null    int64
 1   sex       303 non-null    int64
 2   cp        303 non-null    int64
 3   trestbps  303 non-null    int64
```

```
 4   chol      303 non-null    int64
 5   fbs       303 non-null    int64
 6   restecg   303 non-null    int64
 7   thalach   303 non-null    int64
 8   exang     303 non-null    int64
 9   oldpeak   303 non-null    float64
 10  slope     303 non-null    int64
 11  ca        303 non-null    int64
 12  thal      303 non-null    int64
 13  target    303 non-null    int64
dtypes: float64(1), int64(13)
memory usage: 33.3 KB
```

```
df.describe()
```

	age	sex	cp	trestbps	chol	fbs	restecg
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000
mean	54.366337	0.683168	0.966997	131.623762	246.264026	0.148515	0.528053
std	9.082101	0.466011	1.032052	17.538143	51.830751	0.356198	0.525860
min	29.000000	0.000000	0.000000	94.000000	126.000000	0.000000	0.000000
25%	47.500000	0.000000	0.000000	120.000000	211.000000	0.000000	0.000000
50%	55.000000	1.000000	1.000000	130.000000	240.000000	0.000000	1.000000
75%	61.000000	1.000000	2.000000	140.000000	274.500000	0.000000	1.000000
max	77.000000	1.000000	3.000000	200.000000	564.000000	1.000000	2.000000

```
df.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
target      0
dtype: int64
```

```
from sklearn.feature_selection import SelectKBest
from sklearn.feature_selection import chi2
data = df.copy()
```

```
X = data.iloc[:,0:13]  #independent columns
y = data.iloc[:,-1]    #target column i.e price range
#apply SelectKBest class to extract top 10 best features
bestfeatures = SelectKBest(score_func=chi2, k=10)
fit = bestfeatures.fit(X,y)
dfscores = pd.DataFrame(fit.scores_)
dfcolumns = pd.DataFrame(X.columns)
#concat two dataframes for better visualization
featureScores = pd.concat([dfcolumns,dfscores],axis=1)
featureScores.columns = ['Specs','Score']  #naming the dataframe columns
print(featureScores.nlargest(12,'Score'))  #print 10 best features
```

