In [55]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import confusion_matrix

from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from sklearn.ensemble import RandomForestClassifier
```

In [2]:
```python
df=pd.read_csv('diabetes.csv')
print("shape",df.shape)
df.head()
```

```
shape (768, 9)
```

Out[2]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1

In [3]:
```python
df.describe()
```

Out[3]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	0.471876	33.240885	0.348958
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.331329	11.760232	0.476951
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.078000	21.000000	0.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.243750	24.000000	0.000000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.372500	29.000000	0.000000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.626250	41.000000	1.000000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.420000	81.000000	1.000000

In [4]:
```python
df['Outcome'].value_counts()
```

Out[4]:
```
0    500
1    268
Name: Outcome, dtype: int64
```

In [6]:
```python
df.groupby('Outcome').mean()
```

Out[6]:

Outcome	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age
0	3.298000	109.980000	68.184000	19.664000	68.792000	30.304200	0.429734	31.190000
1	4.865672	141.257463	70.824627	22.164179	100.335821	35.142537	0.550500	37.067164

In [7]:
```python
X = df.drop(columns ='Outcome',axis=1)
Y = df['Outcome']
```

In [9]:
```python
print(X)
```

```
     Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
0              6      148             72             35        0  33.6
1              1       85             66             29        0  26.6
2              8      183             64              0        0  23.3
3              1       89             66             23       94  28.1
4              0      137             40             35      168  43.1
..           ...      ...            ...            ...      ...   ...
763           10      101             76             48      180  32.9
764            2      122             70             27        0  36.8
765            5      121             72             23      112  26.2
766            1      126             60              0        0  30.1
767            1       93             70             31        0  30.4

     DiabetesPedigreeFunction  Age
0                       0.627   50
1                       0.351   31
2                       0.672   32
3                       0.167   21
4                       2.288   33
..                        ...  ...
763                     0.171   63
764                     0.340   27
765                     0.245   30
766                     0.349   47
767                     0.315   23

[768 rows x 8 columns]
```

In [10]:
```python
print(Y)
```

```
0      1
1      0
2      1
3      0
4      1
      ..
763    0
764    0
765    0
766    1
767    0
Name: Outcome, Length: 768, dtype: int64
```

In [11]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Pregnancies               768 non-null    int64
 1   Glucose                   768 non-null    int64
 2   BloodPressure             768 non-null    int64
 3   SkinThickness             768 non-null    int64
 4   Insulin                   768 non-null    int64
 5   BMI                       768 non-null    float64
 6   DiabetesPedigreeFunction  768 non-null    float64
 7   Age                       768 non-null    int64
 8   Outcome                   768 non-null    int64
dtypes: float64(2), int64(7)
memory usage: 54.1 KB
```

