```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

Load the data

```
data =
pd.read_csv("C:/Users/Wind/Downloads/Compressed/archive_7/data.csv")

data.head()

         id diagnosis  radius_mean  texture_mean  perimeter_mean
area_mean  \
0    842302         M        17.99         10.38          122.80
1001.0
1    842517         M        20.57         17.77          132.90
1326.0
2  84300903         M        19.69         21.25          130.00
1203.0
3  84348301         M        11.42         20.38           77.58
386.1
4  84358402         M        20.29         14.34          135.10
1297.0

   smoothness_mean  compactness_mean  concavity_mean  concave
points_mean  \
0          0.11840           0.27760          0.3001
0.14710
1          0.08474           0.07864          0.0869
0.07017
2          0.10960           0.15990          0.1974
0.12790
3          0.14250           0.28390          0.2414
0.10520
4          0.10030           0.13280          0.1980
0.10430

   ...  texture_worst  perimeter_worst  area_worst
smoothness_worst  \
0  ...          17.33           184.60      2019.0            0.1622

1  ...          23.41           158.80      1956.0            0.1238

2  ...          25.53           152.50      1709.0            0.1444

3  ...          26.50            98.87       567.7            0.2098

4  ...          16.67           152.20      1575.0            0.1374
```

```
   compactness_worst  concavity_worst  concave points_worst
symmetry_worst  \
0              0.6656           0.7119                0.2654
0.4601
1              0.1866           0.2416                0.1860
0.2750
2              0.4245           0.4504                0.2430
0.3613
3              0.8663           0.6869                0.2575
0.6638
4              0.2050           0.4000                0.1625
0.2364

   fractal_dimension_worst  Unnamed: 32
0                  0.11890          NaN
1                  0.08902          NaN
2                  0.08758          NaN
3                  0.17300          NaN
4                  0.07678          NaN

[5 rows x 33 columns]
```

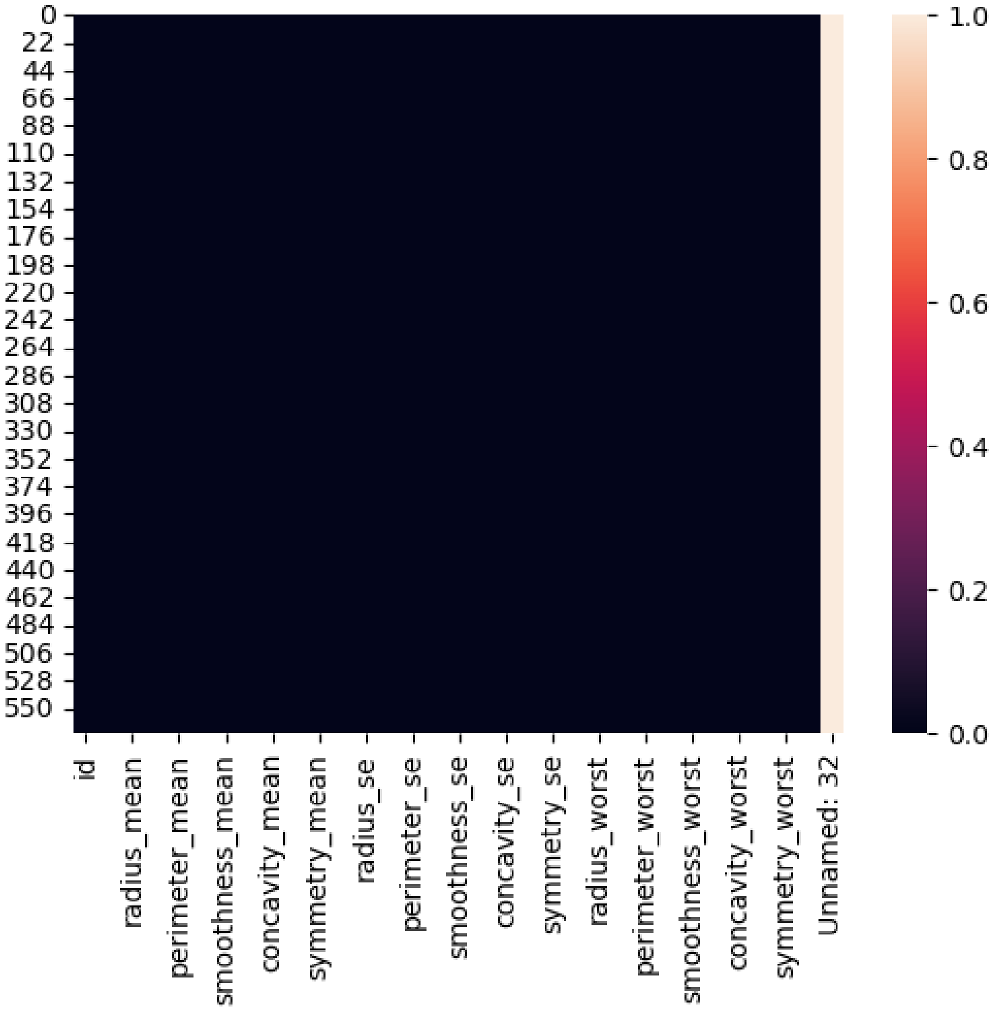
Clean the data

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 33 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   id                       569 non-null    int64
 1   diagnosis                569 non-null    object
 2   radius_mean              569 non-null    float64
 3   texture_mean             569 non-null    float64
 4   perimeter_mean           569 non-null    float64
 5   area_mean                569 non-null    float64
 6   smoothness_mean          569 non-null    float64
 7   compactness_mean         569 non-null    float64
 8   concavity_mean           569 non-null    float64
 9   concave points_mean      569 non-null    float64
 10  symmetry_mean            569 non-null    float64
 11  fractal_dimension_mean   569 non-null    float64
 12  radius_se                569 non-null    float64
 13  texture_se               569 non-null    float64
 14  perimeter_se             569 non-null    float64
 15  area_se                  569 non-null    float64
 16  smoothness_se            569 non-null    float64
 17  compactness_se           569 non-null    float64
 18  concavity_se             569 non-null    float64
 19  concave points_se        569 non-null    float64
 20  symmetry_se              569 non-null    float64
 21  fractal_dimension_se     569 non-null    float64
 22  radius_worst             569 non-null    float64
 23  texture_worst            569 non-null    float64
 24  perimeter_worst          569 non-null    float64
 25  area_worst               569 non-null    float64
 26  smoothness_worst         569 non-null    float64
 27  compactness_worst        569 non-null    float64
 28  concavity_worst          569 non-null    float64
 29  concave points_worst     569 non-null    float64
 30  symmetry_worst           569 non-null    float64
 31  fractal_dimension_worst  569 non-null    float64
 32  Unnamed: 32              0 non-null      float64
dtypes: float64(31), int64(1), object(1)
memory usage: 146.8+ KB
```

```
sns.heatmap(data.isnull())
#cheking null values using heatmap
```

```
<Axes: >
```



```
duplicates = data[data.duplicated()].count()
duplicates
#checking duplicates count
```

```
id                         0
diagnosis                  0
radius_mean                0
texture_mean               0
perimeter_mean             0
area_mean                  0
smoothness_mean            0
compactness_mean           0
concavity_mean             0
concave points_mean        0
symmetry_mean              0
fractal_dimension_mean     0
radius_se                  0
texture_se                 0
```

```
perimeter_se               0
area_se                    0
smoothness_se              0
compactness_se             0
concavity_se               0
concave points_se          0
symmetry_se                0
fractal_dimension_se       0
radius_worst               0
texture_worst              0
perimeter_worst            0
area_worst                 0
smoothness_worst           0
compactness_worst          0
concavity_worst            0
concave points_worst       0
symmetry_worst             0
fractal_dimension_worst    0
Unnamed: 32                0
dtype: int64
```

```
data.drop(["Unnamed: 32", "id"],axis = 1, inplace = True)
data.head()
#dropping the useless column
```

```
  diagnosis  radius_mean  texture_mean  perimeter_mean  area_mean  \
0         M        17.99         10.38          122.80     1001.0   
1         M        20.57         17.77          132.90     1326.0   
2         M        19.69         21.25          130.00     1203.0   
3         M        11.42         20.38           77.58      386.1   
4         M        20.29         14.34          135.10     1297.0   

   smoothness_mean  compactness_mean  concavity_mean  concave 
points_mean  \
0          0.11840           0.27760          0.3001   
0.14710   
1          0.08474           0.07864          0.0869   
0.07017   
2          0.10960           0.15990          0.1974   
0.12790   
3          0.14250           0.28390          0.2414   
0.10520   
4          0.10030           0.13280          0.1980   
0.10430   

   symmetry_mean  ...  radius_worst  texture_worst  perimeter_worst  \
0         0.2419  ...         25.38          17.33           184.60   
1         0.1812  ...         24.99          23.41           158.80   
2         0.2069  ...         23.57          25.53           152.50   
3         0.2597  ...         14.91          26.50            98.87   
```

```
4         0.1809  ...         22.54          16.67           152.20

   area_worst  smoothness_worst  compactness_worst  concavity_worst  \
0      2019.0            0.1622             0.6656           0.7119
1      1956.0            0.1238             0.1866           0.2416
2      1709.0            0.1444             0.4245           0.4504
3       567.7            0.2098             0.8663           0.6869
4      1575.0            0.1374             0.2050           0.4000

   concave points_worst  symmetry_worst  fractal_dimension_worst
0                0.2654          0.4601                  0.11890
1                0.1860          0.2750                  0.08902
2                0.2430          0.3613                  0.08758
3                0.2575          0.6638                  0.17300
4                0.1625          0.2364                  0.07678

[5 rows x 31 columns]
```