```
        Specs       Score
7    thalach  188.320472
9    oldpeak   72.644253
11        ca   66.440765
2         cp   62.598098
8      exang   38.914377
4       chol   23.936394
0        age   23.286624
3   trestbps   14.823925
10     slope    9.804095
1        sex    7.576835
12      thal    5.791853
6    restecg    2.978271
```

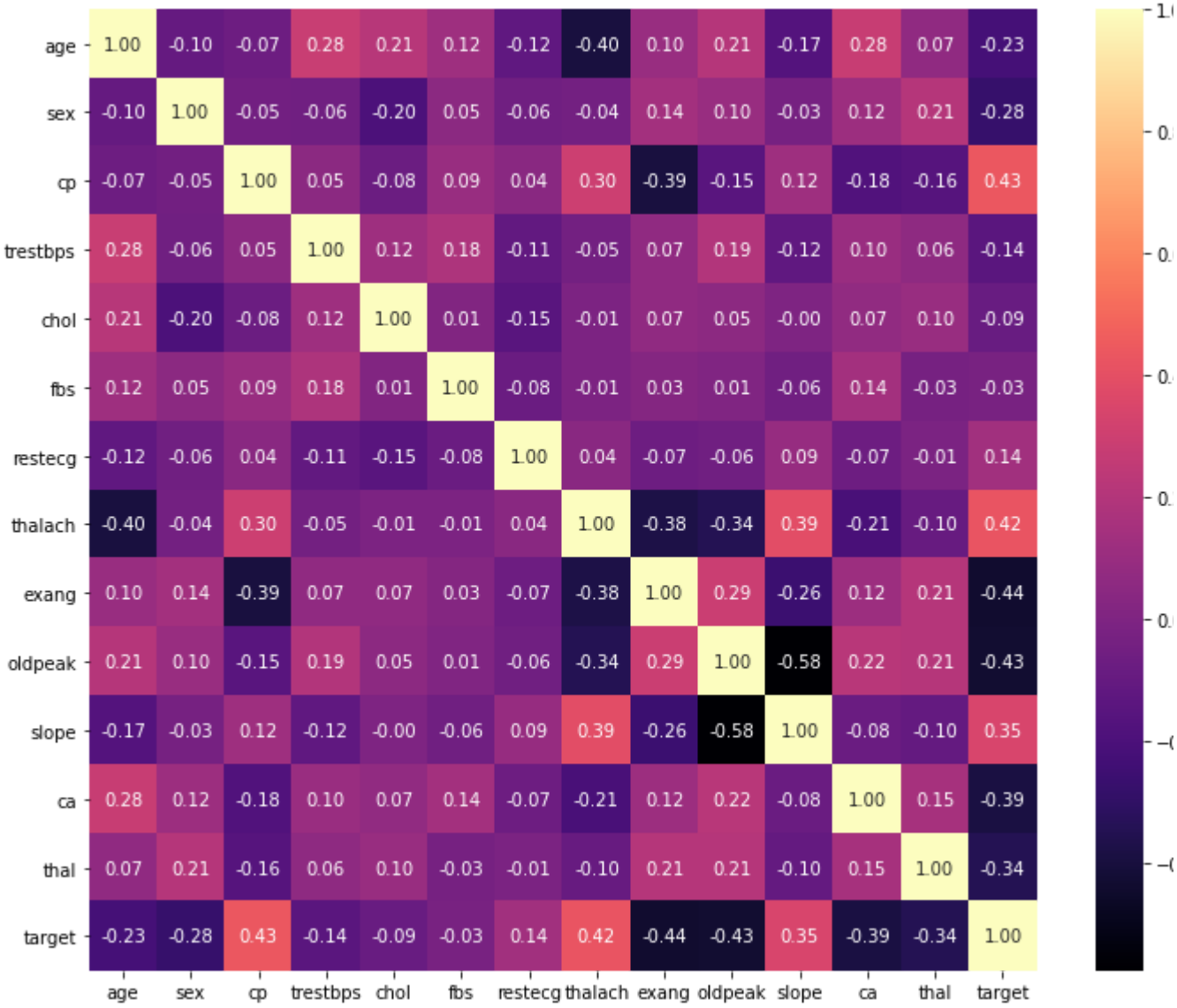
```
from sklearn.ensemble import ExtraTreesClassifier
import matplotlib.pyplot as plt

model = ExtraTreesClassifier()
model.fit(X,y)
print(model.feature_importances_) #use inbuilt class feature_importances of tree based classi
#plot graph of feature importances for better visualization
feat_importances = pd.Series(model.feature_importances_, index=X.columns)
feat_importances.nlargest(13).plot(kind='barh')
plt.show()
```

```
       [0.06829859 0.05365263 0.12177194 0.06383964 0.05981136 0.01973602
```

```
import seaborn as sns
plt.figure(figsize=(12,10))
sns.heatmap(df.corr(),annot=True,cmap="magma",fmt='.2f')
```

```
       <matplotlib.axes._subplots.AxesSubplot at 0x7f48ffcee160>
```




```
for i in df.columns:
    print(i,len(df[i].unique()))
```

```
     age 41
     sex 2
     cp 4
     trestbps 49
     chol 152
     fbs 2
     restecg 3
     thalach 91
     exang 2
     oldpeak 40
     slope 3
```

```
ca 5
thal 4
target 2
```

```
sns.set_style('darkgrid')
sns.set_palette('Set2')
```

```
df2=df.copy()
df2.head()
```

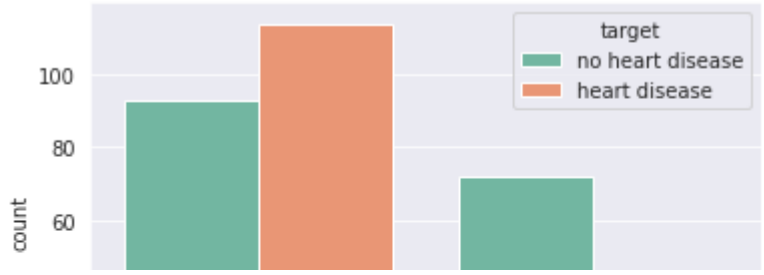
	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2
3	56	1	1	120	236	0	1	178	0	0.8	2	0	2
4	57	0	0	120	354	0	1	163	1	0.6	2	0	2