In [12]:
```python
df.corr()
```

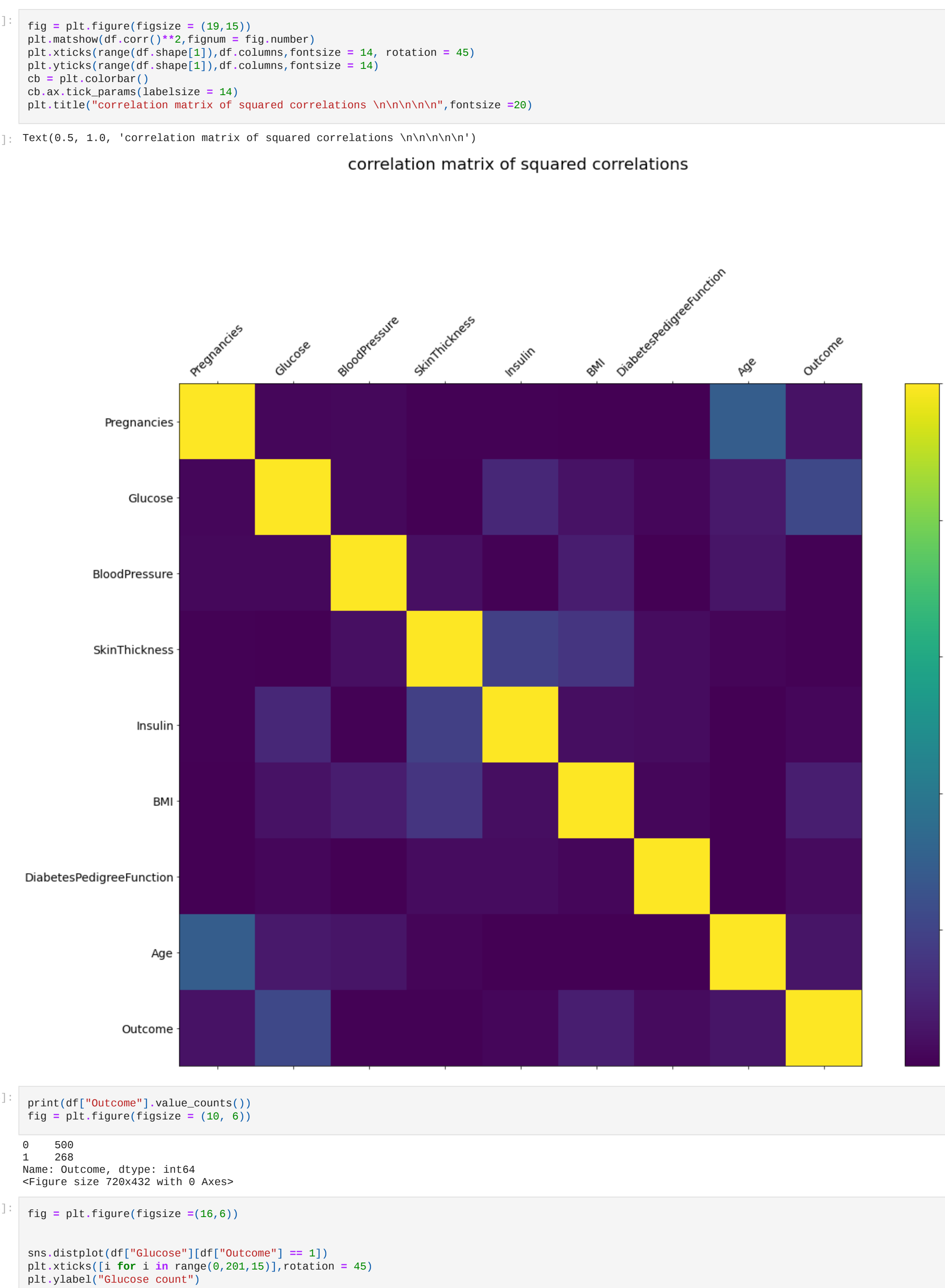
Out[12]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
Pregnancies	1.000000	0.129459	0.141282	-0.081672	-0.073535	0.017683	-0.033523	0.544341	0.221898
Glucose	0.129459	1.000000	0.152590	0.057328	0.331357	0.221071	0.137337	0.263514	0.466581
BloodPressure	0.141282	0.152590	1.000000	0.207371	0.088933	0.281805	0.041265	0.239528	0.065068
SkinThickness	-0.081672	0.057328	0.207371	1.000000	0.436783	0.392573	0.183928	-0.113970	0.074752
Insulin	-0.073535	0.331357	0.088933	0.436783	1.000000	0.197859	0.185071	-0.042163	0.130548
BMI	0.017683	0.221071	0.281805	0.392573	0.197859	1.000000	0.140647	0.036242	0.292695
DiabetesPedigreeFunction	-0.033523	0.137337	0.041265	0.183928	0.185071	0.140647	1.000000	0.033561	0.173844
Age	0.544341	0.263514	0.239528	-0.113970	-0.042163	0.036242	0.033561	1.000000	0.238356
Outcome	0.221898	0.466581	0.065068	0.074752	0.130548	0.292695	0.173844	0.238356	1.000000

In [22]:
```python
fig = plt.figure(figsize = (19,15))
plt.matshow(df.corr()**2,fignum = fig.number)
plt.xticks(range(df.shape[1]),df.columns,fontsize = 14, rotation = 45)
plt.yticks(range(df.shape[1]),df.columns,fontsize = 14)
cb = plt.colorbar()
cb.ax.tick_params(labelsize = 14)
plt.title("correlation matrix of squared correlations \n\n\n\n\n",fontsize =20)
```

Out[22]:
```
Text(0.5, 1.0, 'correlation matrix of squared correlations \n\n\n\n\n')
```

correlation matrix of squared correlations



In [15]:
```python
print(df["Outcome"].value_counts())
fig = plt.figure(figsize = (10, 6))
```

