```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import os
import scipy as sp
import warnings
warnings.filterwarnings("ignore")
%matplotlib inline
```

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

```
data.head()
```

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

```
data.describe()
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFu
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	0.
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.

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```
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.shape
```

```
(768, 9)
```

```
data.value_counts()
```

```
Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin  BMI   DiabetesPedigreeFunction  Age  Outcome
0            57       60             0              0        21.7  0.735                     67   0          1
             67       76             0              0        45.3  0.194                     46   0          1
5            103      108            37             0        39.2  0.305                     65   0          1
             104      74             0              0        28.8  0.153                     48   0          1
             105      72             29             325      36.9  0.159                     28   0          1
```

```
                                                                                ..
2           84       50            23            76       30.4  0.968          21   0          1
            85       65            0             0        39.6  0.930          27   0          1
            87       0             23            0        28.9  0.773          25   0          1
                     58            16            52       32.7  0.166          25   0          1
17          163      72            41            114      40.9  0.817          47   1          1
Length: 768, dtype: int64
```

```
data.dtypes
```

```
Pregnancies                 int64
Glucose                     int64
BloodPressure               int64
SkinThickness               int64
Insulin                     int64
BMI                       float64
DiabetesPedigreeFunction  float64
Age                         int64
Outcome                     int64
dtype: object
```

```
data.columns
```

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

```
data.isnull().sum()
```

```
Pregnancies               0
Glucose                   0
BloodPressure             0
SkinThickness             0
Insulin                   0
BMI                       0
DiabetesPedigreeFunction  0
Age                       0
```

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

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

```
data.isnull().all()
```

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

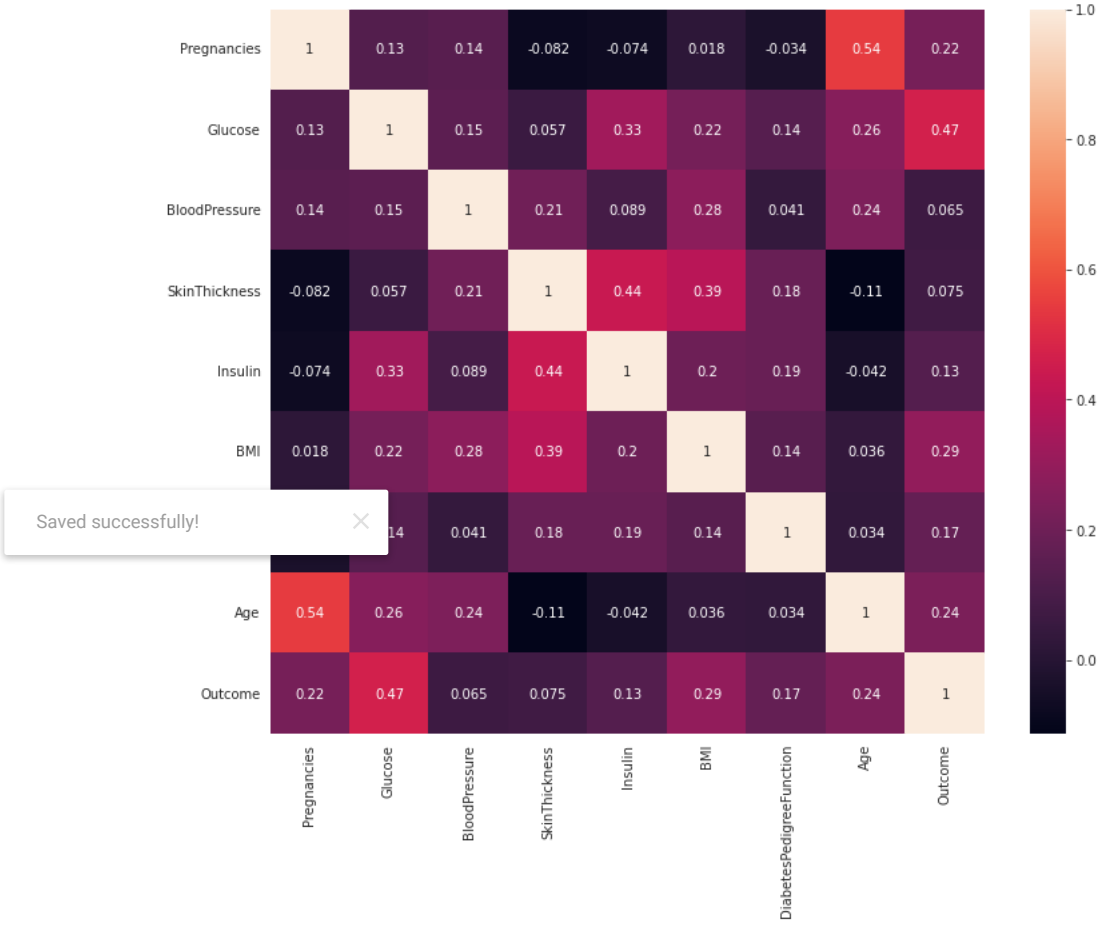
```
data.corr()
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Diabete
Pregnancies	1.000000	0.129459	0.141282	-0.081672	-0.073535	0.017683	
Glucose	0.129459	1.000000	0.152590	0.057328	0.331357	0.221071	
BloodPressure	0.141282	0.152590	1.000000	0.207371	0.088933	0.281805	
SkinThickness	-0.081672	0.057328	0.207371	1.000000	0.436783	0.392573	
Insulin	-0.073535	0.331357	0.088933	0.436783	1.000000	0.197859	
BMI	0.017683	0.221071	0.281805	0.392573	0.197859	1.000000	

```
plt.figure(figsize = (12,10))

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

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba5d871c70>
```



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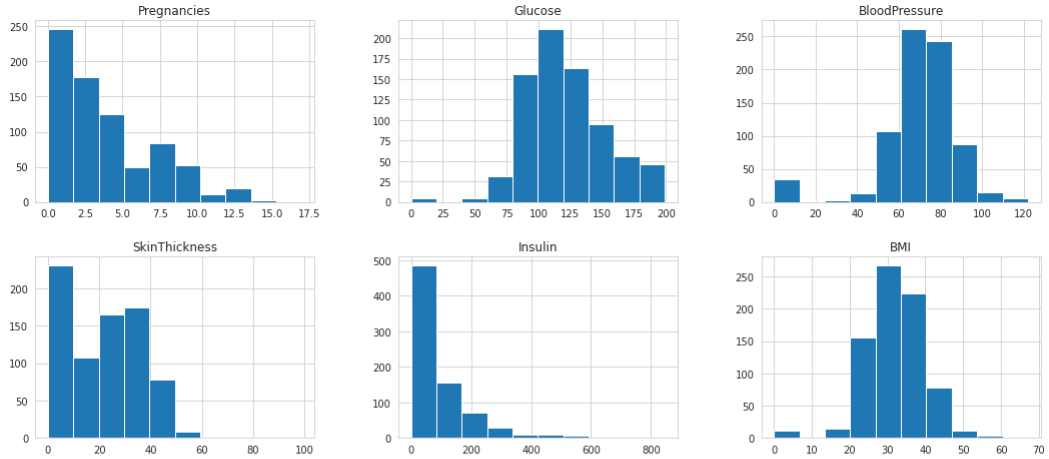
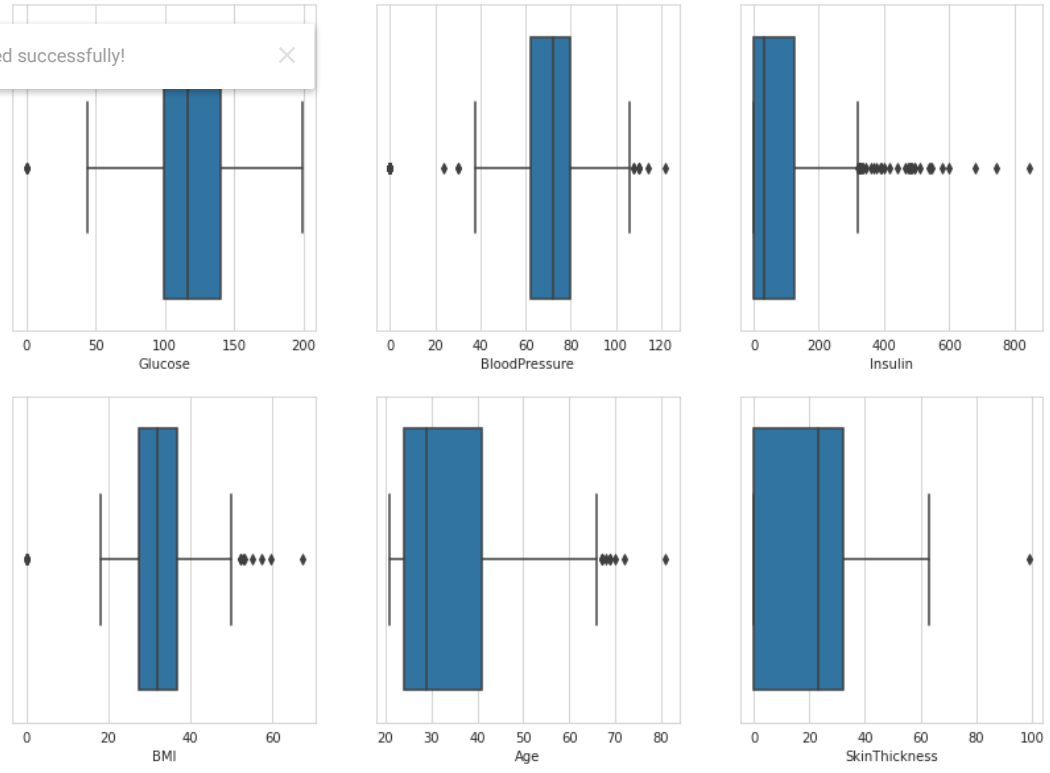
```
data.hist(figsize=(18,12))
plt.show()
```




