Importing libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

Importing dataset

In [2]:
```
dataset = pd.read_csv('diabetes_dataset.csv')
```

Preview Data

In [3]:
```
dataset.head()
```

Out[3]:

	Pregnancies	Glucose_level	Blood_Pressure	thickness_of_skin	Insulin	body_mass_index	diabetes_pedigree_function	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 [5]:
```
dataset.shape
```

Out[5]:
```
(770, 9)
```

dataset.describe().T

In [7]:
```
dataset.isnull().sum()
```

Out[7]:
```
Pregnancies                   0
Glucose_level                 0
Blood_Pressure                0
thickness_of_skin             0
Insulin                       0
body_mass_index               0
diabetes_pedigree_function    0
Age                           0
Outcome                       0
dtype: int64
```

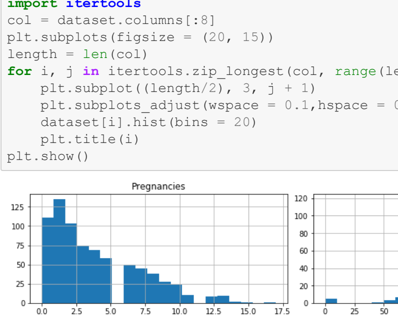
Observations:

1. There are a total 770 records and 9 features in our dataset.
2. Each feature can be either of integer or float datatype.
3. Some features like Glucose, Blood pressure , Insulin, BMI have zero values which represent data is missing.
4. There are zero NaN values in the dataset.
5. In the outcome column, 1 represents diabetes positive and 0 represents diabetes negative.

Data Visualisation

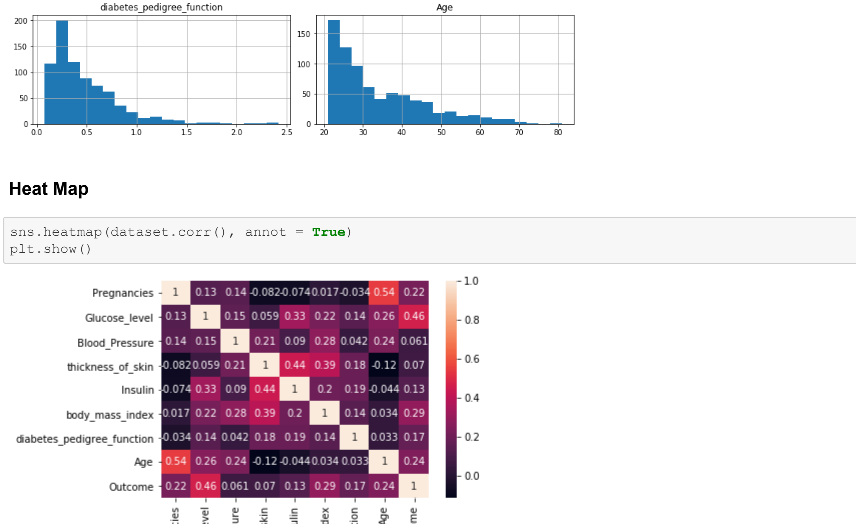
In [8]:
```
sns.countplot(x = 'Outcome',data = dataset)
```