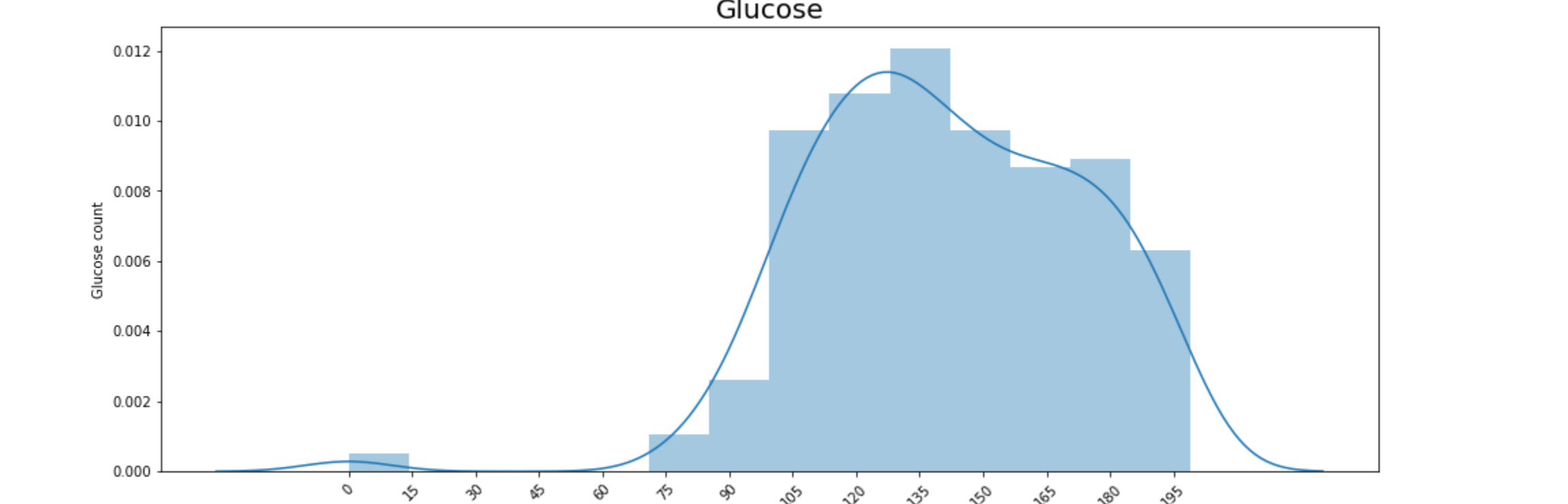
```
0    500
1    268
Name: Outcome, dtype: int64
<Figure size 720x432 with 0 Axes>
```

In [18]:
```python
fig = plt.figure(figsize =(16,6))


sns.distplot(df["Glucose"][df["Outcome"] == 1])
plt.xticks([i for i in range(0,201,15)],rotation = 45)
plt.ylabel("Glucose count")
plt.title("Glucose",fontsize = 20)
```

```
C:\Users\somu reddy\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[18]:
```
Text(0.5, 1.0, 'Glucose')
```

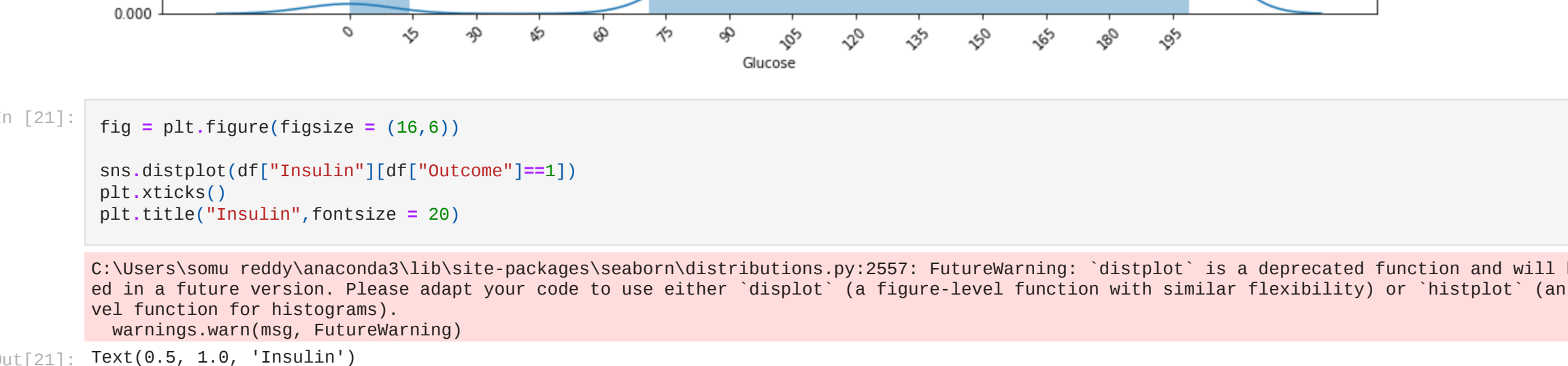


In [21]:
```python
fig = plt.figure(figsize = (16,6))