```
plt.figure(figsize=(14,10))
sns.set_style(style='whitegrid')
plt.subplot(2,3,1)
sns.boxplot(x='Glucose',data=data)
plt.subplot(2,3,2)
sns.boxplot(x='BloodPressure',data=data)
plt.subplot(2,3,3)
sns.boxplot(x='Insulin',data=data)
plt.subplot(2,3,4)
sns.boxplot(x='BMI',data=data)
plt.subplot(2,3,5)
sns.boxplot(x='Age',data=data)
plt.subplot(2,3,6)
sns.boxplot(x='SkinThickness',data=data)
```

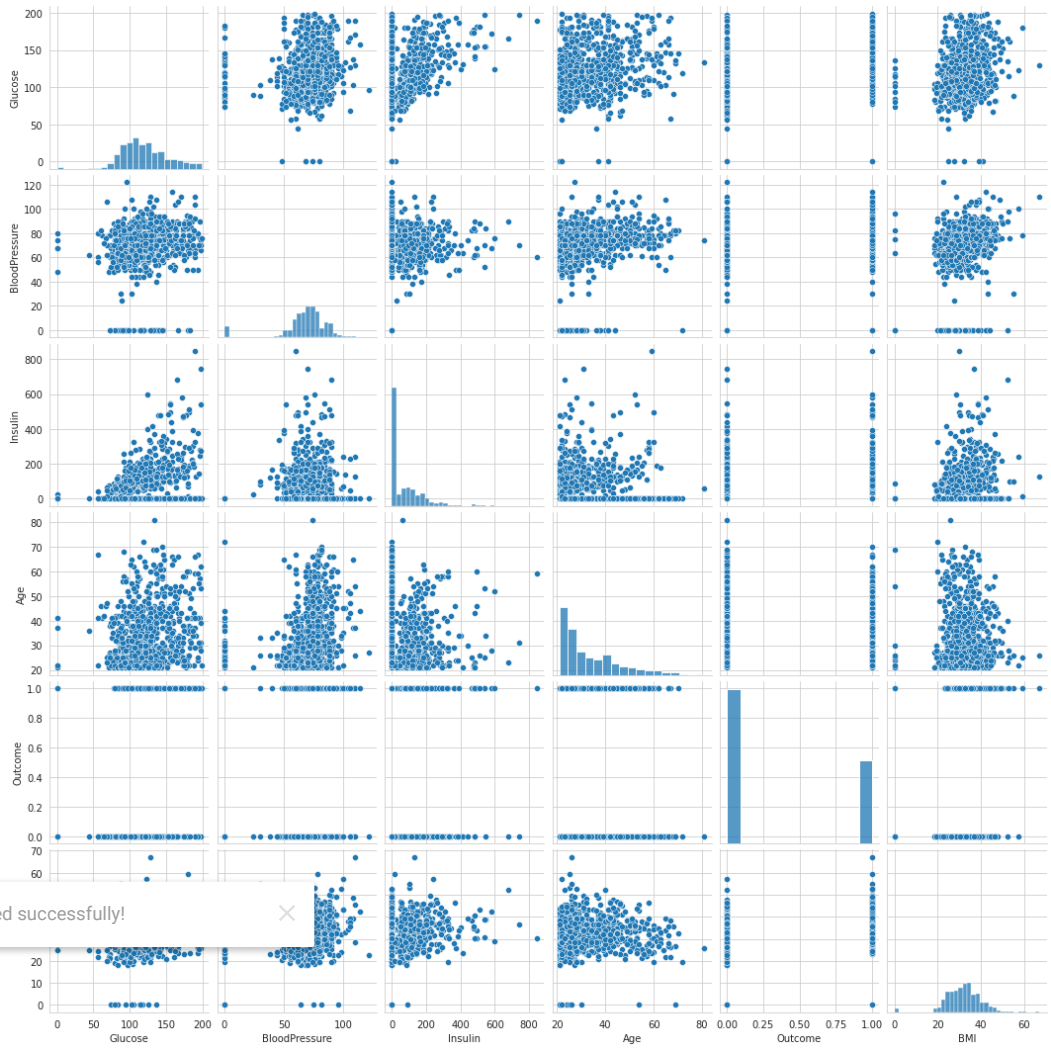
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba5d2746a0>
```


```
mean_col = ['Glucose','BloodPressure','Insulin','Age','Outcome','BMI']

sns.pairplot(data[mean_col],palette='Accent')
```

```
<seaborn.axisgrid.PairGrid at 0x7fba5d1a57c0>
```



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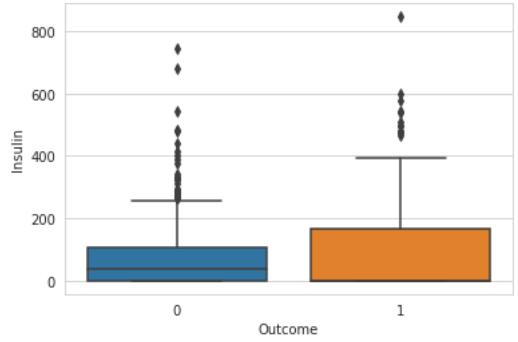
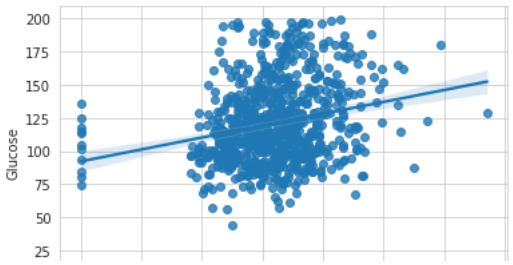
```
sns.boxplot(x='Outcome',y='Insulin',data=data)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba5c8976d0>
```



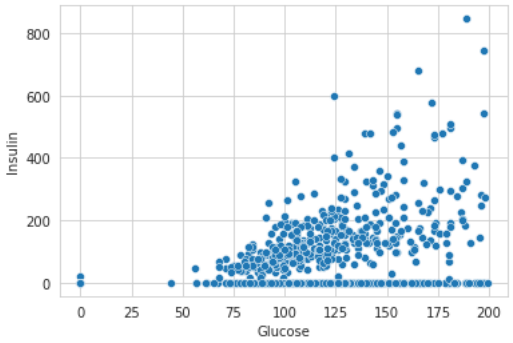

```
sns.regplot(x='BMI', y= 'Glucose', data=data)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba5c7e2df0>
```



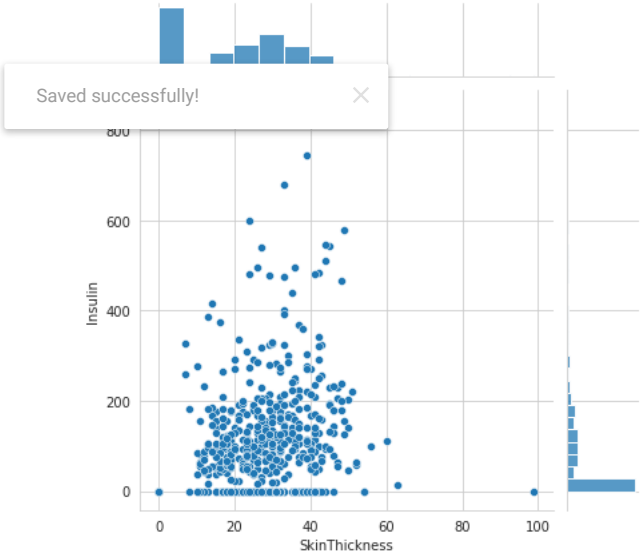

```
sns.scatterplot(x='Glucose', y= 'Insulin', data=data)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba5c7cf040>
```



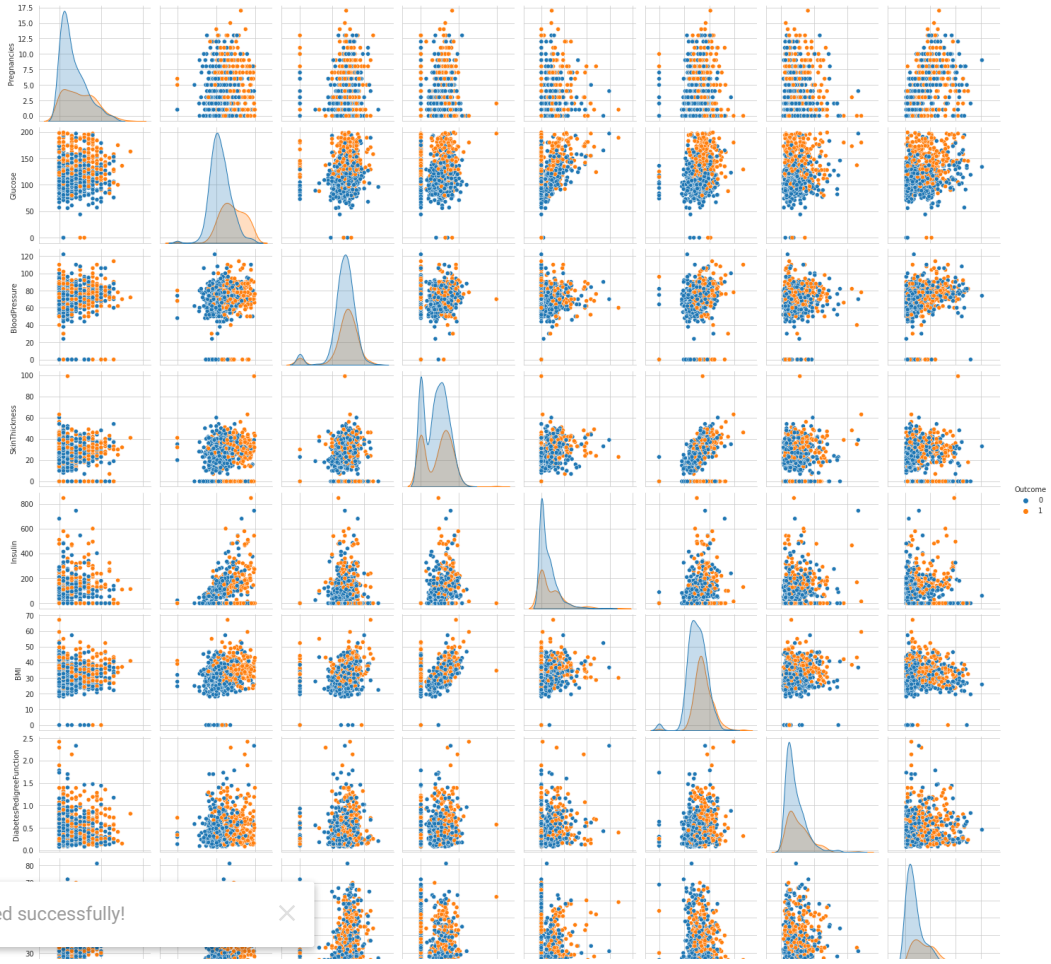

```
sns.jointplot(x='SkinThickness', y= 'Insulin', data=data)
```

```
<seaborn.axisgrid.JointGrid at 0x7fba5c724700>
```




```
sns.pairplot(data,hue='Outcome')
```

```
<seaborn.axisgrid.PairGrid at 0x7fba5c6d1760>
```



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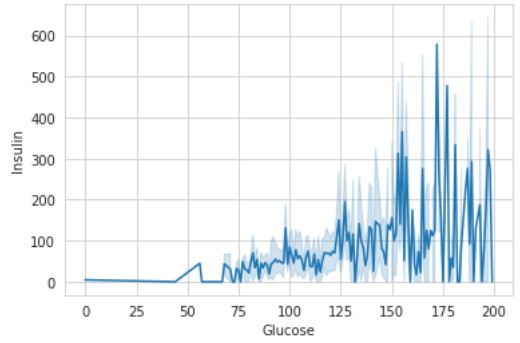
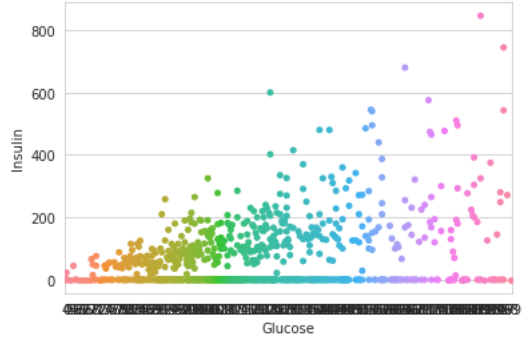
```
sns.lineplot(x='Glucose', y= 'Insulin', data=data)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba591a5550>
```

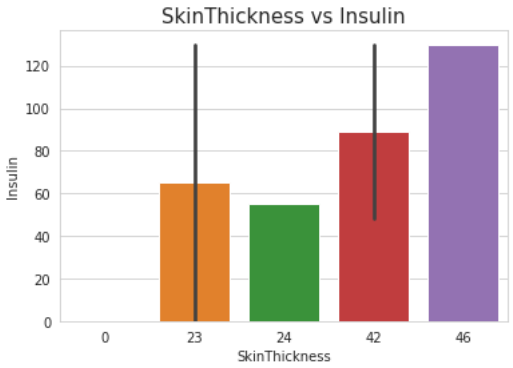



```
sns.swarmplot(x='Glucose', y= 'Insulin', data=data)
```

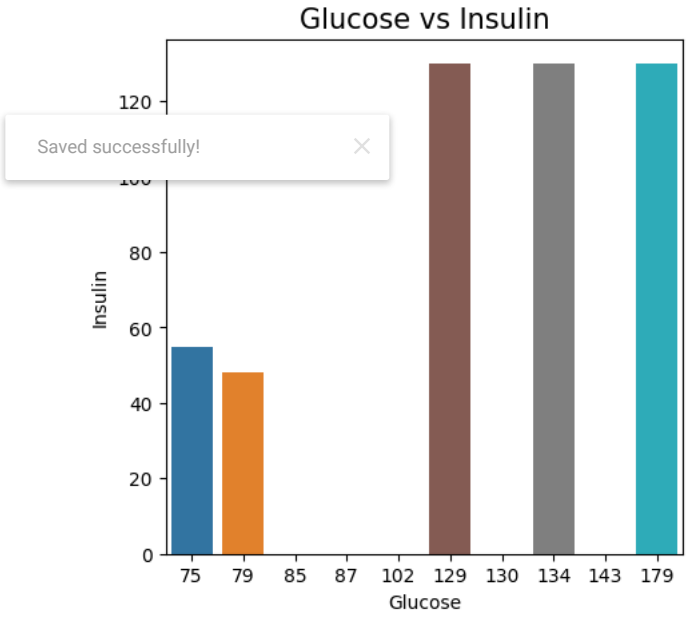
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fba590c9490>
```



```
sns.barplot(x="SkinThickness", y="Insulin", data=data[170:180])
plt.title("SkinThickness vs Insulin",fontsize=15)
plt.xlabel("SkinThickness")
plt.ylabel("Insulin")
plt.show()
plt.style.use("ggplot")
```




```
plt.style.use("default")
plt.figure(figsize=(5,5))
sns.barplot(x="Glucose", y="Insulin", data=data[170:180])
plt.title("Glucose vs Insulin",fontsize=15)
plt.xlabel("Glucose")
plt.ylabel("Insulin")
plt.show()
```




```
x = data.drop(columns = 'Outcome')

# Getting Predicting Value
y = data['Outcome']

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(len(x_train))
print(len(x_test))
print(len(y_train))
print(len(y_test))
```

```
614
154
614
154
```

```
from sklearn.linear_model import LogisticRegression
reg = LogisticRegression()
reg.fit(x_train,y_train)
```

```
LogisticRegression()
```

```
y_pred=reg.predict(x_test)
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
print("Classification Report is:\n",classification_report(y_test,y_pred))
print("Confusion Matrix:\n",confusion_matrix(y_test,y_pred))
print("Training Score:\n",reg.score(x_train,y_train)*100)
print("Mean Squared Error:\n",mean_squared_error(y_test,y_pred))
print("R2 score is:\n",r2_score(y_test,y_pred))
```

```
Classification Report is:
               precision    recall  f1-score   support

           0       0.84      0.92      0.88       107
           1       0.76      0.62      0.68        47

    accuracy                           0.82       154
   macro avg       0.80      0.77      0.78       154
weighted avg       0.82      0.82      0.82       154

Confusion Matrix:
 [[98  9]
 [18 29]]
Training Score:
 77.19869706840392
Mean Squared Error:
 0.17532467532467533
R2 score is:
 0.1731954662954862
```

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```
*100)
```

```
82.46753246753246
```

```
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=7)

knn.fit(x_train,y_train)
```

```
KNeighborsClassifier(n_neighbors=7)
```

```
y_pred=knn.predict(x_test)
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
print("Classification Report is:\n",classification_report(y_test,y_pred))
print("Confusion Matrix:\n",confusion_matrix(y_test,y_pred))
print("Training Score:\n",knn.score(x_train,y_train)*100)
print("Mean Squared Error:\n",mean_squared_error(y_test,y_pred))
print("R2 score is:\n",r2_score(y_test,y_pred))
```

```
Classification Report is:
               precision    recall  f1-score   support

           0       0.82      0.84      0.83       107
           1       0.61      0.57      0.59        47

    accuracy                           0.76       154
   macro avg       0.72      0.71      0.71       154
weighted avg       0.76      0.76      0.76       154

Confusion Matrix:
 [[90 17]
 [20 27]]
Training Score:
 78.17589576547232
Mean Squared Error:
 0.24025974025974026
R2 score is:
 -0.13302843507655582
```

```
print(accuracy_score(y_test,y_pred)*100)
```

```
75.97402597402598
```

```
from sklearn.svm import SVC

svc = SVC()
svc.fit(x_train, y_train)
```

```
SVC()
```

```
y_pred=svc.predict(x_test)
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
print("Classification Report is:\n",classification_report(y_test,y_pred))
print("Confusion Matrix:\n",confusion_matrix(y_test,y_pred))
print("Training Score:\n",svc.score(x_train,y_train)*100)
print("Mean Squared Error:\n",mean_squared_error(y_test,y_pred))
print("R2 score is:\n",r2_score(y_test,y_pred))
```

```
Classification Report is:
               precision    recall  f1-score   support

           0       0.81      0.92      0.86       107
           1       0.73      0.51      0.60        47

    accuracy                           0.79       154
   macro avg       0.77      0.71      0.73       154
weighted avg       0.78      0.79      0.78       154

Confusion Matrix:
 [[98  9]
```



```
Mean Squared Error:
 0.2077922077922078
R2 score is:
 0.020083515609465197
```

```
print(accuracy_score(y_test,y_pred)*100)
```

```
79.22077922077922
```

```
from sklearn.ensemble import GradientBoostingClassifier
gbc=GradientBoostingClassifier()
gbc.fit(x_train,y_train)
```

```
GradientBoostingClassifier()
```

```
y_pred=gbc.predict(x_test)
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
print("Classification Report is:\n",classification_report(y_test,y_pred))
print("Confusion Matrix:\n",confusion_matrix(y_test,y_pred))
print("Training Score:\n",gbc.score(x_train,y_train)*100)
print("Mean Squared Error:\n",mean_squared_error(y_test,y_pred))
print("R2 score is:\n",r2_score(y_test,y_pred))
```

```
Classification Report is:
               precision    recall  f1-score   support

           0       0.87      0.86      0.86       107
           1       0.69      0.70      0.69        47

    accuracy                           0.81       154
   macro avg       0.78      0.78      0.78       154
weighted avg       0.81      0.81      0.81       154

Confusion Matrix:
 [[92 15]
 [14 33]]
```

```
Training Score:
 91.85667752442997
Mean Squared Error:
 0.18831168831168832
R2 score is:
 0.11195068602107783
```

```
print(accuracy_score(y_test,y_pred)*100)
```

```
81.16883116883116
```

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