```
def chng(sex):
    if sex == 0:
        return 'female'
    else:
        return 'male'
df2['sex'] = df2['sex'].apply(chng)
```

```
def chng2(prob):
  if prob==0:
    return 'heart disease'
  else:
    return 'no heart disease'
df2['target']=df2['target'].apply(chng2)
```

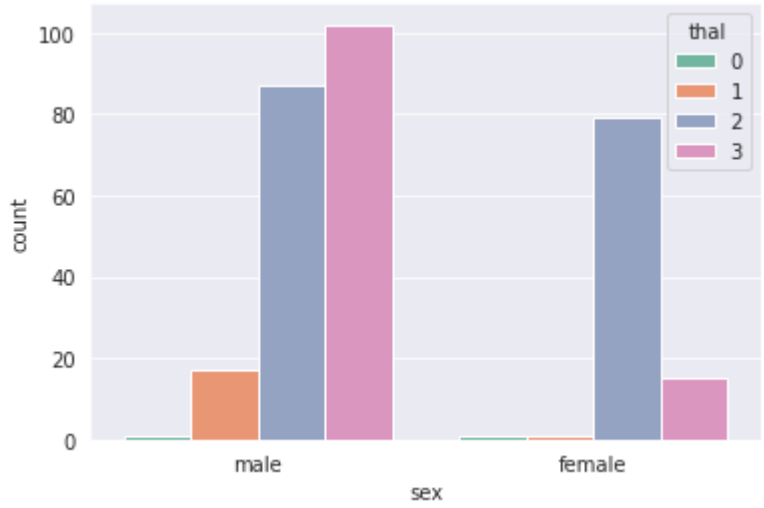
```
sns.countplot(data=df2,x='sex',hue='target')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f48f6ca7b70>
```



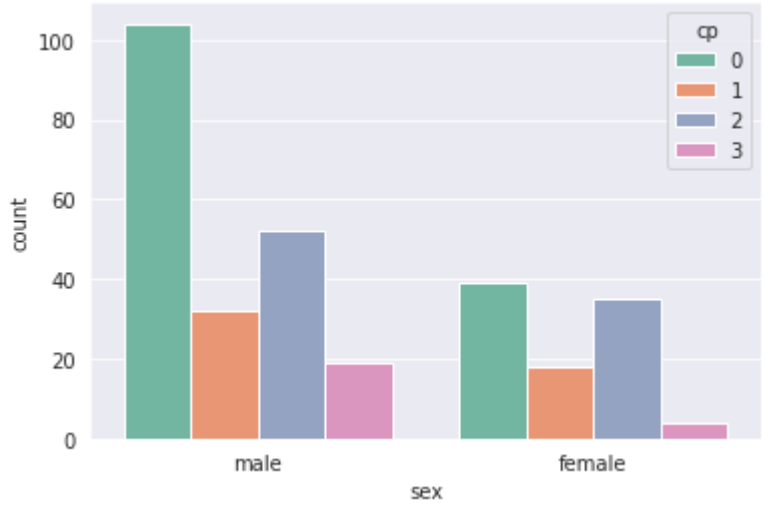