sns.distplot(df["Insulin"][df["Outcome"]==1])
plt.xticks()
plt.title("Insulin",fontsize = 20)
```

```
C:\Users\somu reddy\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[21]:
```
Text(0.5, 1.0, 'Insulin')
```

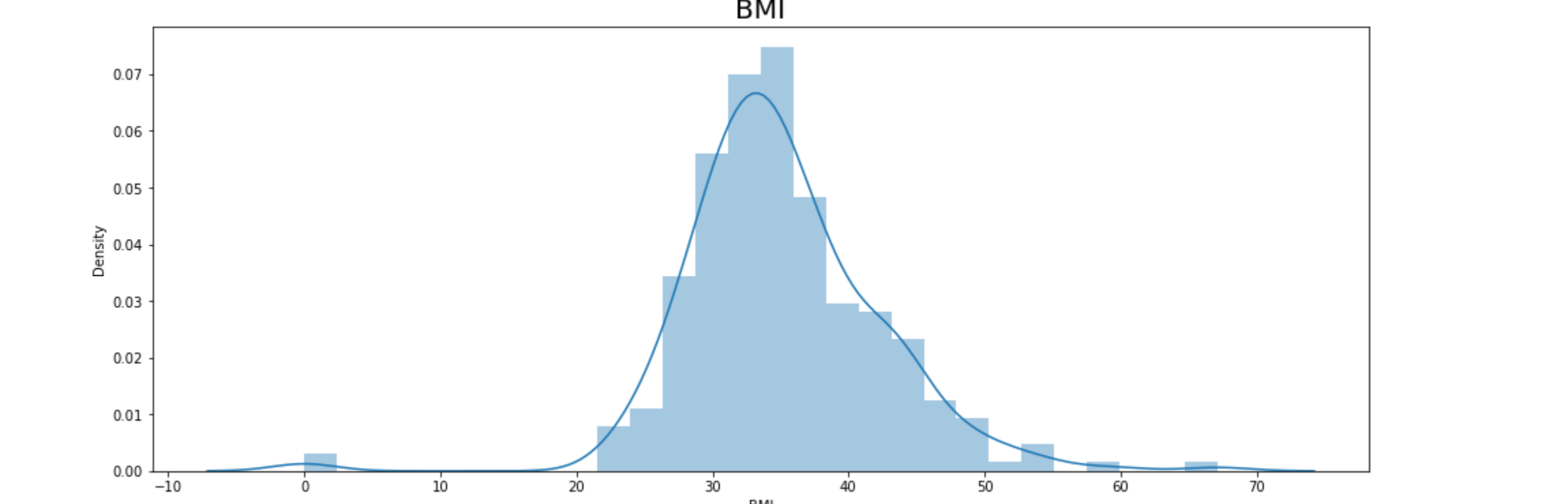


In [23]:
```python
fig = plt.figure(figsize =(16,6))

sns.distplot(df["BMI"][df["Outcome"]==1])
plt.xticks()
plt.title("BMI",fontsize = 20)
```

```
C:\Users\somu reddy\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

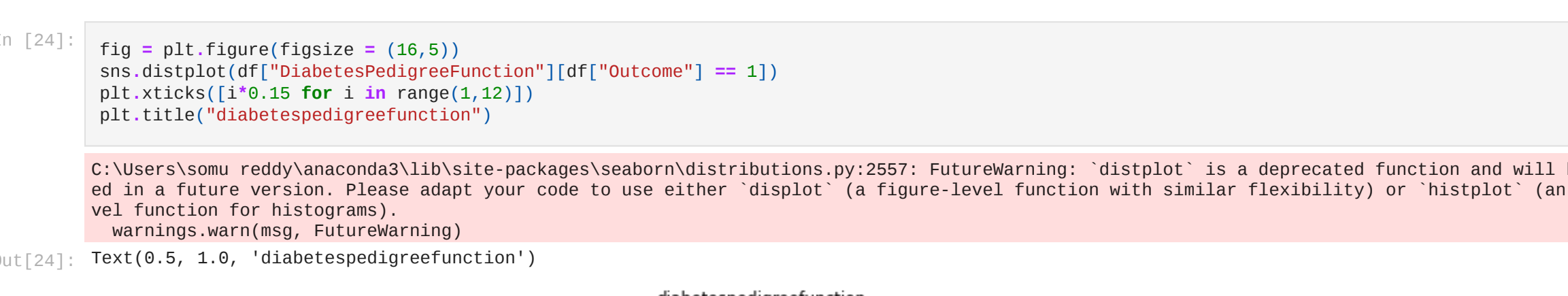
Out[23]:
```
Text(0.5, 1.0, 'BMI')
```



In [24]:
```python
fig = plt.figure(figsize = (16,5))
sns.distplot(df["DiabetesPedigreeFunction"][df["Outcome"] == 1])
plt.xticks([i*0.15 for i in range(1,12)])
plt.title("diabetespedigreefunction")
```

```
