```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt

from google.colab import drive
drive.mount("/content/drive")

df = pd.read_csv("/content/drive/MyDrive/MLLab/Heart.csv")

df.shape
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remoun
(303, 15)
```

```
df.head()
```

	Unnamed: 0	Age	Sex	ChestPain	RestBP	Chol	Fbs	RestECG	MaxHR	ExAng	Old
0	1	63	1	typical	145	233	1	2	150	0	
1	2	67	1	asymptomatic	160	286	0	2	108	1	
2	3	67	1	asymptomatic	120	229	0	2	129	1	
3	4	37	1	nonanginal	130	250	0	0	187	0	

```
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
```

```
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
```

```
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
```

```
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
```

```
df.describe()
```

	Unnamed: 0	Age	Sex	RestBP	Chol	Fbs	RestECG	MaxHR	ExAng	Oldpeak	Slop
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.00000
mean	152.000000	54.438944	0.679868	131.689769	246.693069	0.148515	0.990099	149.607261	0.326733	1.039604	1.60066
std	87.612784	9.038662	0.467299	17.599748	51.776918	0.356198	0.994971	22.875003	0.469794	1.161075	0.61622
min	1.000000	29.000000	0.000000	94.000000	126.000000	0.000000	0.000000	71.000000	0.000000	0.000000	1.00000
25%	76.500000	48.000000	0.000000	120.000000	211.000000	0.000000	0.000000	133.500000	0.000000	0.000000	1.00000
50%	152.000000	56.000000	1.000000	130.000000	241.000000	0.000000	1.000000	153.000000	0.000000	0.800000	2.00000
75%	227.500000	61.000000	1.000000	140.000000	275.000000	0.000000	2.000000	166.000000	1.000000	1.600000	2.00000
max	303.000000	77.000000	1.000000	200.000000	564.000000	1.000000	2.000000	202.000000	1.000000	6.200000	3.00000

```
df.dtypes
```

```
Unnamed: 0      int64
Age             int64
Sex             int64
ChestPain      object
RestBP          int64
Chol            int64
Fbs             int64
RestECG         int64
MaxHR           int64
ExAng           int64
Oldpeak       float64
Slope           int64
Ca            float64
Thal           object
AHD            object
dtype: object
```

```
(df==0).sum()
```

```
Unnamed: 0      0
Age             0
Sex            97
ChestPain       0
RestBP          0
Chol            0
Fbs           258
RestECG       151
MaxHR           0
ExAng         204
Oldpeak        99
Slope           0
Ca            176
Thal            0
AHD             0
dtype: int64
```

```
df.columns
```

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

```
np.mean(df['Age'])
```

```
54.43894389438944
```

```
data = df[['Age', 'Sex','ChestPain','RestBP' , 'Chol', 'Fbs' , 'RestECG' ,'MaxHR' ,'ExAng']]
train , test = train_test_split(data , test_size=0.25, random_state=1)

train.shape
```

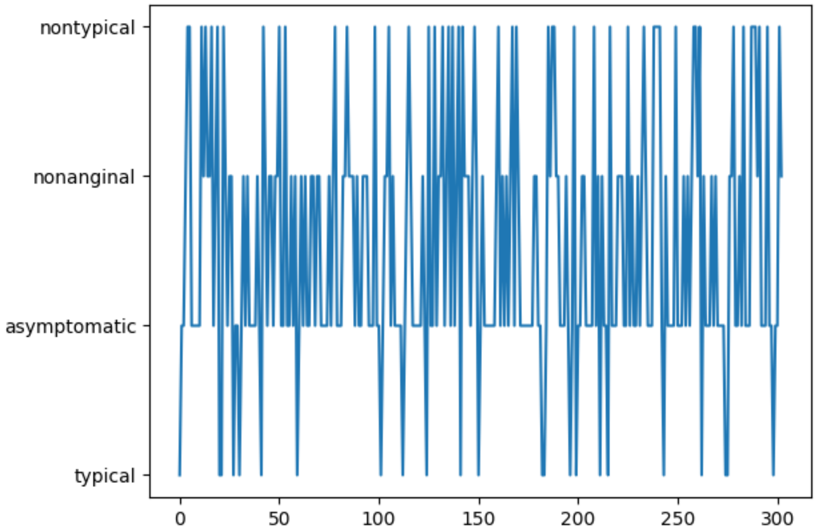
```
(227, 9)
```

```
test.shape
```

```
(76, 9)
```

```
plt.plot(df.ChestPain)
```

```
[<matplotlib.lines.Line2D at 0x7d25e4c5e410>]
```




```
actual = np.concatenate((np.ones(45) , np.zeros(450) , np.ones(5)))
predicted = np.concatenate((np.ones(100) , np.zeros(400)))

print( actual , predicted)
```

```
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```

```
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```
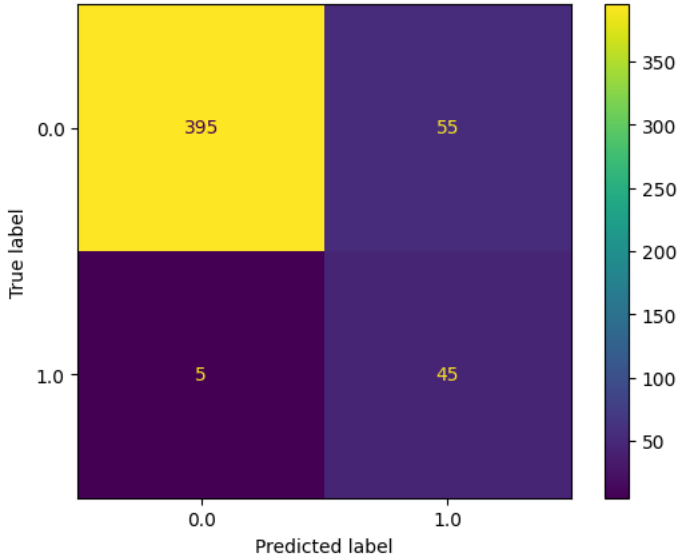

```python
type(predicted)
```

```
numpy.ndarray
```

```python
from sklearn.metrics import ConfusionMatrixDisplay
ConfusionMatrixDisplay.from_predictions(actual , predicted)
```

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x7d25e4cdb460>
```



```python
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
```

```python
accuracy_score(actual , predicted)
```

```
0.88
```