ad0v1h4qd

March 18, 2024

[1]:

```python
import numpy as np
import pandas as pd

#import visualization libraries
import matplotlib.pyplot as plt
import seaborn as sns

#import sklearn libraries
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
```

[2]:

```python
## Remove warnings
import warnings
warnings.filterwarnings('ignore')
```

[3]:

```python
# Load the data sets

df = pd.read_csv("diabetes.csv")
pd.set_option('display.max_columns',None)
df.head()
```

[3]:

```
   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

   DiabetesPedigreeFunction  Age  Outcome
0                     0.627   50        1
1                     0.351   31        0
2                     0.672   32        1
3                     0.167   21        0
4                     2.288   33        1
```

[4]:
```
df.tail()
```

[4]:
```
     Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
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  Outcome
763                     0.171   63        0
764                     0.340   27        0
765                     0.245   30        0
766                     0.349   47        1
767                     0.315   23        0
```

[5]:
```
# checking shape of dataset
df.shape
```

[5]:
```
(768, 9)
```

[6]:
```
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
```

[7]:
```
# checking missing values

df.isnull().mean()*100
```

[7]:
```
Pregnancies                 0.0
Glucose                     0.0
BloodPressure               0.0
```

```
SkinThickness               0.0
Insulin                     0.0
BMI                         0.0
DiabetesPedigreeFunction    0.0
Age                         0.0
Outcome                     0.0
dtype: float64
```

[8]:

```
df.columns
```

[8]:

```
Index(['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
       'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome'],
      dtype='object')
```

[9]:

```
df.describe()  # checking summary of dataset
```

[9]:

```
       Pregnancies     Glucose  BloodPressure  SkinThickness     Insulin  \
count   768.000000  768.000000     768.000000     768.000000  768.000000
mean      3.845052  120.894531      69.105469      20.536458   79.799479
std       3.369578   31.972618      19.355807      15.952218  115.244002
min       0.000000    0.000000       0.000000       0.000000    0.000000
25%       1.000000   99.000000      62.000000       0.000000    0.000000
50%       3.000000  117.000000      72.000000      23.000000   30.500000
75%       6.000000  140.250000      80.000000      32.000000  127.250000
max      17.000000  199.000000     122.000000      99.000000  846.000000

              BMI  DiabetesPedigreeFunction         Age     Outcome
count  768.000000                768.000000  768.000000  768.000000
mean    31.992578                  0.471876   33.240885    0.348958
std      7.884160                  0.331329   11.760232    0.476951
min      0.000000                  0.078000   21.000000    0.000000
25%     27.300000                  0.243750   24.000000    0.000000
50%     32.000000                  0.372500   29.000000    0.000000
75%     36.600000                  0.626250   41.000000    1.000000
max     67.100000                  2.420000   81.000000    1.000000
```

[10]:

```
# calculating probability
df['Outcome'].value_counts()/len(df)*100
```

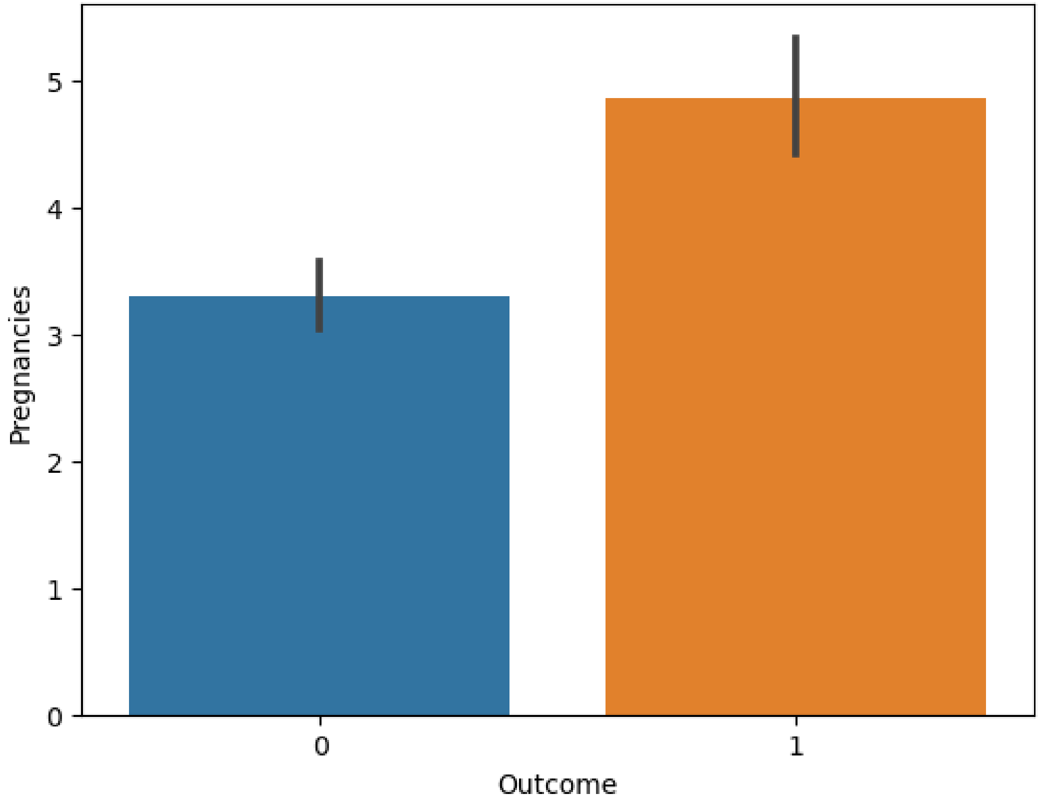
[10]:

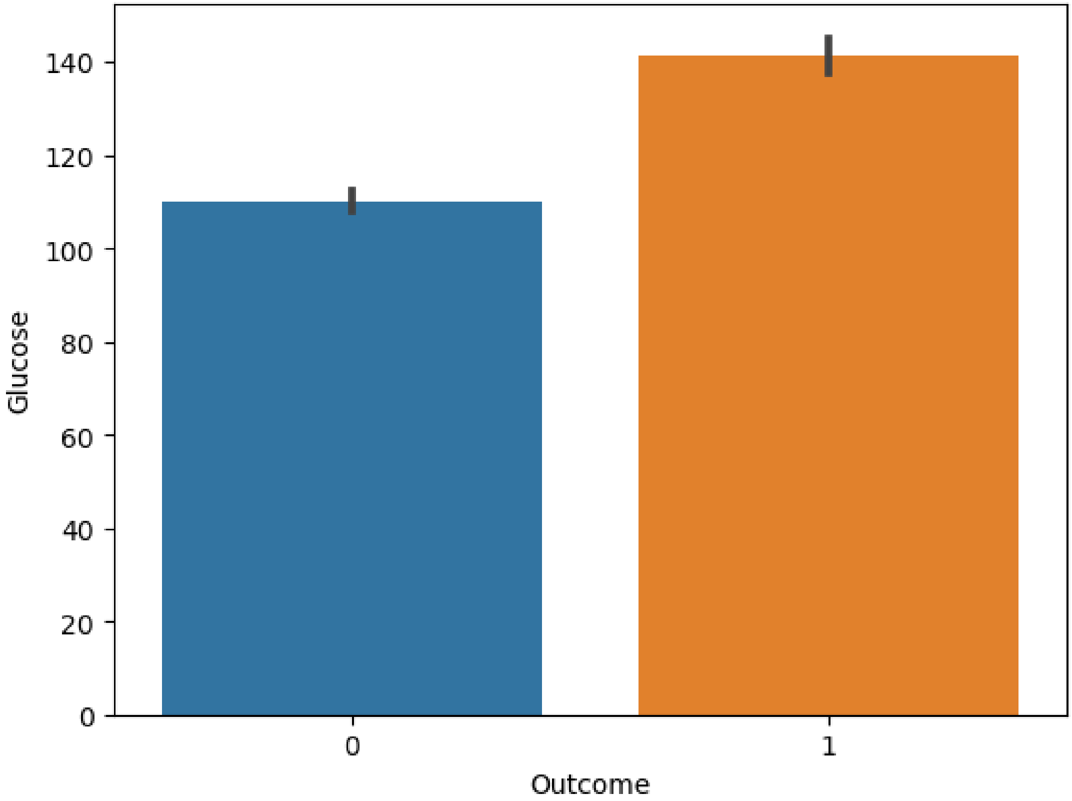
```
Outcome
0    65.104167
1    34.895833
Name: count, dtype: float64
```

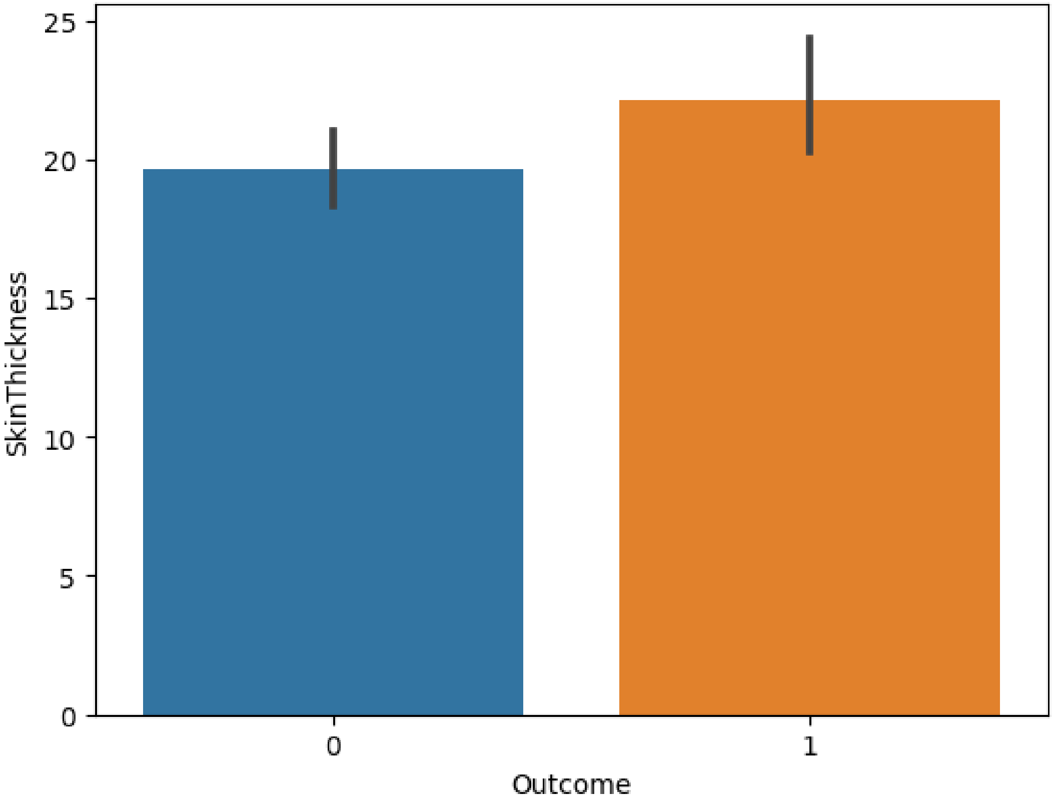
[11]:

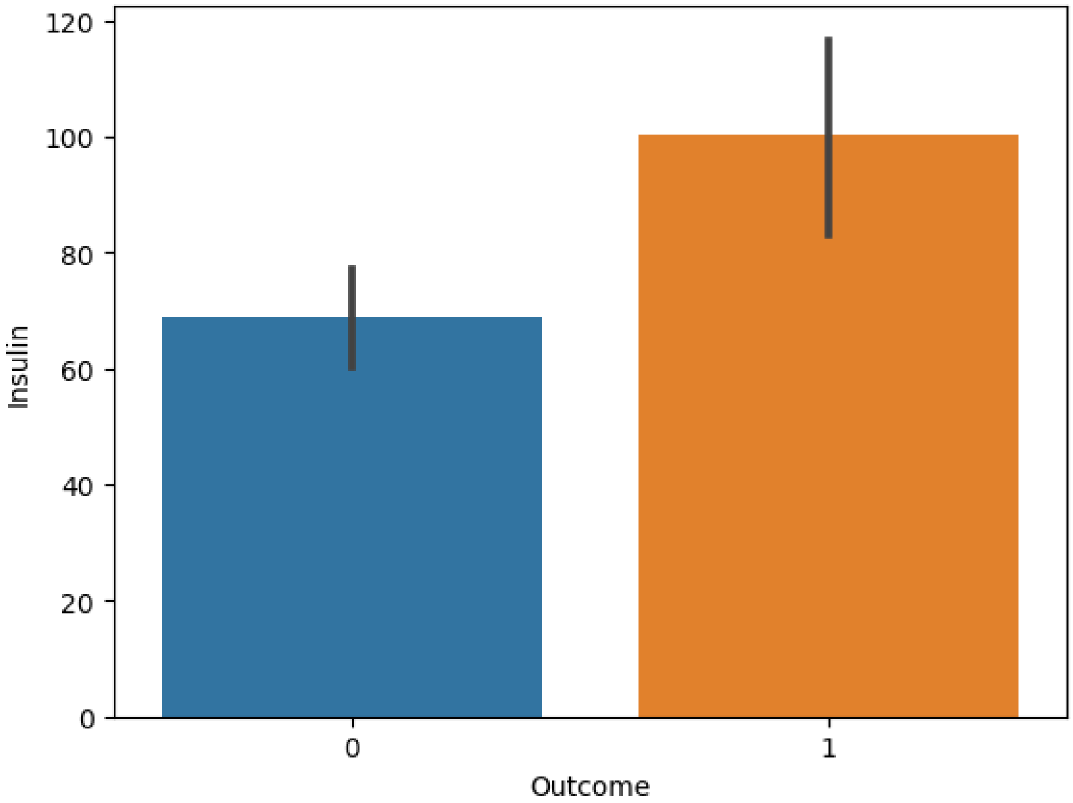
```
# EDA
plt.figure()
sns.barplot(x='Outcome',y='Pregnancies',data=df)
```

```
plt.show()
plt.figure()
sns.barplot(x='Outcome' , y='Glucose' , data=df)
plt.show()
plt.figure()
sns.barplot(x='Outcome', y='SkinThickness' , data=df)
plt.show()
plt.figure()
sns.barplot(x='Outcome', y='Insulin' , data=df)
plt.show()
plt.figure()
sns.barplot(x='Outcome', y='BMI' , data=df)
plt.show()
plt.figure()
sns.barplot(x='Outcome', y='DiabetesPedigreeFunction' , data=df)
plt.figure()
sns.barplot(x='Outcome', y='Age' , data=df)
plt.show()
```

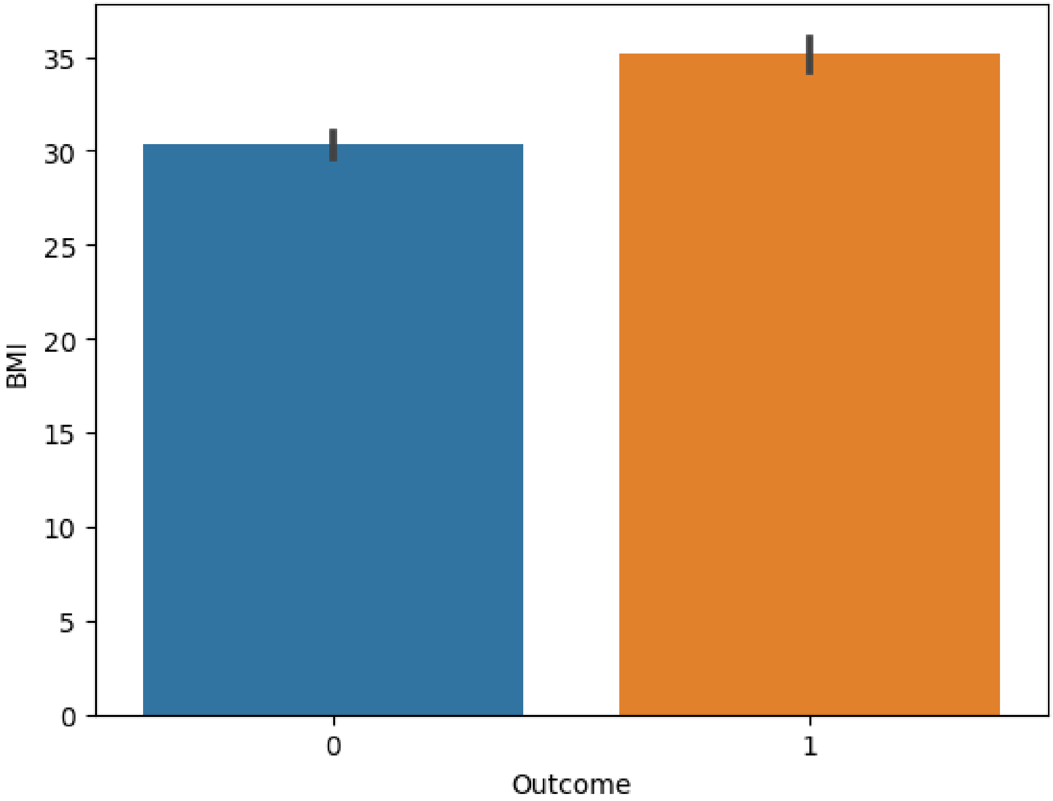


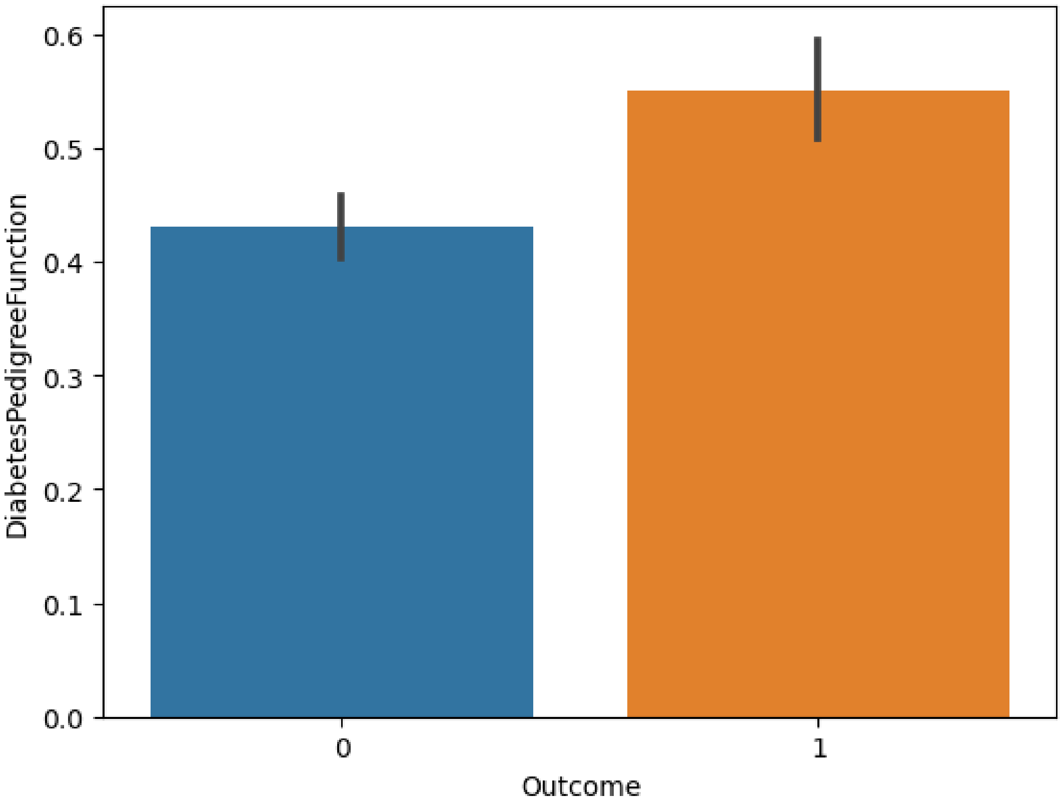

140
120
100
80
60
40
20
0
Glucose
0
1
Outcome


25
20
15
10
5
0
SkinThickness
0
1
Outcome

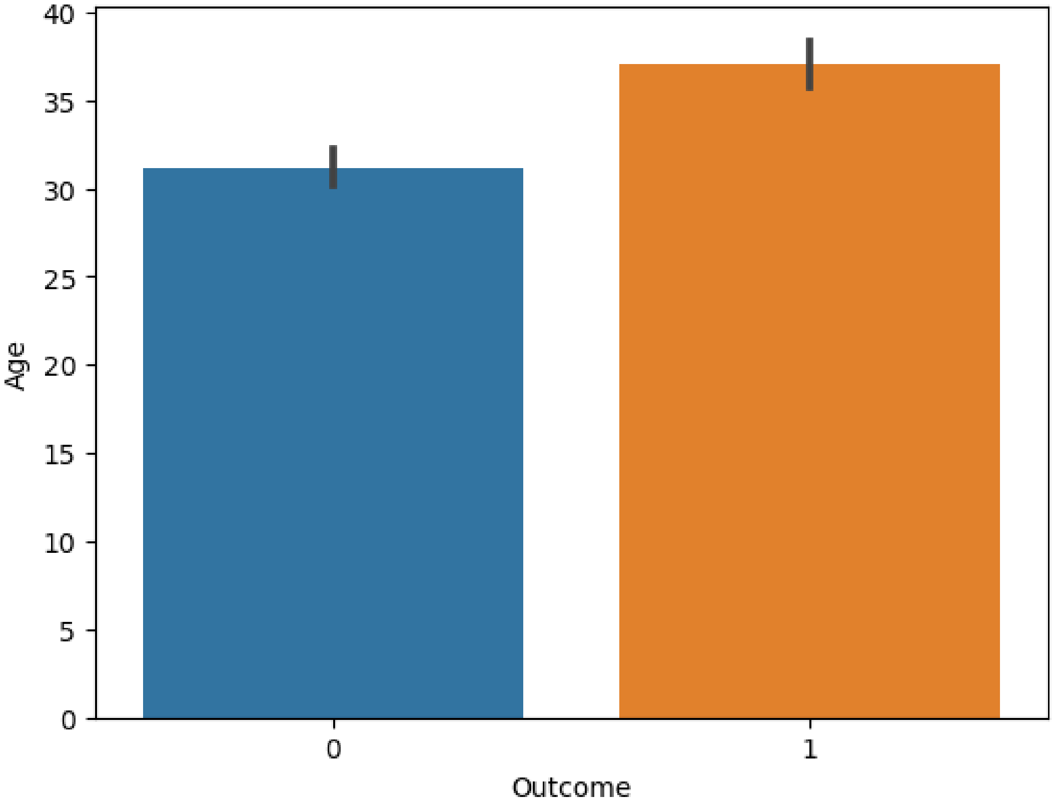


120
100
80
60
40
20
0
Insulin
0
1
Outcome

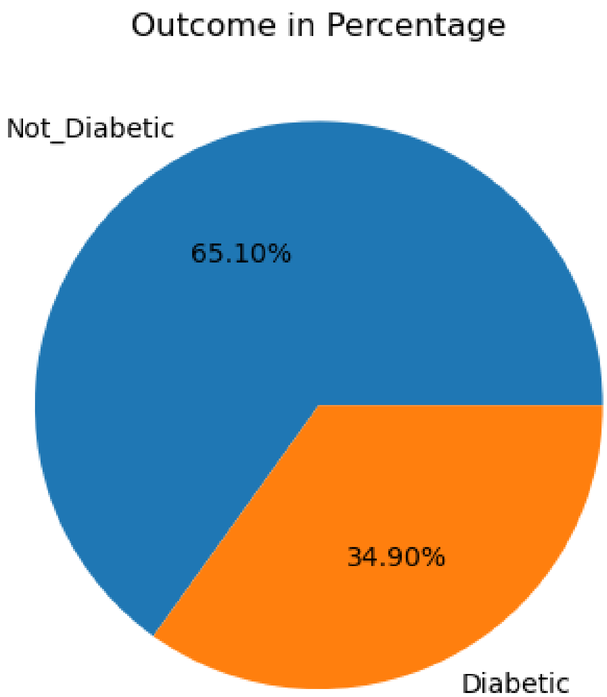

35
30
25
20
15
10
5
0
BMI
0
1
Outcome



DiabetesPedigreeFunction
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
1
Outcome



[12]:
```
plt.title('Outcome in Percentage')
plt.pie(df['Outcome'].
  ↪value_counts(),labels=['Not_Diabetic','Diabetic'],autopct='%1.2f%%')
plt.show()
```

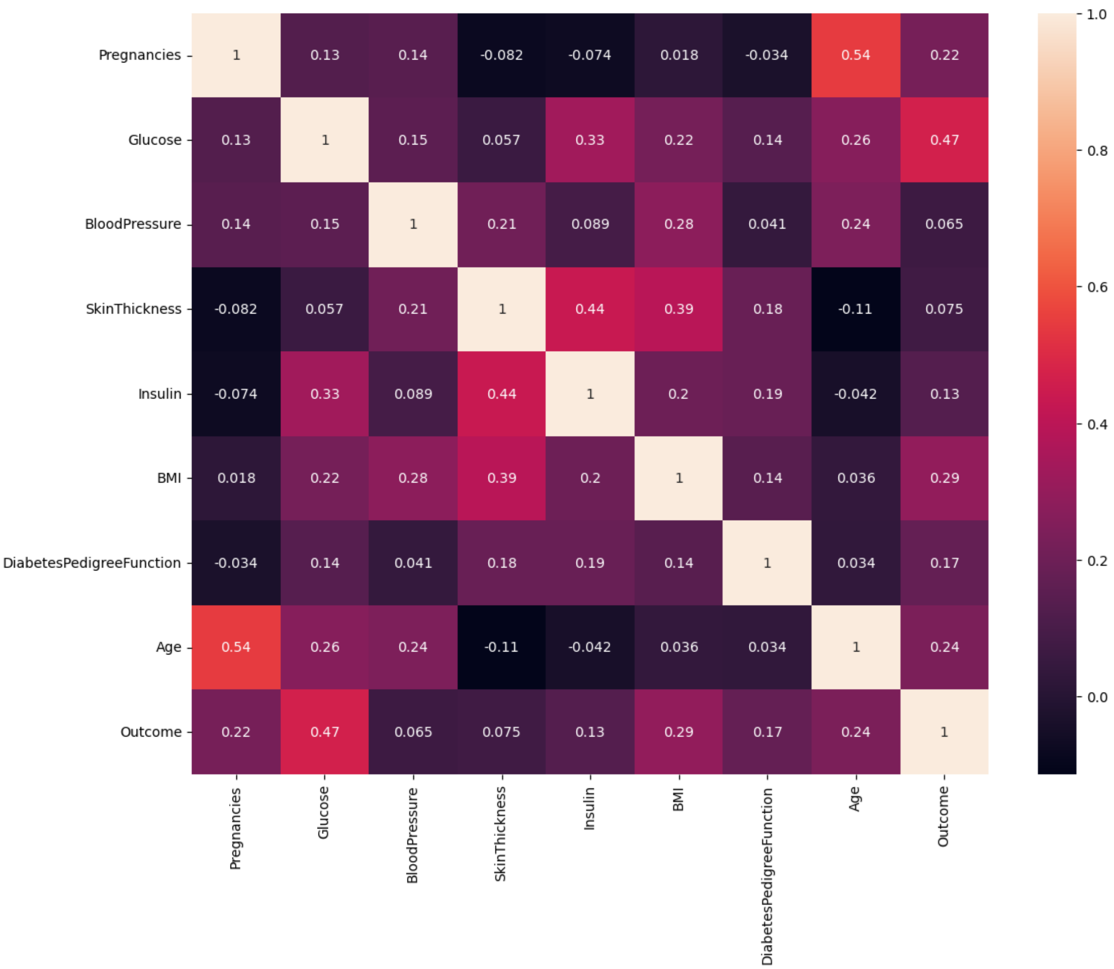


[13]:

```
plt.figure(figsize=(13,10))
sns.heatmap(df.corr(),annot=True)
```

[13]:

```
<Axes: >
```



[14]:

```
# Data preprocessing
 # Replacing Nan with mean values
df["Glucose"].fillna(df["Glucose"].mean(), inplace = True)
df["BloodPressure"].fillna(df["BloodPressure"].mean(), inplace = True)
df["SkinThickness"].fillna(df["SkinThickness"].mean(), inplace = True)
df["Insulin"].fillna(df["Insulin"].mean(), inplace = True)
df["BMI"].fillna(df["BMI"].mean(), inplace = True)
df["Pregnancies"].fillna(df["Pregnancies"].mean(), inplace = True)
df["DiabetesPedigreeFunction"].fillna(df["DiabetesPedigreeFunction"].mean(),␣
 ↪inplace = True)
```

[15]:

```
df.describe().T
```

[15]:

```
                          count        mean        std    min      25%  \
Pregnancies               768.0    3.845052   3.369578  0.000  1.00000
Glucose                   768.0  120.894531  31.972618  0.000 99.00000
BloodPressure             768.0   69.105469  19.355807  0.000 62.00000
```

```
SkinThickness              768.0   20.536458   15.952218   0.000    0.00000
Insulin                    768.0   79.799479  115.244002   0.000    0.00000
BMI                        768.0   31.992578    7.884160   0.000   27.30000
DiabetesPedigreeFunction   768.0    0.471876    0.331329   0.078    0.24375
Age                        768.0   33.240885   11.760232  21.000   24.00000
Outcome                    768.0    0.348958    0.476951   0.000    0.00000

                               50%        75%     max
Pregnancies                 3.0000    6.00000   17.00
Glucose                   117.0000  140.25000  199.00
BloodPressure              72.0000   80.00000  122.00
SkinThickness              23.0000   32.00000   99.00
Insulin                    30.5000  127.25000  846.00
BMI                        32.0000   36.60000   67.10
DiabetesPedigreeFunction    0.3725    0.62625    2.42
Age                        29.0000   41.00000   81.00
Outcome                     0.0000    1.00000    1.00
```

0.0.1 Prediction using Logistic Regression

[16]:

```
#Splitting Data
X = df.drop(columns='Outcome',axis=1)
Y = df['Outcome']
```

[17]:

```
#Splitting the data
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.
 ↪2,stratify=Y,random_state=2)
print(X.shape)
print(X_train.shape)
print(X_test.shape)
```

```
(768, 8)
(614, 8)
(154, 8)
```

[18]:

```
model = LogisticRegression()
model.fit(X_train, Y_train)
y_predict = model.predict(X_test)
```

[19]:

```
y_predict
```

[19]:

```
array([0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1,
       0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
       0, 1, 1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
       1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1,
         1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1],
        dtype=int64)
```

[20]:

```
#confusion matrix
from sklearn.metrics import confusion_matrix
confusion_matrix(y_predict,Y_test)
```

[20]:

```
array([[88, 26],
       [12, 28]], dtype=int64)
```

[21]:

```
from sklearn.metrics import accuracy_score ,classification_report,f1_score
```

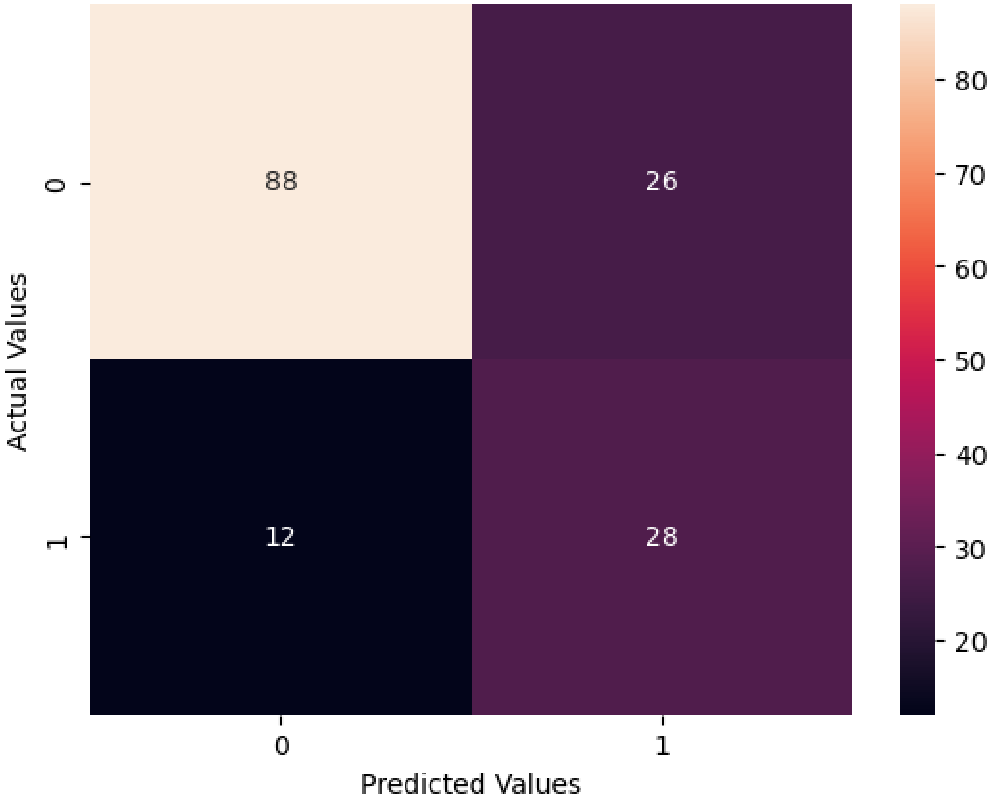
[22]:

```
Accuracy=accuracy_score(Y_test,y_predict)
print("Accuracy Score of test data : ",Accuracy)
```

```
Accuracy Score of test data :  0.7532467532467533
```

[23]:

```
#Evaluating model
cf_matrix = confusion_matrix(y_predict,Y_test)
sns.heatmap(cf_matrix,annot=True,fmt=".0f")
plt.xlabel("Predicted Values")
plt.ylabel("Actual Values")
plt.show()
```



[24]:

```
print(classification_report(Y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.77      0.88      0.82       100
           1       0.70      0.52      0.60        54

    accuracy                           0.75       154
   macro avg       0.74      0.70      0.71       154
weighted avg       0.75      0.75      0.74       154
```

[25]:

```
#Model Testing

y_predict = model.predict([[4,130,65,30,90,33.6,0.627,50]])
print(y_predict)
if y_predict==1:
    print("You are Diabetic")
else:
    print("You are not Diabetic")
```

```
[1]
You are Diabetic
```

[26]:

```
#Model Testing

y_predict = model.predict([[4,110,40,20,150,30.6,0.527,30]])
print(y_predict)
if y_predict==1:
    print("You are Diabetic")
else:
    print("You are not Diabetic")
```

```
[0]
You are not Diabetic
```

0.0.2 Prediction Random Forest Classifier

[27]:

```
from sklearn.ensemble import RandomForestClassifier
rf = RandomForestClassifier()
```

[28]:

```
rf.fit(X_train,Y_train)
```

[28]:

```
RandomForestClassifier()
```

[29]:

```
Y_pred1 = rf.predict(X_test)
Y_pred1
```

[29]:

```
array([0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0,
       0, 1, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
       1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1,
       1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0],
      dtype=int64)
```

[30]:

```
confusion_matrix(Y_pred1,Y_test)
```

[30]:

```
array([[87, 25],
       [13, 29]], dtype=int64)
```

[31]:

```
accuracy=accuracy_score(Y_test,Y_pred1)
print("Accuracy Score of test data : ",accuracy)
```

```
Accuracy Score of test data :  0.7532467532467533
```

[32]:

```
print(classification_report(Y_test,Y_pred1))
```

```
              precision    recall  f1-score   support

           0       0.78      0.87      0.82       100
           1       0.69      0.54      0.60        54

    accuracy                           0.75       154
   macro avg       0.73      0.70      0.71       154
weighted avg       0.75      0.75      0.74       154
```

[33]:

```
predict1 = rf.predict([[4,110,40,20,150,30.6,0.527,30]])
print(predict1)
if predict1==1:
    print("You are Diabetic")
else:
    print("You are not Diabetic")
```

```
[0]
You are not Diabetic
```

Thank You