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

```
data=pd.read_csv("diabetes.csv")
```

```
data
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigr
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	

768 rows × 9 columns

```
data.isnull().any()
```

```
Pregnancies                 False
Glucose                     False
BloodPressure               False
SkinThickness               False
Insulin                     False
BMI                         False
DiabetesPedigreeFunction    False
Age                         False
Outcome                     False
dtype: bool
```

```
data.isna().sum()
```

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

```
data.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
```

```
data.describe()
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI
count	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
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000

```
data.columns
```

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

```
x=data.iloc[:,:-1].values
y=data.iloc[:,-1].values
```

```
#training and testing
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test= train_test_split(x,y,test_size=0.2,random_state=0)
print(x_train)
```

```
[[7.00e+00 1.50e+02 7.80e+01 ... 3.52e+01 6.92e-01 5.40e+01]
 [4.00e+00 9.70e+01 6.00e+01 ... 2.82e+01 4.43e-01 2.20e+01]
 [0.00e+00 1.65e+02 9.00e+01 ... 5.23e+01 4.27e-01 2.30e+01]
 ...
 [4.00e+00 9.40e+01 6.50e+01 ... 2.47e+01 1.48e-01 2.10e+01]
 [1.10e+01 8.50e+01 7.40e+01 ... 3.01e+01 3.00e-01 3.50e+01]
 [5.00e+00 1.36e+02 8.20e+01 ... 0.00e+00 6.40e-01 6.90e+01]]
```

```
#feature scaling using standard scaler
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
x_train= sc.fit_transform(x_train)
x_test=sc.transform(x_test)
```

```
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]]
```

```
from sklearn.tree import DecisionTreeClassifier
model=DecisionTreeClassifier()
model.fit(x_train,y_train)
```

```
▾ DecisionTreeClassifier
DecisionTreeClassifier()
```

```
y_pred=model.predict(x_test)
```

```
np.array((y_pred, y_test ))
```

```
array([[1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0,
        0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1,
        1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1,
```

```
       0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1,
       0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0],
      [1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1,
       1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1,
       1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
       1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1,
       0, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0]])
```

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

```
              precision    recall  f1-score   support

           0       0.88      0.83      0.86       107
           1       0.66      0.74      0.70        47

    accuracy                           0.81       154
   macro avg       0.77      0.79      0.78       154
weighted avg       0.81      0.81      0.81       154
```

```
print(confusion_matrix(y_test,y_pred))
```

```
[[89 18]
 [12 35]]
```

```
print(data.corr())
```

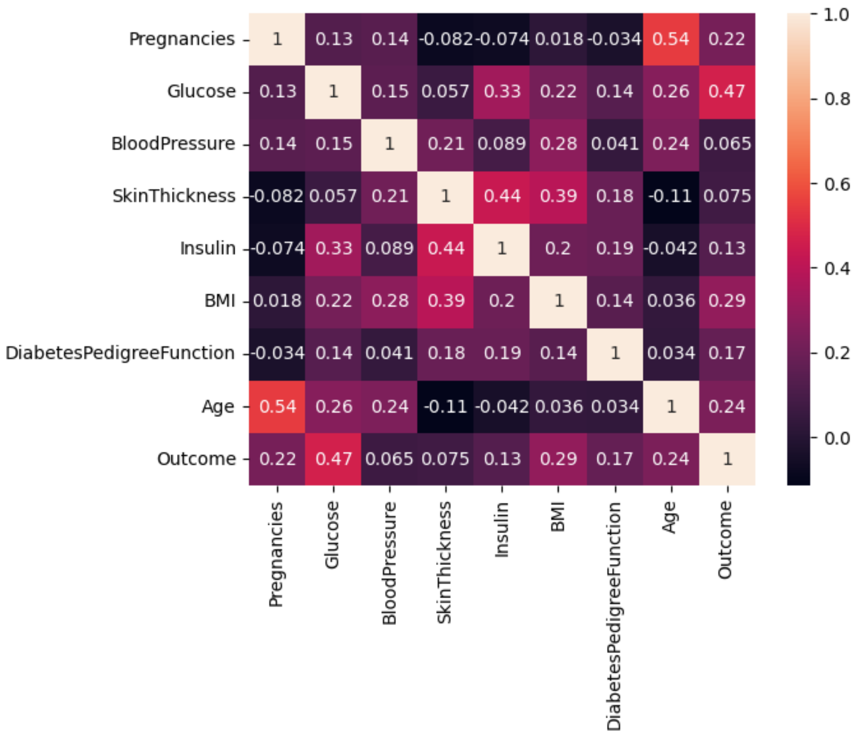
```
                          Pregnancies   Glucose  BloodPressure  SkinThickness  \
Pregnancies                  1.000000  0.129459       0.141282      -0.081672
Glucose                      0.129459  1.000000       0.152590       0.057328
BloodPressure                0.141282  0.152590       1.000000       0.207371
SkinThickness               -0.081672  0.057328       0.207371       1.000000
Insulin                     -0.073535  0.331357       0.088933       0.436783
BMI                          0.017683  0.221071       0.281805       0.392573
DiabetesPedigreeFunction    -0.033523  0.137337       0.041265       0.183928
Age                          0.544341  0.263514       0.239528      -0.113970
Outcome                      0.221898  0.466581       0.065068       0.074752

                           Insulin       BMI  DiabetesPedigreeFunction  \
Pregnancies              -0.073535  0.017683                 -0.033523
Glucose                   0.331357  0.221071                  0.137337
BloodPressure             0.088933  0.281805                  0.041265
SkinThickness             0.436783  0.392573                  0.183928
Insulin                   1.000000  0.197859                  0.185071
BMI                       0.197859  1.000000                  0.140647
DiabetesPedigreeFunction  0.185071  0.140647                  1.000000
Age                      -0.042163  0.036242                  0.033561
Outcome                   0.130548  0.292695                  0.173844

                               Age   Outcome
Pregnancies               0.544341  0.221898
Glucose                   0.263514  0.466581
BloodPressure             0.239528  0.065068
SkinThickness            -0.113970  0.074752
Insulin                  -0.042163  0.130548
BMI                       0.036242  0.292695
DiabetesPedigreeFunction  0.033561  0.173844
Age                       1.000000  0.238356
Outcome                   0.238356  1.000000
```

```
import seaborn as sns
sns.heatmap(data.corr(),annot=True)
```

```
<Axes: >
```




```
from sklearn.ensemble import BaggingClassifier
from sklearn.metrics import accuracy_score
base_model = DecisionTreeClassifier(random_state=42)
bagging_model_dt = BaggingClassifier(base_model, n_estimators=10, random_state=42)
# Train and evaluate the bagging classifier with decision trees
bagging_model_dt.fit(x_train, y_train)
y_pred_dt = bagging_model_dt.predict(x_test)
accuracy_dt = accuracy_score(y_test, y_pred_dt)

print("Bagging Classifier with Decision Trees Accuracy:", accuracy_dt)
```

```
Bagging Classifier with Decision Trees Accuracy: 0.7857142857142857
```

2nd data accuracy

```
x=data.iloc[:,:-3].values
y=data.iloc[:,-1].values
```

```
#training and testing
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test= train_test_split(x,y,test_size=0.2,random_state=0)
print(x_train)
```

```
[[  7.   150.    78.    29.   126.    35.2]
 [  4.    97.    60.    23.     0.    28.2]
 [  0.   165.    90.    33.   680.    52.3]
 ...
 [  4.    94.    65.    22.     0.    24.7]
 [ 11.    85.    74.     0.     0.    30.1]
 [  5.   136.    82.     0.     0.     0. ]]
```

```
#feature scaling using standard scaler
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
x_train= sc.fit_transform(x_train)
x_test=sc.transform(x_test)
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```
from sklearn.tree import DecisionTreeClassifier
model=DecisionTreeClassifier()
model.fit(x_train,y_train)
```

```
▾ DecisionTreeClassifier
DecisionTreeClassifier()
```

```
y_pred=model.predict(x_test)
```

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

```
              precision    recall  f1-score   support

           0       0.83      0.82      0.83       107
           1       0.60      0.62      0.61        47

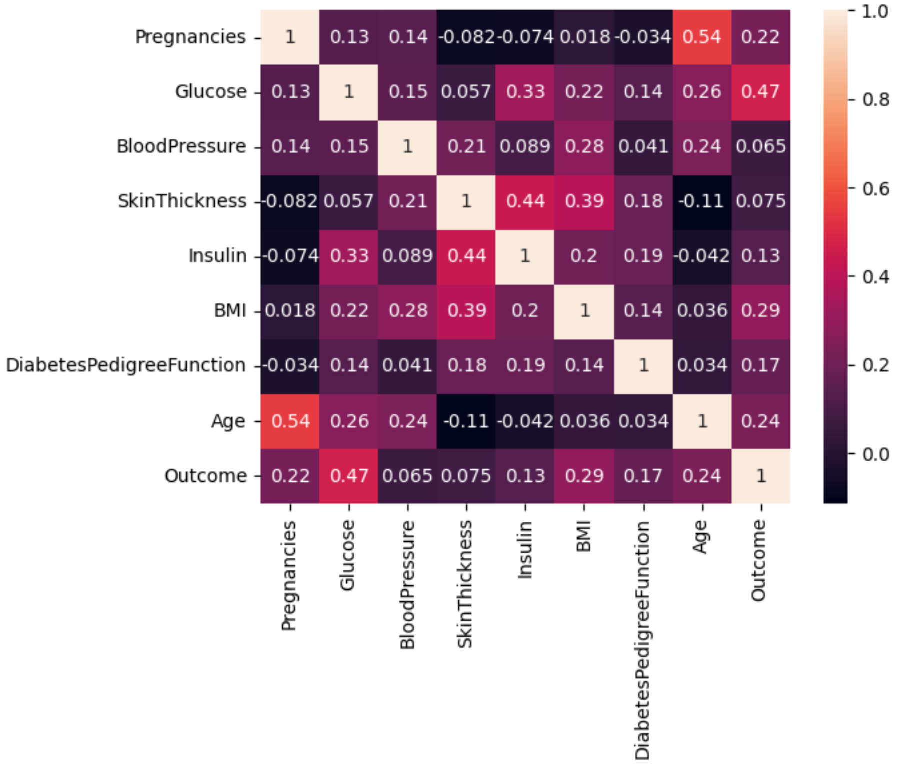
    accuracy                           0.76       154
   macro avg       0.72      0.72      0.72       154
weighted avg       0.76      0.76      0.76       154
```

```
print(confusion_matrix(y_test,y_pred))
```

```
[[88 19]
 [18 29]]
```

```
import seaborn as sns
sns.heatmap(data.corr(),annot=True)
```

```
<Axes: >
```




```
from sklearn.ensemble import BaggingClassifier
from sklearn.metrics import accuracy_score
base_model = DecisionTreeClassifier(random_state=42)
bagging_model_dt = BaggingClassifier(base_model, n_estimators=10, random_state=42)
#classifier with decision trees
bagging_model_dt.fit(x_train, y_train)
y_pred_dt = bagging_model_dt.predict(x_test)
accuracy_dt = accuracy_score(y_test, y_pred_dt)

print("Bagging Classifier with DT Accuracy:", accuracy_dt)
```

```
Bagging Classifier with DT Accuracy: 0.7662337662337663
```