Out[8]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x149aff0>
```



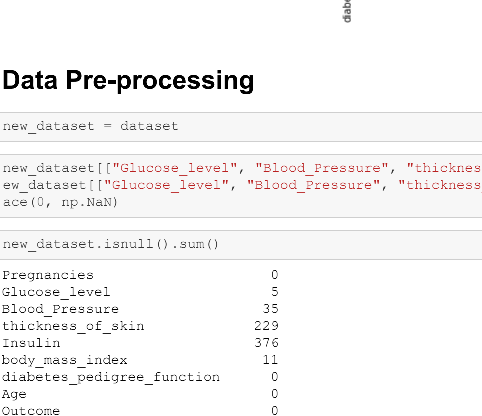
Histogram of each feature

In [9]:
```
import itertools
col = dataset.columns[:8]
plt.subplots(figsize = (20, 15))
length = len(col)
for i, j in itertools.zip_longest(col, range(length)):
    plt.subplot((length/2), 3, j + 1)
    plt.subplots_adjust(wspace = 0.1,hspace = 0.5)
    dataset[i].hist(bins = 20)
    plt.title(i)
plt.show()
```



Heat Map

In [10]:
```
sns.heatmap(dataset.corr(), annot = True)
plt.show()
```



Data Pre-processing

In [11]:
```
new_dataset = dataset
```

In [14]:
```
new_dataset[["Glucose_level", "Blood_Pressure", "thickness_of_skin", "Insulin", "body_mass_index"]] = n
ew_dataset[["Glucose_level", "Blood_Pressure", "thickness_of_skin", "Insulin", "body_mass_index"]].repl
ace(0, np.NaN)
```

In [16]:
```
new_dataset.isnull().sum()
```

Out[16]:
```
Pregnancies                     0
Glucose_level                   5
Blood_Pressure                 35
thickness_of_skin             229
Insulin                       376
body_mass_index                11
diabetes_pedigree_function      0
Age                             0
Outcome                         0
dtype: int64
```

In [17]:
```
new_dataset["Glucose_level"].fillna(new_dataset["Glucose_level"].mean(), inplace = True)
new_dataset["Blood_Pressure"].fillna(new_dataset["Blood_Pressure"].mean(), inplace = True)
new_dataset["thickness_of_skin"].fillna(new_dataset["thickness_of_skin"].mean(), inplace = True)
new_dataset["Insulin"].fillna(new_dataset["Insulin"].mean(), inplace = True)
new_dataset["body_mass_index"].fillna(new_dataset["body_mass_index"].mean(), inplace = True)
```

In [18]:
```
new_dataset.describe().T
```

Out[18]:

	count	mean	std	min	25%	50%	75%	max
Pregnancies	770.0	3.846753	3.365455	0.000	1.000	3.000000	6.000000	17.00
Glucose_level	770.0	121.637908	30.411284	44.000	100.000	117.000000	140.000000	199.00
Blood_Pressure	770.0	72.345578	12.135249	24.000	64.000	72.000000	80.000000	122.00
thickness_of_skin	770.0	29.153420	8.779503	7.000	25.000	29.153420	32.000000	99.00
Insulin	770.0	155.548223	84.910475	14.000	122.000	155.548223	155.548223	846.00
body_mass_index	770.0	32.441238	6.878091	18.200	27.500	32.400000	36.575000	67.10
diabetes_pedigree_function	770.0	0.471606	0.330947	0.078	0.244	0.372500	0.625500	2.42
Age	770.0	33.274026	11.763003	21.000	24.000	29.000000	41.000000	81.00
Outcome	770.0	0.350649	0.477483	0.000	0.000	0.000000	1.000000	1.00

In [19]:
```
from sklearn.preprocessing import MinMaxScaler
sc = MinMaxScaler(feature_range = (0, 1))
dataset_scaled = sc.fit_transform(new_dataset)
```

In [20]:
```
dataset_scaled = pd.DataFrame(dataset_scaled)
```

In [21]:
```
X = dataset_scaled.iloc[:, [1, 4, 5, 7]].values
Y = dataset_scaled.iloc[:, 8].values
```

In [23]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.20, random_state = 42, stratify
 = new_dataset['Outcome'] )
```

In [24]:
```
print("X_train shape:", X_train.shape)
print("X_test shape:", X_test.shape)
print("Y_train shape:", Y_train.shape)
print("Y_test shape:", Y_test.shape)
```

```
X_train shape: (616, 4)
X_test shape: (154, 4)
Y_train shape: (616,)
Y_test shape: (154,)
```

Data modeling

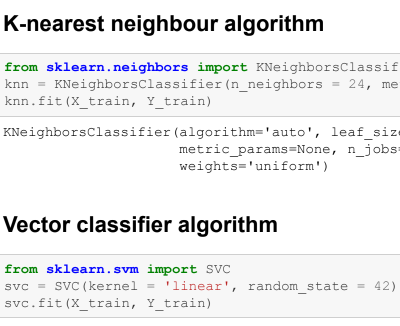
Logistic regression algorithm

In [25]:
```
from sklearn.linear_model import LogisticRegression
logreg = LogisticRegression(random_state = 42)
logreg.fit(X_train, Y_train)
```

Out[25]:
```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='warn', n_jobs=None, penalty='l2',
                   random_state=42, solver='warn', tol=0.0001, verbose=0,
                   warm_start=False)
```

In [27]:
```
from sklearn import metrics
from sklearn.neighbors import KNeighborsClassifier
X_axis = list(range(1, 31))
acc = pd.Series()
x = range(1,31)

for i in list(range(1, 31)):
    knn_model = KNeighborsClassifier(n_neighbors = i)
    knn_model.fit(X_train, Y_train)
    prediction = knn_model.predict(X_test)
    acc = acc.append(pd.Series(metrics.accuracy_score(prediction, Y_test)))
plt.plot(X_axis, acc)
plt.xticks(x)
plt.title("Best value for n_estimators")
plt.xlabel("n_estimators")
plt.ylabel("Accuracy")
plt.grid()
plt.show()
print('Highest value is given by -> ',acc.values.max())
```




```
Highest value is given by ->  0.7922077922077922
```

K-nearest neighbour algorithm

In [28]:
```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors = 24, metric = 'minkowski', p = 2)
knn.fit(X_train, Y_train)
```

Out[28]:
```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                     metric_params=None, n_jobs=None, n_neighbors=24, p=2,
                     weights='uniform')
```

Vector classifier algorithm

In [29]:
```
from sklearn.svm import SVC
svc = SVC(kernel = 'linear', random_state = 42)
svc.fit(X_train, Y_train)
```

Out[29]:
```
SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='linear', max_iter=-1, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=False)
```

Naive Bayes algorithm

In [30]:
```
from sklearn.naive_bayes import GaussianNB
nb = GaussianNB()
nb.fit(X_train, Y_train)
```

Out[30]:
```
GaussianNB(priors=None, var_smoothing=1e-09)
```

Decision tree algorithm

In [31]:
```
from sklearn.tree import DecisionTreeClassifier
dectree = DecisionTreeClassifier(criterion = 'entropy', random_state = 42)
dectree.fit(X_train, Y_train)
```

Out[31]:
```
DecisionTreeClassifier(class_weight=None, criterion='entropy', max_depth=None,
                       max_features=None, max_leaf_nodes=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, presort=False,
                       random_state=42, splitter='best')
```

Random Forest algorithm

In [32]:
```
from sklearn.ensemble import RandomForestClassifier
ranfor = RandomForestClassifier(n_estimators = 11, criterion = 'entropy', random_state = 42)
ranfor.fit(X_train, Y_train)
```

Out[32]:
```
RandomForestClassifier(bootstrap=True, class_weight=None, criterion='entropy',
                       max_depth=None, max_features='auto', max_leaf_nodes=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, n_estimators=11,
                       n_jobs=None, oob_score=False, random_state=42, verbose=0,
                       warm_start=False)
```

Predictions on dataset

In [33]:
```
Y_pred_logreg = logreg.predict(X_test)
Y_pred_knn = knn.predict(X_test)
Y_pred_svc = svc.predict(X_test)
Y_pred_nb = nb.predict(X_test)
Y_pred_dectree = dectree.predict(X_test)
Y_pred_ranfor = ranfor.predict(X_test)
```

Model Evaluation

In [34]:
```
from sklearn.metrics import accuracy_score
accuracy_logreg = accuracy_score(Y_test, Y_pred_logreg)
accuracy_knn = accuracy_score(Y_test, Y_pred_knn)
accuracy_svc = accuracy_score(Y_test, Y_pred_svc)
accuracy_nb = accuracy_score(Y_test, Y_pred_nb)
accuracy_dectree = accuracy_score(Y_test, Y_pred_dectree)
accuracy_ranfor = accuracy_score(Y_test, Y_pred_ranfor)
```

In [35]:
```
print("Logistic Regression: " + str(accuracy_logreg * 100))
print("K Nearest neighbors: " + str(accuracy_knn * 100))
print("Vector Classifier algorithm: " + str(accuracy_svc * 100))
print("Naive Bayes algorithm: " + str(accuracy_nb * 100))
print("Decision tree algorithm: " + str(accuracy_dectree * 100))
print("Random Forest: " + str(accuracy_ranfor * 100))
```

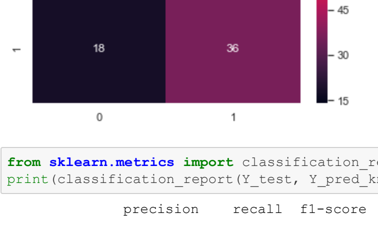
```
Logistic Regression: 72.72727272727273
K Nearest neighbors: 79.22077922077922
Vector Classifier algorithm: 73.37662337662337
Naive Bayes algorithm: 72.72727272727273
Decision tree algorithm: 68.83116883116884
Random Forest: 71.42857142857143
```

In [40]:
```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(Y_test, Y_pred_knn)
cm
```

Out[40]:
```
array([[86, 14],
       [18, 36]], dtype=int64)
```

In [41]:
```
sns.heatmap(pd.DataFrame(cm), annot=True)
```

Out[41]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x157accd0>
```



In [42]:
```
from sklearn.metrics import classification_report
print(classification_report(Y_test, Y_pred_knn))
```

```
              precision    recall  f1-score   support

         0.0       0.83      0.86      0.84       100
         1.0       0.72      0.67      0.69        54

    accuracy                           0.79       154
   macro avg       0.77      0.76      0.77       154
weighted avg       0.79      0.79      0.79       154
```

In [ ]: