```
import numpy as np
import pandas as pd
df=pd.read_csv("/content/Heart.csv")
print(df.shape)
```

```
(303, 15)
```

```
print(df.head)
```

```
<bound method NDFrame.head of      Unnamed: 0  Age  Sex     ChestPain  RestBP  Chol  Fbs  RestECG  MaxHR  \
0             1   63    1       typical     145   233    1        2    150   
1             2   67    1  asymptomatic     160   286    0        2    108   
2             3   67    1  asymptomatic     120   229    0        2    129   
3             4   37    1    nonanginal     130   250    0        0    187   
4             5   41    0    nontypical     130   204    0        2    172   
..          ...  ...  ...           ...     ...   ...  ...      ...    ...   
298         299   45    1       typical     110   264    0        0    132   
299         300   68    1  asymptomatic     144   193    1        0    141   
300         301   57    1  asymptomatic     130   131    0        0    115   
301         302   57    0    nontypical     130   236    0        2    174   
302         303   38    1    nonanginal     138   175    0        0    173   

     ExAng  Oldpeak  Slope   Ca        Thal  AHD  
0        0      2.3      3  0.0       fixed   No  
1        1      1.5      2  3.0      normal  Yes  
2        1      2.6      2  2.0  reversable  Yes  
3        0      3.5      3  0.0      normal   No  
4        0      1.4      1  0.0      normal   No  
..     ...      ...    ...  ...         ...  ...  
298      0      1.2      2  0.0  reversable  Yes  
299      0      3.4      2  2.0  reversable  Yes  
300      1      1.2      2  1.0  reversable  Yes  
301      0      0.0      2  1.0      normal  Yes  
302      0      0.0      1  NaN      normal   No  

[303 rows x 15 columns]>
```

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

```
Unnamed: 0    0
Age           0
Sex           0
ChestPain     0
RestBP        0
Chol          0
Fbs           0
RestECG       0
MaxHR         0
ExAng         0
Oldpeak       0
Slope         0
Ca            4
Thal          2
AHD           0
dtype: int64
```

```
print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 15 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   Unnamed: 0  303 non-null    int64  
 1   Age         303 non-null    int64  
 2   Sex         303 non-null    int64  
 3   ChestPain   303 non-null    object 
 4   RestBP      303 non-null    int64  
 5   Chol        303 non-null    int64  
 6   Fbs         303 non-null    int64  
 7   RestECG     303 non-null    int64  
 8   MaxHR       303 non-null    int64  
 9   ExAng       303 non-null    int64  
 10  Oldpeak     303 non-null    float64
 11  Slope       303 non-null    int64  
 12  Ca          299 non-null    float64
 13  Thal        301 non-null    object 
 14  AHD         303 non-null    object 
dtypes: float64(2), int64(10), object(3)
memory usage: 35.6+ KB
None
```

```
print(df.nunique())
```

```
Unnamed: 0    303
Age            41
Sex             2
ChestPain       4
RestBP         50
Chol          152
Fbs             2
RestECG         3
MaxHR          91
ExAng           2
Oldpeak        40
Slope           3
Ca              4
Thal            3
AHD             2
dtype: int64
```

```
print(df.describe())
```

```
       Unnamed: 0         Age         Sex      RestBP        Chol         Fbs  \
count  303.000000  303.000000  303.000000  303.000000  303.000000  303.000000   
mean   152.000000   54.438944    0.679868  131.689769  246.693069    0.148515   
std     87.612784    9.038662    0.467299   17.599748   51.776918    0.356198   
min      1.000000   29.000000    0.000000   94.000000  126.000000    0.000000   
25%     76.500000   48.000000    0.000000  120.000000  211.000000    0.000000   
50%    152.000000   56.000000    1.000000  130.000000  241.000000    0.000000   
75%    227.500000   61.000000    1.000000  140.000000  275.000000    0.000000   
max    303.000000   77.000000    1.000000  200.000000  564.000000    1.000000   

          RestECG       MaxHR       ExAng     Oldpeak       Slope          Ca  
count  303.000000  303.000000  303.000000  303.000000  303.000000  299.000000  
mean     0.990099  149.607261    0.326733    1.039604    1.600660    0.672241  
std      0.994971   22.875003    0.469794    1.161075    0.616226    0.937438  
min      0.000000   71.000000    0.000000    0.000000    1.000000    0.000000  
25%      0.000000  133.500000    0.000000    0.000000    1.000000    0.000000  
50%      1.000000  153.000000    0.000000    0.800000    2.000000    0.000000  
75%      2.000000  166.000000    1.000000    1.600000    2.000000    1.000000  
max      2.000000  202.000000    1.000000    6.200000    3.000000    3.000000  
```

```
print(df.count())
```

```
Unnamed: 0    303
Age           303
Sex           303
ChestPain     303
RestBP        303
Chol          303
Fbs           303
RestECG       303
MaxHR         303
ExAng         303
Oldpeak       303
Slope         303
Ca            299
Thal          301
AHD           303
dtype: int64
```

```
print(df==0)
```

```
     Unnamed: 0    Age    Sex  ChestPain  RestBP   Chol    Fbs  RestECG  \
0         False  False  False      False   False  False  False    False   
1         False  False  False      False   False  False   True    False   
2         False  False  False      False   False  False   True    False   
3         False  False  False      False   False  False   True     True   
4         False  False   True      False   False  False   True    False   
..          ...    ...    ...        ...     ...    ...    ...      ...   
298       False  False  False      False   False  False   True     True   
299       False  False  False      False   False  False  False     True   
300       False  False  False      False   False  False   True     True   
301       False  False   True      False   False  False   True    False   
302       False  False  False      False   False  False   True     True   

     MaxHR  ExAng  Oldpeak  Slope     Ca   Thal    AHD  
0    False   True    False  False   True  False  False  
1    False  False    False  False  False  False  False  
2    False  False    False  False  False  False  False  
3    False   True    False  False   True  False  False  
4    False   True    False  False   True  False  False  
..     ...    ...      ...    ...    ...    ...    ...  
298  False   True    False  False   True  False  False  
299  False   True    False  False  False  False  False  
300  False  False    False  False  False  False  False  
301  False   True     True  False  False  False  False  
302  False   True     True  False  False  False  False  
```

```
[303 rows x 15 columns]
```

```
print(df[df==0])
```

```
     Unnamed: 0  Age  Sex ChestPain  RestBP  Chol  Fbs  RestECG  MaxHR  ExAng  \
0           NaN  NaN  NaN       NaN     NaN   NaN  NaN      NaN    NaN    0.0   
1           NaN  NaN  NaN       NaN     NaN   NaN  0.0      NaN    NaN    NaN   
2           NaN  NaN  NaN       NaN     NaN   NaN  0.0      NaN    NaN    NaN   
3           NaN  NaN  NaN       NaN     NaN   NaN  0.0      0.0    NaN    0.0   
4           NaN  NaN  0.0       NaN     NaN   NaN  0.0      NaN    NaN    0.0   
..          ...  ...  ...       ...     ...   ...  ...      ...    ...    ...   
298         NaN  NaN  NaN       NaN     NaN   NaN  0.0      0.0    NaN    0.0   
299         NaN  NaN  NaN       NaN     NaN   NaN  NaN      0.0    NaN    0.0   
300         NaN  NaN  NaN       NaN     NaN   NaN  0.0      0.0    NaN    NaN   
301         NaN  NaN  0.0       NaN     NaN   NaN  0.0      NaN    NaN    0.0   
302         NaN  NaN  NaN       NaN     NaN   NaN  0.0      0.0    NaN    0.0   

     Oldpeak  Slope   Ca Thal  AHD  
0        NaN    NaN  0.0  NaN  NaN  
1        NaN    NaN  NaN  NaN  NaN  
2        NaN    NaN  NaN  NaN  NaN  
3        NaN    NaN  0.0  NaN  NaN  
4        NaN    NaN  0.0  NaN  NaN  
..       ...    ...  ...  ...  ...  
298      NaN    NaN  0.0  NaN  NaN  
299      NaN    NaN  NaN  NaN  NaN  
300      NaN    NaN  NaN  NaN  NaN  
301      0.0    NaN  NaN  NaN  NaN  
302      0.0    NaN  NaN  NaN  NaN  

[303 rows x 15 columns]
```

```
print(df.Age.mean())
```

```
54.43894389438944
```

```
print(df.columns)
```

```
Index(['Unnamed: 0', 'Age', 'Sex', 'ChestPain', 'RestBP', 'Chol', 'Fbs',
       'RestECG', 'MaxHR', 'ExAng', 'Oldpeak', 'Slope', 'Ca', 'Thal', 'AHD'],
      dtype='object')
```

```
data=df[['Age','Sex','Chol','Slope','Ca']]
```

```
from sklearn.model_selection import train_test_split
train,test = train_test_split(data, test_size=0.25, random_state=1)
print(train.shape)
```

```
(227, 5)
```

```
print(test.shape)
```

```
(76, 5)
```

```
actual = np.concatenate((np.ones(45),np.zeros(450),np.ones(5)))
print(actual)
```

```
[1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
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 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
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 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 1. 1. 1. 1.]
```

```
predicted =np.concatenate((np.ones(100),np.zeros(400)))
print(predicted)
```

```
[1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
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 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
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 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.]
```
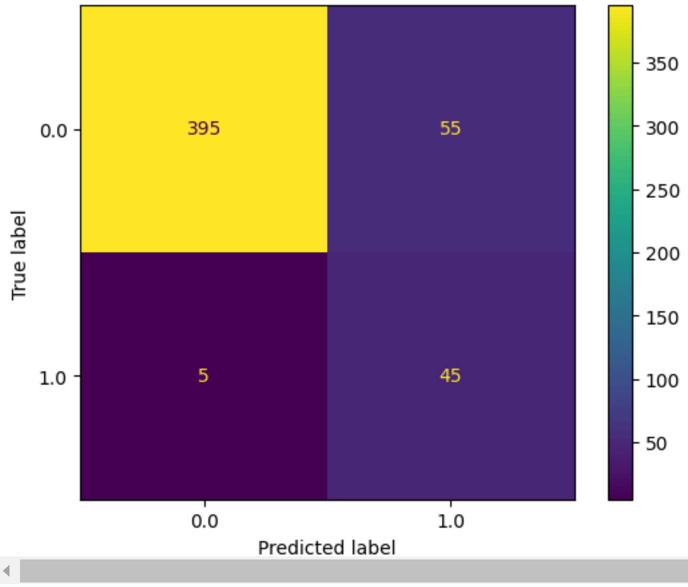

```
type(predicted)
np.ndarray
from sklearn.metrics import ConfusionMatrixDisplay
print(ConfusionMatrixDisplay.from_predictions(actual,predicted))
```

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay object at 0x7b12c0238
```



```
from sklearn.metrics import classification_report
from sklearn.metrics import accuracy_score

print(classification_report(actual,predicted))
```

```
              precision    recall  f1-score   support

         0.0       0.99      0.88      0.93       450
         1.0       0.45      0.90      0.60        50

    accuracy                           0.88       500
   macro avg       0.72      0.89      0.76       500
weighted avg       0.93      0.88      0.90       500
```

```
print(accuracy_score(actual,predicted))
```

```
0.88
```

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