```
sns.countplot(data=df2,x='sex',hue='thal')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f48f516b2b0>
```



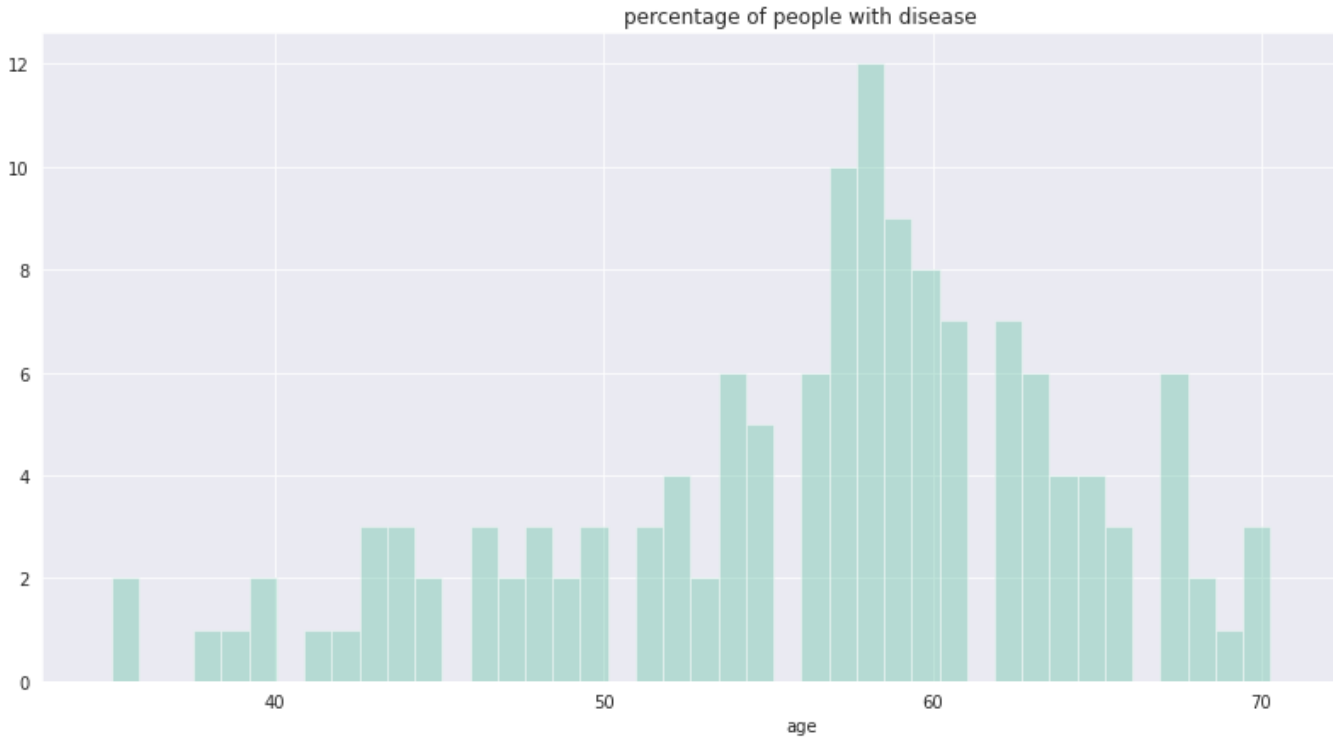

```
sns.countplot(data=df2,x='sex',hue='cp')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f48f6c68c88>
```



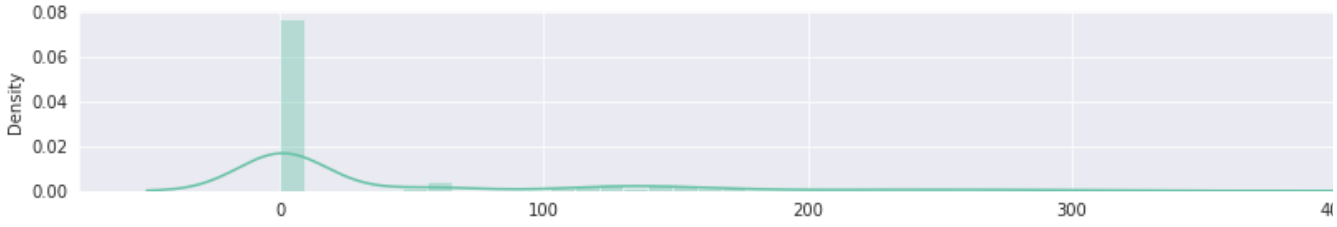

```
plt.figure(figsize=(16,7))
sns.distplot(df[df['target']==0]['age'],kde=False,bins=50)
plt.title("percentage of people with disease")
```