C:\Users\somu reddy\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[24]:
```
Text(0.5, 1.0, 'diabetespedigreefunction')
```

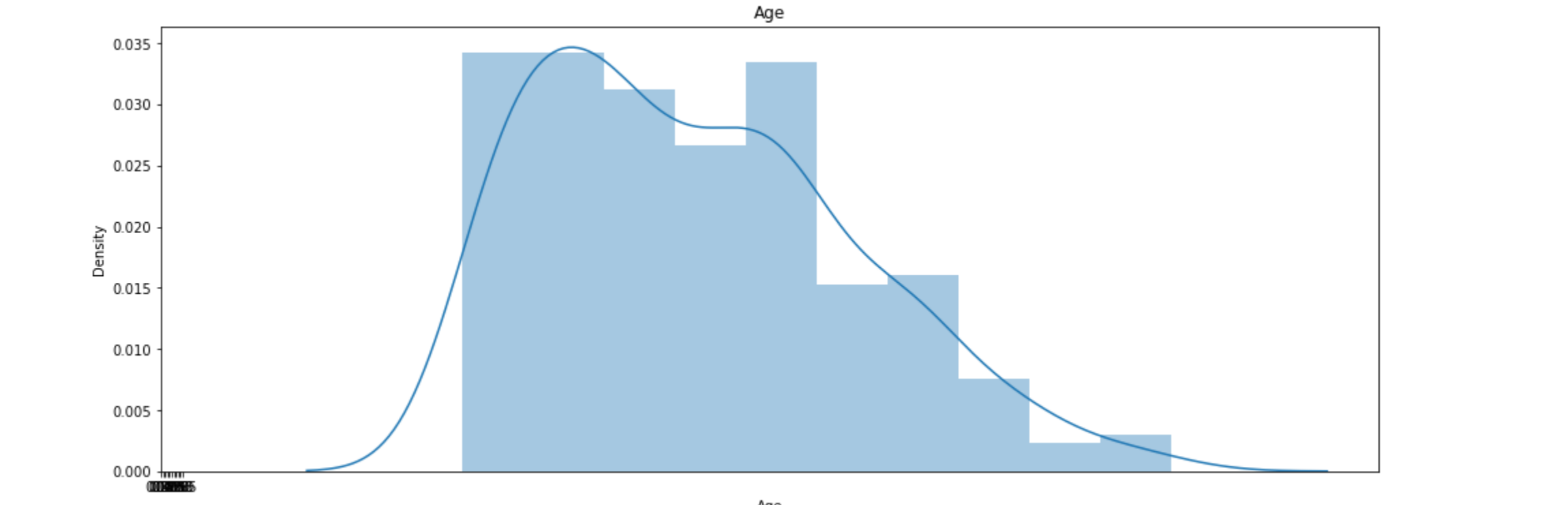


In [25]:
```python
fig = plt.figure(figsize = (16,6))

sns.distplot(df["Age"][df["Outcome"] == 1])
plt.xticks([i*0.15 for i in range(1,12)])
plt.title("Age")
```

```
C:\Users\somu reddy\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[25]:
```
Text(0.5, 1.0, 'Age')
```



In [27]:
```python
x = df.drop(["Pregnancies","BloodPressure","SkinThickness"],axis = 1)
y = df.iloc[:,-1]
```

In [29]:
```python
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size = 0.2,random_state=0)

print("X_train size:", X_train.shape)
print("y_train size: ",y_train.shape,"\n")
print("X_test size:", X_test.shape)
print("y_test size:",y_test.shape)
```

```
X_train size: (614, 8)
y_train size:  (614,)

X_test size: (154, 8)
y_test size: (154,)
```

In [31]:
```python
sc= StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.fit_transform(X_test)
```

In [32]:
```python
print(sc)
```

```
StandardScaler()
```

In [33]:
```python
print(X_train)
```

```
[[ 0.90832902  0.91569367  0.44912368 ...  0.37852648  0.67740401
   1.69955804]
 [ 0.03644676 -0.75182191 -0.47230103 ... -0.50667229 -0.07049698
  -0.96569189]
 [-1.12606292  1.38763205  1.06340683 ...  2.54094063 -0.11855487
  -0.88240283]
 ...
 [ 0.03644676 -0.84620959 -0.21634972 ... -0.94927168 -0.95656442
  -1.04898095]
 [ 2.0708387  -1.12937261  0.24436264 ... -0.26640405 -0.50001442
   0.11706589]
 [ 0.32707418  0.47521786  0.65388473 ... -4.07275877  0.52121586
   2.94889395]]
```

In [34]:
```python
print(X_test)
```

```
[[-0.89295432  2.39507259  0.39763774 ...  1.52657475  2.78935129
  -0.93064283]
 [-0.56553774 -0.42589245  0.2898275  ...  0.31944116 -0.27698825
  -0.83598035]
 [ 0.08929543 -1.37643502 -0.35703388 ...  0.37136088 -0.31725331
  -0.64665539]
 ...
 [ 0.08929543  0.64730077  0.93668889 ...  1.66935399  0.4694641
  -0.93064283]
 [-0.23812115 -0.14992848  0.2898275  ... -0.62809381 -1.19689011
  -0.74131787]
 [-0.89295432 -0.42589245  0.18201727 ... -0.04399691  1.01459113
  -0.74131787]]
```

In [38]:
```python
kn_classifier = KNeighborsClassifier(n_neighbors =5,metric = 'minkowski',p = 2)
kn_classifier.fit(X_train,y_train)
```

Out[38]:
```
KNeighborsClassifier()
```

In [39]:
```python
kn_y_pred = kn_classifier.predict(X_test)
```

In [41]:
```python
cm_kn = confusion_matrix(y_test, kn_y_pred)
print(cm_kn)
```

```
[[96 11]
 [17 30]]
```

In [42]:
```python
print("Correct:",sum(kn_y_pred == y_test))
print("Incorrect : ",sum(kn_y_pred != y_test))
print("Accuracy:",sum(kn_y_pred ==y_test)/len(kn_y_pred))
```

```
Correct: 126
Incorrect :  28
Accuracy: 0.8181818181818182
```

In [43]:
```python
svc_classifier = SVC(kernel ="linear",random_state = 0)
svc_classifier.fit(X_train,y_train)
```

Out[43]:
```
SVC(kernel='linear', random_state=0)
```

In [45]:
```python
svc_y_pred = svc_classifier.predict(X_test)
```

In [46]:
```python
svc_cm = confusion_matrix(y_test,svc_y_pred)
print(svc_cm)
```

```
[[96 11]
 [18 29]]
```

In [53]:
```python
print("Correct:",sum(svc_y_pred == y_test))
print("Incorrect : ",sum(svc_y_pred != y_test))
print("Accuracy:",sum(svc_y_pred ==y_test)/len(kn_y_pred))
```

```
Correct: 125
Incorrect :  29
Accuracy: 0.8116883116883117
```

In [50]:
```python
nb_classifier = GaussianNB()
nb_classifier.fit(X_train,y_train)
```

Out[50]:
```
GaussianNB()
```

In [51]:
```python
nb_y_pred =nb_classifier.predict(X_test)
```

In [52]:
```python
nb_cm = confusion_matrix(nb_y_pred,y_test)
print(nb_cm)
```

```
[[87 16]
 [20 31]]
```

In [54]:
```python
print("Correct:",sum(nb_y_pred == y_test))
print("Incorrect : ",sum(nb_y_pred != y_test))
print("Accuracy:",sum(nb_y_pred ==y_test)/len(nb_y_pred))
```

```
Correct: 118
Incorrect :  36
Accuracy: 0.7662337662337663
```

In [ ]: