Reading and Importing Data

In [1]:
```python
#importing csv file
import pandas as pd
import numpy as np
import seaborn as sns
from sklearn.metrics import recall_score
from sklearn.metrics import precision_score
from sklearn.metrics import recall_score
from sklearn.metrics import classification_report
from sklearn.metrics import classification_report, confusion_matrix
data = pd.read_csv("diabetes.csv")
```

In [2]:
```python
data.head()
```

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
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
```

In [4]:
```python
data.shape
```

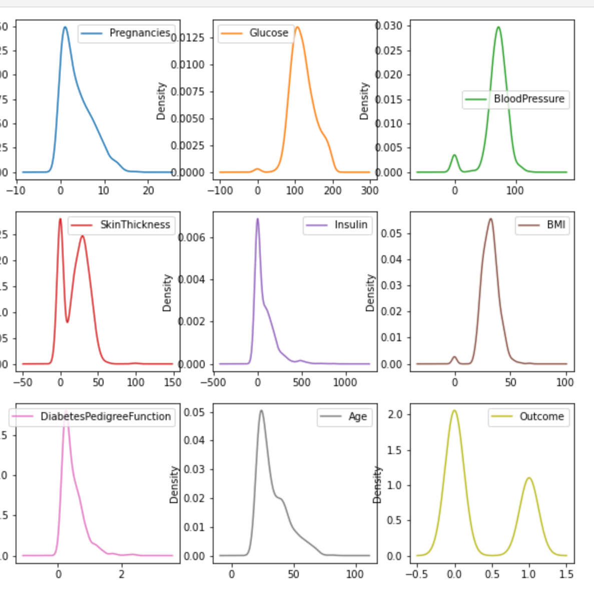
Out[4]: (768, 9)

In [5]:
```python
data.describe()
```

Out[5]:

	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 [6]:
```python
from matplotlib import pyplot
import matplotlib.pyplot as plt
data.plot(kind='density', subplots=True, layout=(3,3), sharex=False , figsize =(10,10))
plt.show()
```



Data pre-processing

In [7]:
```python
data.isnull().sum()
```

Out[7]:
```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

In [8]:
```python
features = data.columns
cols = (data[features] == 0).sum()
print(cols)
```

```
Pregnancies                 111
Glucose                       5
BloodPressure                35
SkinThickness               227
Insulin                     374
BMI                          11
DiabetesPedigreeFunction      0
Age                           0
Outcome                     500
dtype: int64
```

In [9]:
```python
data['Pregnancies']=data['Pregnancies'].replace(0,data['Pregnancies'].mean())
```

In [10]:
```python
data['Glucose']=data['Glucose'].replace(0,data['Glucose'].mean())
```

In [11]:
```python
data['BloodPressure']=data['BloodPressure'].replace(0,data['BloodPressure'].mean())
```

In [12]:
```python
data['SkinThickness']=data['SkinThickness'].replace(0,data['SkinThickness'].mean())
```

In [13]:
```python
data['Insulin']=data['Insulin'].replace(0,data['Insulin'].mean())
```

In [14]:
```python
data['BMI']=data['BMI'].replace(0,data['BMI'].mean())
```

In [15]:
```python
features = data.columns
cols = (data[features] == 0).sum()
print(cols)
```

```
Pregnancies                   0
Glucose                       0
BloodPressure                 0
SkinThickness                 0
Insulin                       0
BMI                           0
DiabetesPedigreeFunction      0
Age                           0
Outcome                     500
dtype: int64
```

Visualisation

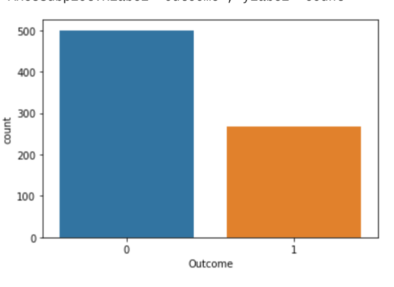
In [16]:
```python
data['Outcome'].value_counts()
```

Out[16]:
```
0    500
1    268
Name: Outcome, dtype: int64
```

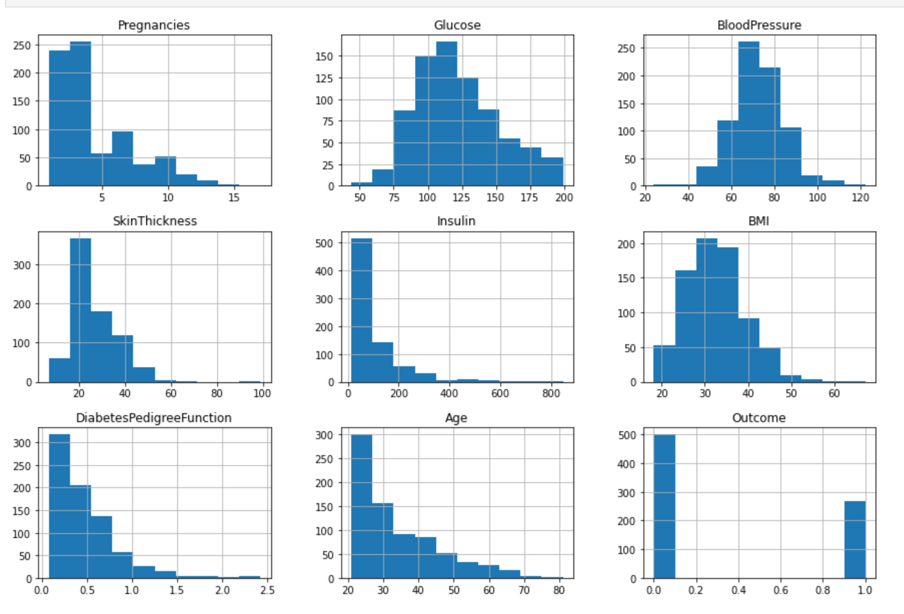
In [17]:
```python
sns.countplot(data['Outcome'],label="Count")
```

```
C:\Users\KIIT\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinte
rpretation.
  warnings.warn(
```

Out[17]: <AxesSubplot:xlabel='Outcome', ylabel='count'>

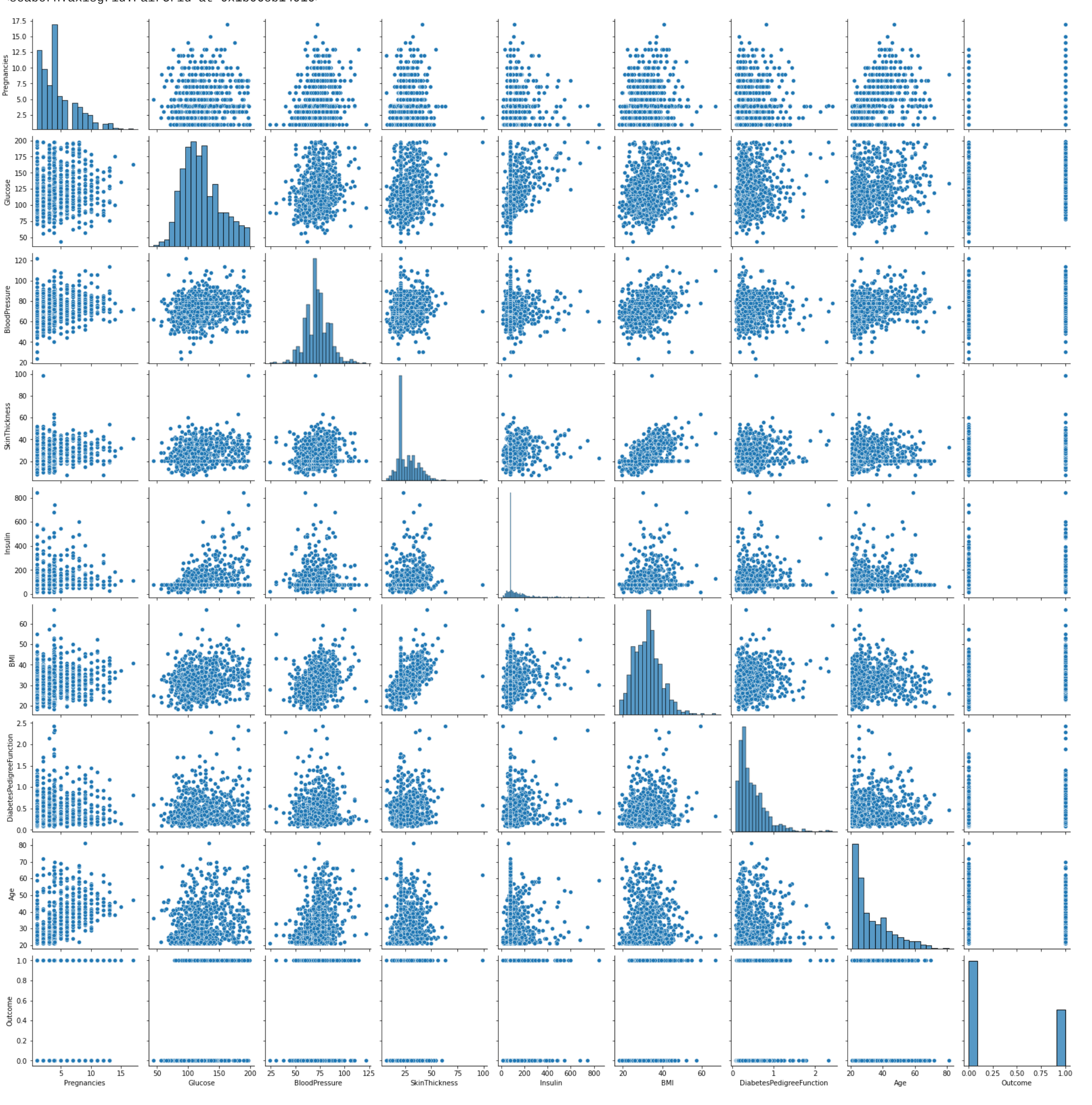


In [18]:
```python
data.hist(figsize=(15,10))
plt.show()
```



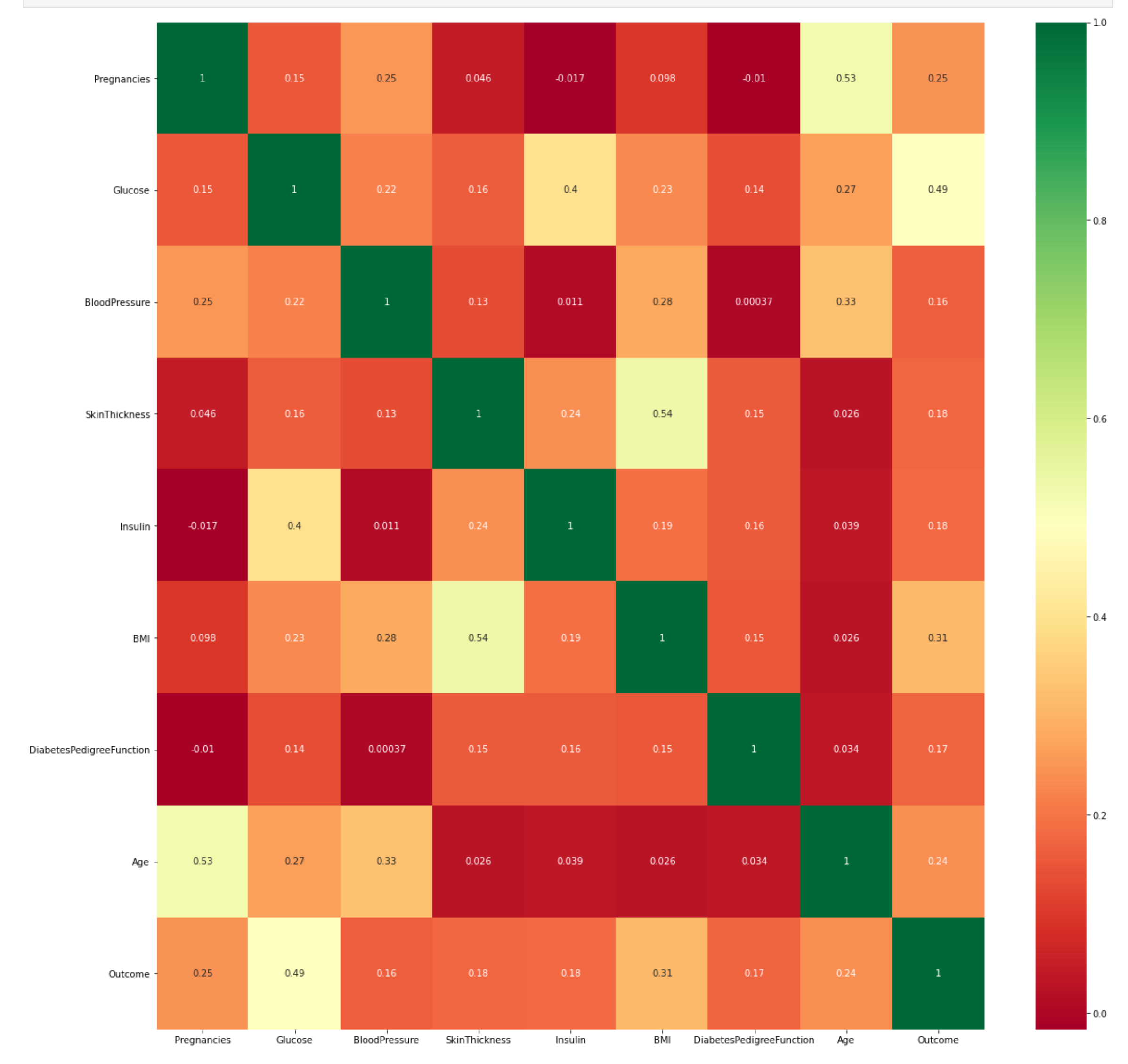
In [19]:
```python
sns.pairplot(data)
```

Out[19]: <seaborn.axisgrid.PairGrid at 0x1b06cb14910>



Co-Relation

In [21]:
```python
corrmat = data.corr()
top_corr_features = corrmat.index
plt.figure(figsize=(20,20))
g=sns.heatmap(data[top_corr_features].corr(),annot=True,cmap= "RdYlGn")
```



In [22]:
```python
data.corr()
```

Out[22]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
Pregnancies	1.000000	0.152568	0.253275	0.045776	-0.016738	0.097663	-0.010297	0.525261	0.247971
Glucose	0.152568	1.000000	0.219666	0.160766	0.396597	0.231478	0.137106	0.266600	0.492908
BloodPressure	0.253275	0.219666	1.000000	0.134155	0.010926	0.281231	0.000371	0.326740	0.162986
SkinThickness	0.045776	0.160766	0.134155	1.000000	0.240361	0.535703	0.154961	0.026423	0.175026
Insulin	-0.016738	0.396597	0.010926	0.240361	1.000000	0.189856	0.157806	0.038652	0.179185
BMI	0.097663	0.231478	0.281231	0.535703	0.189856	1.000000	0.153508	0.025748	0.312254
DiabetesPedigreeFunction	-0.010297	0.137106	0.000371	0.154961	0.157806	0.153508	1.000000	0.033561	0.173844
Age	0.525261	0.266600	0.326740	0.026423	0.038652	0.025748	0.033561	1.000000	0.238356
Outcome	0.247971	0.492908	0.162986	0.175026	0.179185	0.312254	0.173844	0.238356	1.000000

Training and Testing Data

In [23]:
```python
from sklearn.model_selection import train_test_split
x = data.drop(['Outcome'],axis=1)
y = data['Outcome']
```

In [24]:
```python
x_train , x_test ,y_train ,y_test =train_test_split(x,y ,test_size=0.4, random_state = 0)
```

In [25]:
```python
x_train.shape
```

Out[25]: (460, 8)

In [26]:
```python
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)
```

In [27]:
```python
x_train
```

Out[27]:
```
array([[-0.46500509,  0.21706518,  0.39668828, ..., -0.61376354,
        -0.43821198,  0.0507091 ],
       [-1.13643605, -1.4276812 ,  0.06850793, ..., -0.38506909,
         0.16184365, -0.96347286],
       [-0.12928961,  0.67759417, -1.24421347, ..., -0.45653611,
        -0.54410415,  0.30425459],
       ...,
       [-0.12928961, -0.96715221, -0.66989786, ..., -1.14261946,
        -0.95296558, -1.04798802],
       [ 2.22071875, -1.26320656,  0.06850793, ..., -0.37077569,
        -0.50586531,  0.13522426],
       [ 0.20642587,  0.41443475,  0.72486863, ..., -0.10026186,
         0.4942274 ,  3.0087398 ]])
```

In [28]:
```python
x_test
```

Out[28]:
```
array([[-1.13643605,  2.48681519,  0.2325981 , ...,  1.45877993,
         2.71208005, -0.96347286],
       [-0.80072057, -0.53951816,  0.06850793, ...,  0.12949343,
        -0.1999546 , -0.8789577 ],
       [-0.12928961, -1.55926091, -0.91603312, ...,  0.18666704,
        -0.23819344, -0.70992737],
       ...,
       [ 0.54214135,  0.80917388, -0.09558225, ...,  0.12949343,
         0.45598856,  1.40295171],
       [-1.13643605,  0.74338402, -1.40830365, ..., -0.4279493 ,
         0.27067727, -0.37186672],
       [ 0.54214135,  0.34864489, -0.25967242, ...,  0.38677469,
         0.20596538, -0.37186672]])
```

In [29]:
```python
unique_classes = list(y_train.unique())
unique_classes

from sklearn.utils import class_weight

out_dict = {}
for classes in unique_classes:
    out_dict[classes] = y_train.shape[0]/((y_train.loc[y_train == classes].shape[0])
                                     *len(unique_classes))

out_dict
```

Out[29]: {1: 1.393939393939394, 0: 0.7796610169491526}

Using Logistic Regression

In [30]:
```python
from sklearn.linear_model import LogisticRegression
clf = LogisticRegression(class_weight={1: 1.393939393939394, 0: 0.7796610169491526})
clf.fit(x_train, y_train)
```

Out[30]: LogisticRegression(class_weight={0: 0.7796610169491526, 1: 1.393939393939394})

In [31]:
```python
y_pred= clf.predict(x_test)
```

In [32]:
```python
from sklearn.metrics import accuracy_score
accuracy_score(y_pred , y_test)
```

Out[32]: 0.7597402597402597

In [33]:
```python
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.82      0.81      0.82       205
           1       0.64      0.65      0.64       103

    accuracy                           0.76       308
   macro avg       0.73      0.73      0.73       308
weighted avg       0.76      0.76      0.76       308
```

Using Random Forest Regressor

In [34]:
```python
from sklearn.ensemble import RandomForestClassifier
clf = RandomForestClassifier(class_weight={1: 1.393939393939394, 0: 0.7796610169491526})
clf.fit(x_train, y_train)
predicted = clf.predict(x_test)
```

In [35]:
```python
accuracy_score(predicted, y_test)
```

Out[35]: 0.7532467532467533

In [36]:
```python
print(classification_report(y_test,predicted))
```

```
              precision    recall  f1-score   support

           0       0.77      0.90      0.83       205
           1       0.70      0.47      0.56       103

    accuracy                           0.75       308
   macro avg       0.73      0.68      0.69       308
weighted avg       0.75      0.75      0.74       308
```

Using Decision Tree Classifier

In [37]:
```python
from sklearn.tree import DecisionTreeClassifier
clf = DecisionTreeClassifier(class_weight={1: 1.393939393939394, 0: 0.7796610169491526})
clf.fit(x_train, y_train)
predicted = clf.predict(x_test)
```

In [38]:
```python
accuracy_score(predicted, y_test)
```

Out[38]: 0.7305194805194806

In [39]:
```python
print(classification_report(y_test,predicted))
```

```
              precision    recall  f1-score   support

           0       0.79      0.81      0.80       205
           1       0.60      0.56      0.58       103

    accuracy                           0.73       308
   macro avg       0.70      0.69      0.69       308
weighted avg       0.73      0.73      0.73       308
```