```
/usr/local/lib/python3.6/dist-packages/seaborn/distributions.py:2557: FutureWarning: `d
  warnings.warn(msg, FutureWarning)
Text(0.5, 1.0, 'percentage of people with disease')
```



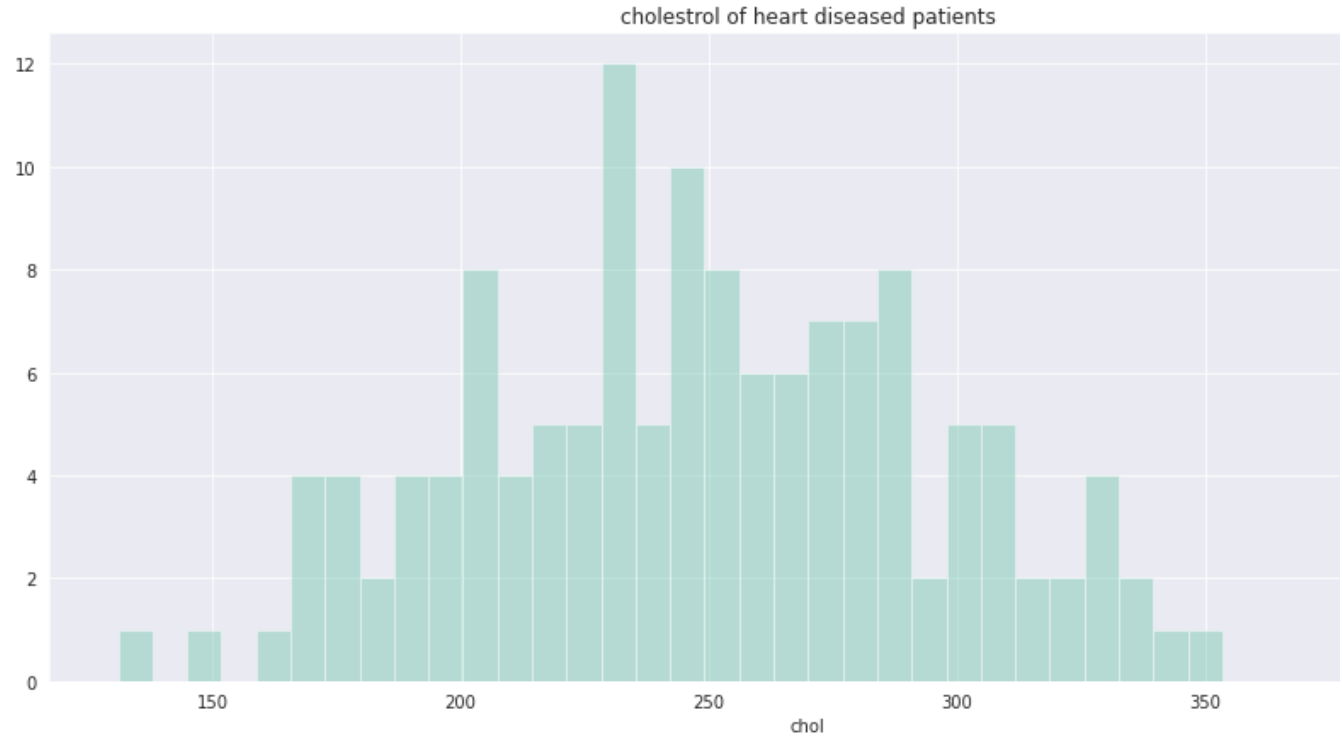

```
#cholestrol of heart diseased patients
plt.figure(figsize=(16,2))
sns.distplot(df[df['target']==0 ])
```

```
/usr/local/lib/python3.6/dist-packages/seaborn/distributions.py:2557: FutureWarning: `d
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7f48f4f6fb70>
```



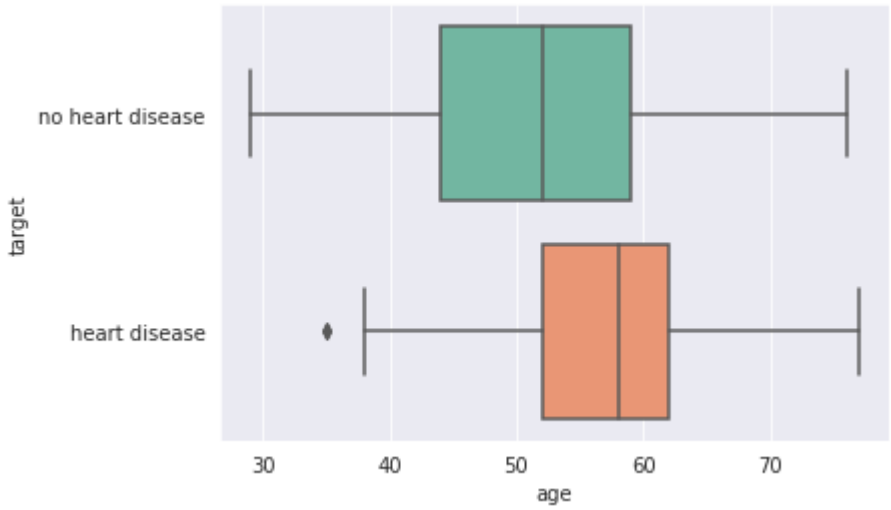

```
plt.figure(figsize=(16,7))
sns.distplot(df[df['target']==0]['chol'],kde=False,bins=40)
plt.title('cholestrol of heart diseased patients')
```

```
/usr/local/lib/python3.6/dist-packages/seaborn/distributions.py:2557: FutureWarning: `d
  warnings.warn(msg, FutureWarning)
Text(0.5, 1.0, 'cholestrol of heart diseased patients')
```




```
#boxplot to determine heart disease with age
sns.boxplot(data=df2,x='age',y='target')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f48f4e70ac8>
```



CLASSIFICATION MODEL BUILDING

```
x=df.drop('target',axis=1)
```

```
y=df['target']
```

```
x.head()
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2
3	56	1	1	120	236	0	1	178	0	0.8	2	0	2
4	57	0	0	120	354	0	1	163	1	0.6	2	0	2

```
x.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
dtype: int64
```

```
y.isnull().sum()
```

```
0
```

```
y.head()
```

```
0    1
1    1
2    1
3    1
4    1
Name: target, dtype: int64
```

```
x.dtypes
```

```
age          int64
sex          int64
cp           int64
```

```
trestbps      int64
chol          int64
fbs           int64
restecg       int64
thalach       int64
exang         int64
oldpeak     float64
slope         int64
ca            int64
thal          int64
dtype: object
```

```
x.shape
```

```
(303, 13)
```

```
from sklearn.model_selection import train_test_split
xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.3,stratify=y,random_state=42)
```

```
x.describe()
```

	age	sex	cp	trestbps	chol	fbs	restecg
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000
mean	54.366337	0.683168	0.966997	131.623762	246.264026	0.148515	0.528053
std	9.082101	0.466011	1.032052	17.538143	51.830751	0.356198	0.525860
min	29.000000	0.000000	0.000000	94.000000	126.000000	0.000000	0.000000
25%	47.500000	0.000000	0.000000	120.000000	211.000000	0.000000	0.000000
50%	55.000000	1.000000	1.000000	130.000000	240.000000	0.000000	1.000000
75%	61.000000	1.000000	2.000000	140.000000	274.500000	0.000000	1.000000
max	77.000000	1.000000	3.000000	200.000000	564.000000	1.000000	2.000000

```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler()
xtrain=scaler.fit_transform(xtrain)
xtest=scaler.transform(xtest)
from sklearn.neighbors import KNeighborsClassifier
model=KNeighborsClassifier(n_neighbors=8)
```

```
model.fit(xtrain,ytrain)
```

```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                     metric_params=None, n_jobs=None, n_neighbors=8, p=2,
```

```
                            weights='uniform')
```

```
model.score(xtest,ytest)
```

```
0.7912087912087912
```

```
import numpy as np
```

```
np.sqrt(303)
```

```
17.406895185529212
```

```
x.head()
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2
3	56	1	1	120	236	0	1	178	0	0.8	2	0	2
4	57	0	0	120	354	0	1	163	1	0.6	2	0	2

```
data=pd.DataFrame({0:[64,25],1:[1,0],2:[3,2],3:[120,130],4:[200,300],5:[1,0],6:[0,1],7:[100,2
```

```
data=scaler.transform(data)
```

```
model.predict(data)
```

```
array([0, 1])
```

FROM THE CLASSIFICATION MODEL IT IS ASSUMED THAT A has no heart disease even though the age is 64,but most of the features are tend to be normal. B has the chance of getting heart disease because of high cholestrol and high heart rate.

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