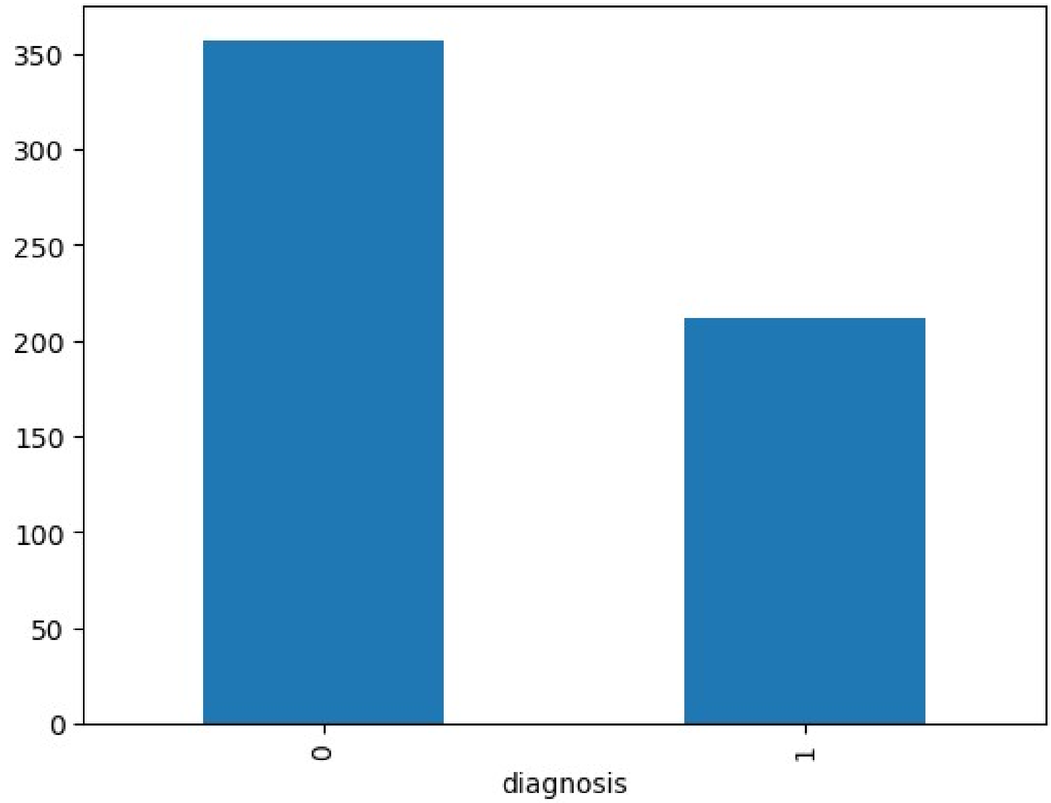
```
data.diagnosis = [1 if value == "M" else 0 for value in
data.diagnosis]
data.head()
```

```
   diagnosis  radius_mean  texture_mean  perimeter_mean  area_mean  \
0          1        17.99         10.38          122.80     1001.0
1          1        20.57         17.77          132.90     1326.0
2          1        19.69         21.25          130.00     1203.0
3          1        11.42         20.38           77.58      386.1
4          1        20.29         14.34          135.10     1297.0

   smoothness_mean  compactness_mean  concavity_mean  concave
points_mean  \
0          0.11840           0.27760          0.3001
0.14710
1          0.08474           0.07864          0.0869
0.07017
2          0.10960           0.15990          0.1974
0.12790
3          0.14250           0.28390          0.2414
0.10520
4          0.10030           0.13280          0.1980
0.10430

   symmetry_mean  ...  radius_worst  texture_worst  perimeter_worst  \
0         0.2419  ...         25.38          17.33           184.60
1         0.1812  ...         24.99          23.41           158.80
2         0.2069  ...         23.57          25.53           152.50
3         0.2597  ...         14.91          26.50            98.87
4         0.1809  ...         22.54          16.67           152.20

   area_worst  smoothness_worst  compactness_worst  concavity_worst  \
0      2019.0                 0.1622                   0.6656                 0.7119
1      1956.0                 0.1238                   0.1866                 0.2416
2      1709.0                 0.1444                   0.4245                 0.4504
3       567.7                 0.2098                   0.8663                 0.6869
4      1575.0                 0.1374                   0.2050                 0.4000

   concave points_worst  symmetry_worst  fractal_dimension_worst
0                0.2654          0.4601                  0.11890
1                0.1860          0.2750                  0.08902
2                0.2430          0.3613                  0.08758
3                0.2575          0.6638                  0.17300
4                0.1625          0.2364                  0.07678

[5 rows x 31 columns]
```

Visualize

```
data["diagnosis"] = data['diagnosis'].astype("category", copy = False)
data["diagnosis"].value_counts().plot(kind = "bar")
#plotting diagnosis count
```

```
<Axes: xlabel='diagnosis'>
```



```
y = data["diagnosis"]
X = data.drop(["diagnosis"], axis = 1)
y
#selecting the x values and y values (target column)
```

```
0      1
1      1
2      1
3      1
4      1
      ..
564    1
565    1
566    1
567    1
568    0
Name: diagnosis, Length: 569, dtype: category
Categories (2, int64): [0, 1]
```

Scale

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
#fit
X_scaled = scaler.fit_transform(X)
X_scaled
#scaling the data to sensible values
```

```
array([[ 1.09706398, -2.07333501,  1.26993369, ...,  2.29607613,
         2.75062224,  1.93701461],
       [ 1.82982061, -0.35363241,  1.68595471, ...,  1.0870843 ,
        -0.24388967,  0.28118999],
       [ 1.57988811,  0.45618695,  1.56650313, ...,  1.95500035,
         1.152255  ,  0.20139121],
       ...,
       [ 0.70228425,  2.0455738 ,  0.67267578, ...,  0.41406869,
        -1.10454895, -0.31840916],
       [ 1.83834103,  2.33645719,  1.98252415, ...,  2.28998549,
         1.91908301,  2.21963528],
       [-1.80840125,  1.22179204, -1.81438851, ..., -1.74506282,
        -0.04813821, -0.75120669]])
```

Split

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(X_scaled, y,
test_size=0.30,random_state = 42)
#splitting the data to train and test splits
```

Train

```
from sklearn.linear_model import LogisticRegression
#Instantiate
lr = LogisticRegression()
#Train
lr.fit(X_train,y_train)
#Predict
y_pred = lr.predict(X_test)
y_pred
print(f"Logistic Regression-Training set score: {lr.score(X_train,
y_train):.2f}")
print(f"Logistic Regression-Test set score: {lr.score(X_test,
y_test):.2f}")
```

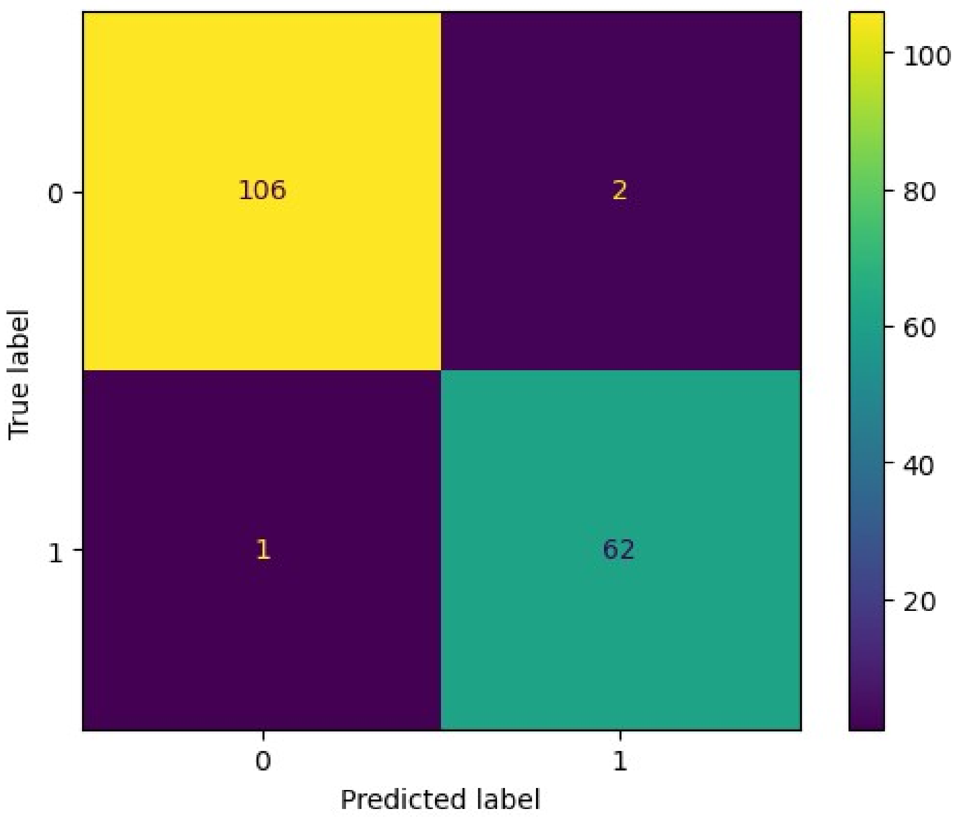
```
Logistic Regression-Training set score: 0.99
Logistic Regression-Test set score: 0.98
```

Confusion matrix !

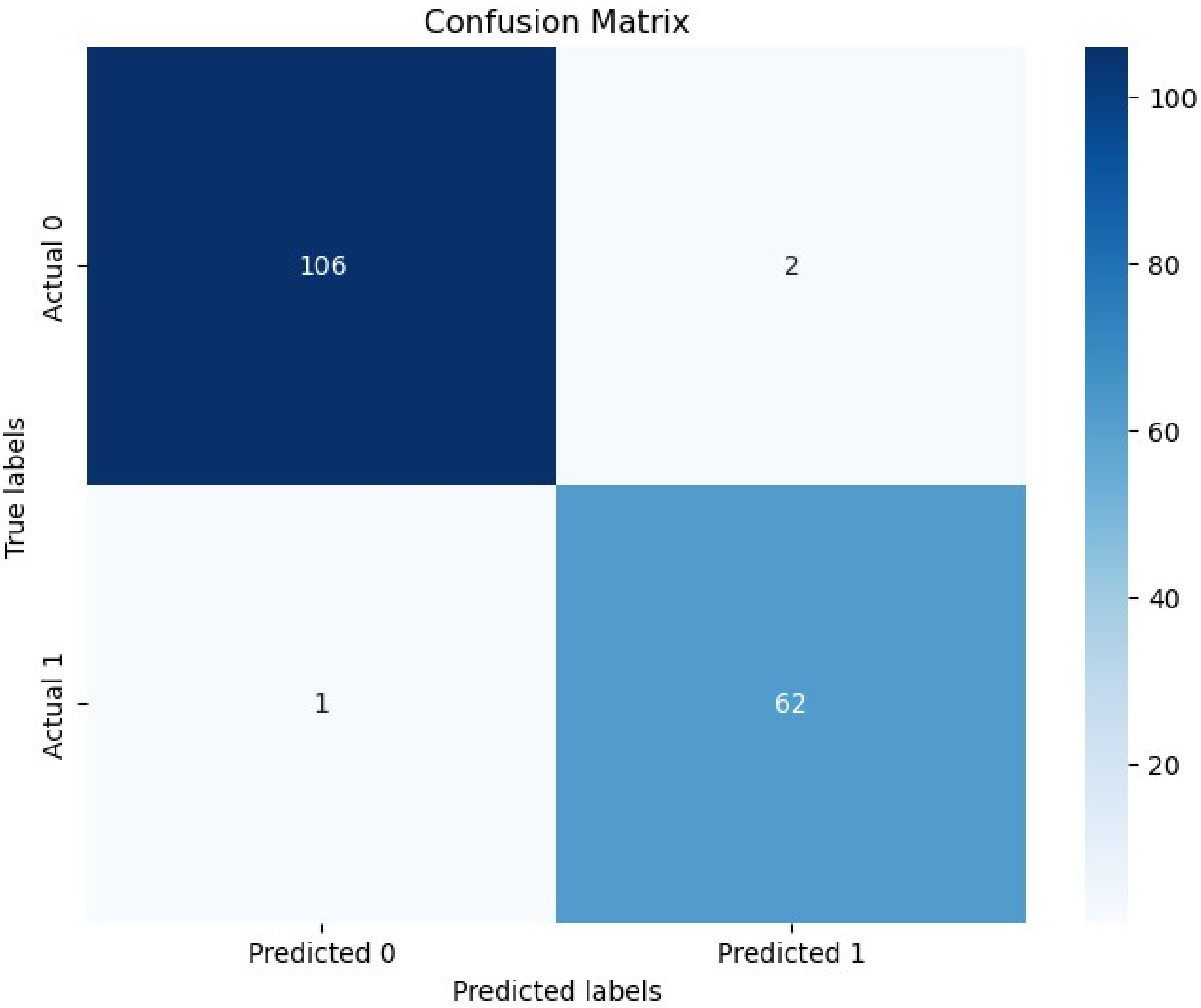
```
from sklearn.metrics import confusion_matrix
confusion_matrix(y_test, y_pred)
```

```
array([[106,   2],
       [  1,  62]], dtype=int64)
```

```
from sklearn.metrics import ConfusionMatrixDisplay

disp =
ConfusionMatrixDisplay(confusion_matrix=confusion_matrix(y_test,
y_pred))
disp.plot()
plt.show()
```



```
import seaborn as sns

cm = confusion_matrix(y_test, y_pred)
# Plot the confusion matrix as a heatmap
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt='g', cmap='Blues',
xticklabels=['Predicted 0', 'Predicted 1'], yticklabels=['Actual 0',
'Actual 1'])
plt.xlabel('Predicted labels')
plt.ylabel('True labels')
plt.title('Confusion Matrix')
plt.show()
```



Evaluate

```
from sklearn.metrics import accuracy_score
accuracy = accuracy_score(y_test,y_pred)
print(f"Accuracy: {accuracy:.2f}")
#approximating the the nearest 2 numbers, 98% accuracy found
```

```
Accuracy: 0.98
```

```
from sklearn.metrics import classification_report
print(classification_report(y_pred,y_test))
```

```
              precision    recall  f1-score   support

           0       0.98      0.99      0.99       107
           1       0.98      0.97      0.98        64

    accuracy                           0.98       171
   macro avg       0.98      0.98      0.98       171
```

```
weighted avg       0.98      0.98      0.98       171
```