Import Libraries

In [212…
```
import numpy as np
import pandas as pd
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns

import warnings
warnings.filterwarnings("ignore")
```

Import Dataset

In [4]:
```
dataset= pd.read_csv('health care diabetes.csv')
```

In [5]:
```
dataset.head()
```

Out[5]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age
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

In [6]:
```
dataset.shape
```

Out[6]:
```
(768, 9)
```

Project Task: Week 1 - Data Exploration and Missing Values Treatment

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

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

Since there is no null value.It means 0 represent as missing value, so let us find how many have missing value in pecentage.

In [8]:
```
(dataset['Glucose'][dataset['Glucose']==0].count()/768)*100
```

Out[8]:
```
0.6510416666666667
```

0.65 of data having missing value, so we can ignore it.

In [9]:
```
(dataset['BloodPressure'][dataset['BloodPressure']==0].count()/768)*100
```

Out[9]:
```
4.557291666666666
```

In [10]:
```
(dataset['SkinThickness'][dataset['SkinThickness']==0].count()/768)*100
```

Out[10]:
```
29.557291666666668
```

In [11]:
```
(dataset['Insulin'][dataset['Insulin']==0].count()/768)*100
```

Out[11]:
```
48.69791666666667
```

In [12]:
```
(dataset['BMI'][dataset['BMI']==0].count()/768)*100
```

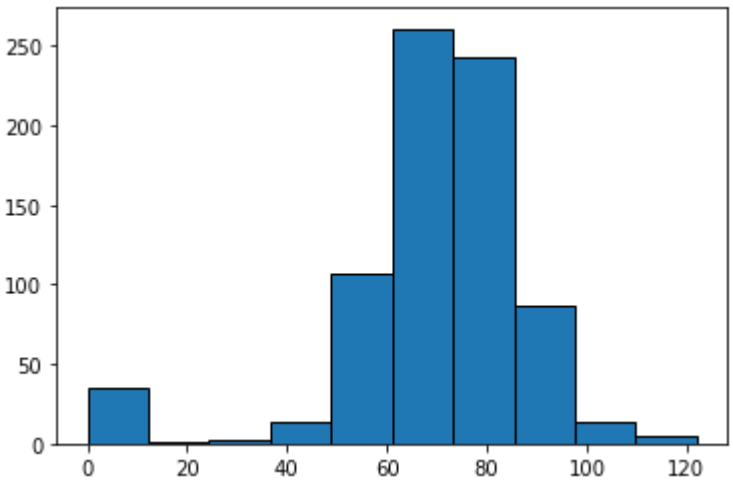
Out[12]:
```
1.4322916666666665
```

1.43 of data having missing value, so we can ignore it.

The data of BloodPressure, SkinThickness and Insulin having high missing value, so lets try to fill up.

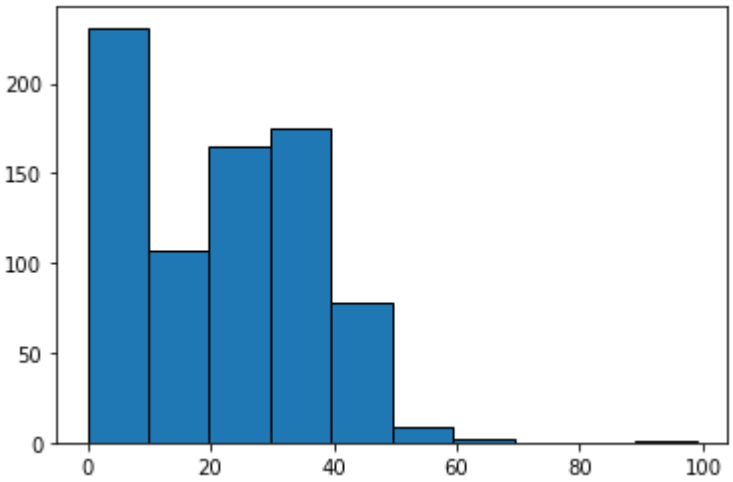
In [13]:
```
plt.hist(dataset['BloodPressure'],edgecolor='black')
```

Out[13]:
```
(array([ 35.,   1.,   2.,  13., 107., 261., 243.,  87.,  14.,   5.]),
 array([  0. ,  12.2,  24.4,  36.6,  48.8,  61. ,  73.2,  85.4,  97.6,
        109.8, 122. ]),
 <BarContainer object of 10 artists>)
```



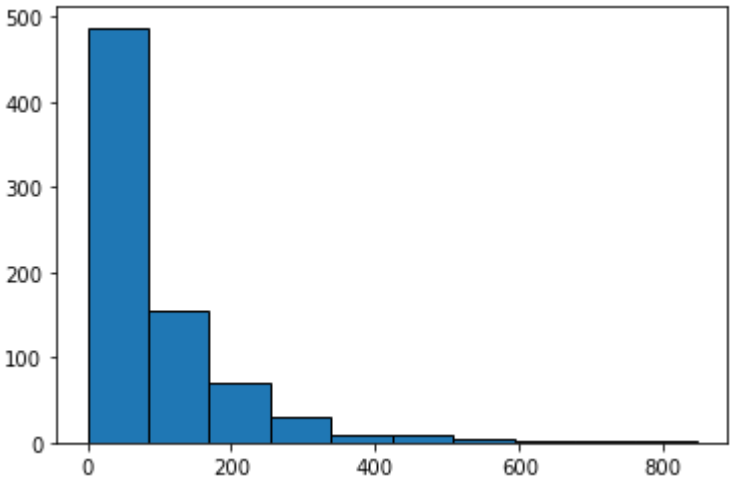
In [14]:
```
plt.hist(dataset['SkinThickness'],edgecolor='black')
```

Out[14]:
```
(array([231., 107., 165., 175.,  78.,   9.,   2.,   0.,   0.,   1.]),
 array([ 0. ,  9.9, 19.8, 29.7, 39.6, 49.5, 59.4, 69.3, 79.2, 89.1, 99. ]),
 <BarContainer object of 10 artists>)
```



In [15]:
```
plt.hist(dataset['Insulin'],edgecolor='black')
```

Out[15]:
```
(array([487., 155.,  70.,  30.,   8.,   9.,   5.,   1.,   2.,   1.]),
 array([  0. ,  84.6, 169.2, 253.8, 338.4, 423. , 507.6, 592.2, 676.8,
        761.4, 846. ]),
 <BarContainer object of 10 artists>)
```



In [16]:
```
dataset[dataset['BloodPressure']!=0]['BloodPressure'].describe()
```

Out[16]:
```
count    733.000000
mean      72.405184
std       12.382158
min       24.000000
25%       64.000000
50%       72.000000
75%       80.000000
max      122.000000
Name: BloodPressure, dtype: float64
```

In [17]:
```
dataset[dataset['SkinThickness']!=0]['SkinThickness'].describe()
```

Out[17]:
```
count    541.000000
mean      29.153420
std       10.476982
min        7.000000
25%       22.000000
50%       29.000000
75%       36.000000
max       99.000000
Name: SkinThickness, dtype: float64
```

In [18]:
```
dataset[dataset['Insulin']!=0]['Insulin'].describe()
```

Out[18]:
```
count    394.000000
mean     155.548223
std      118.775855
min       14.000000
25%       76.250000
50%      125.000000
75%      190.000000
max      846.000000
Name: Insulin, dtype: float64
```

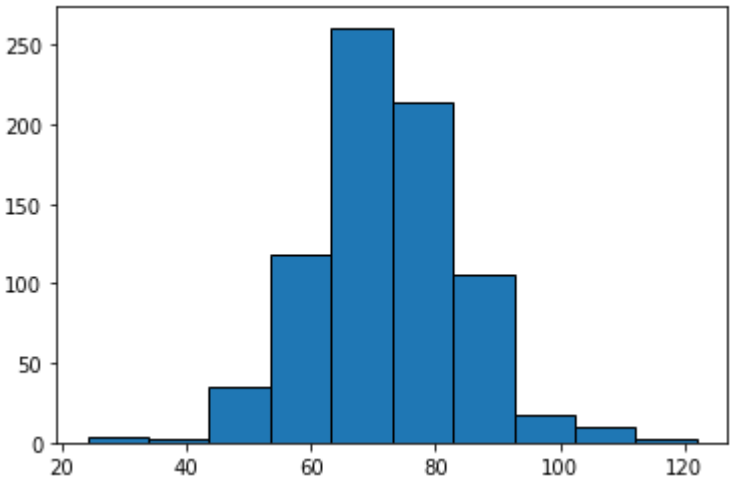
mean value of BloodPressure = 72.405184 ,mean value of SkinThickness = 29.153420, mean value of Insulin = 155.548223. Lets replace 0 with mean value.

In [19]:
```
from numpy import nan
dataset_imp = dataset.copy()
dataset_imp[['BloodPressure','SkinThickness','Insulin']]=dataset_imp[['BloodPressure',
```

In [20]:
```
dataset_imp.fillna(dataset_imp.mean(), inplace=True)
```

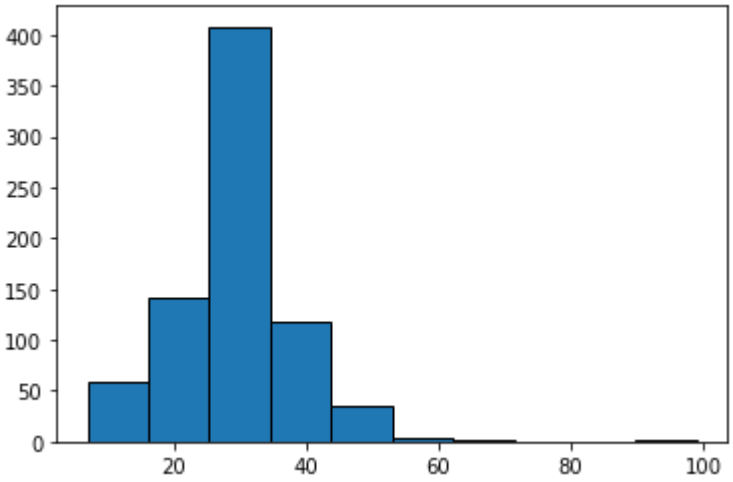
In [21]:
```
plt.hist(dataset_imp['BloodPressure'],edgecolor='black')
```

Out[21]:
```
(array([  3.,   2.,  35., 118., 261., 214., 105.,  18.,  10.,   2.]),
 array([ 24. ,  33.8,  43.6,  53.4,  63.2,  73. ,  82.8,  92.6, 102.4,
        112.2, 122. ]),
 <BarContainer object of 10 artists>)
```



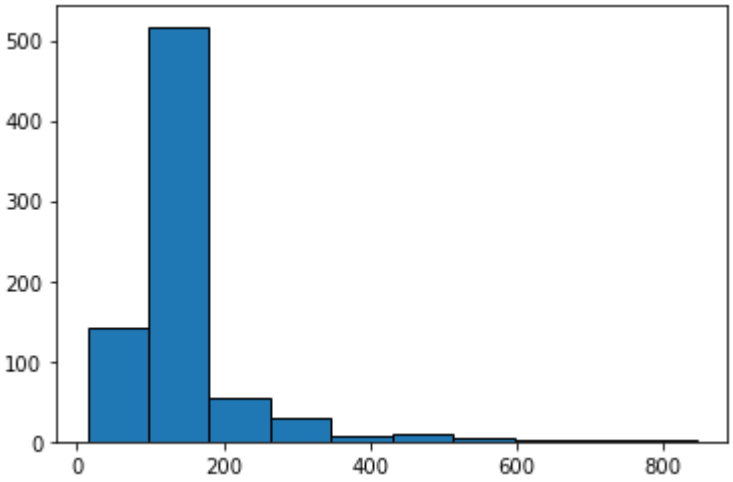
In [22]:
```
plt.hist(dataset_imp['SkinThickness'],edgecolor='black')
```

Out[22]:
```
(array([ 59., 141., 408., 118.,  36.,   4.,   1.,   0.,   0.,   1.]),
 array([ 7. , 16.2, 25.4, 34.6, 43.8, 53. , 62.2, 71.4, 80.6, 89.8, 99. ]),
 <BarContainer object of 10 artists>)
```



In [23]:
```
plt.hist(dataset_imp['Insulin'],edgecolor='black')
```

Out[23]:
```
(array([142., 517.,  55.,  29.,   7.,  10.,   4.,   1.,   2.,   1.]),
 array([ 14. ,  97.2, 180.4, 263.6, 346.8, 430. , 513.2, 596.4, 679.6,
        762.8, 846. ]),
 <BarContainer object of 10 artists>)
```



In [24]:
```
dataset.describe()
```

Out[24]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigr
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	

In [25]:
```
dataset_imp.describe()
```

Out[25]:

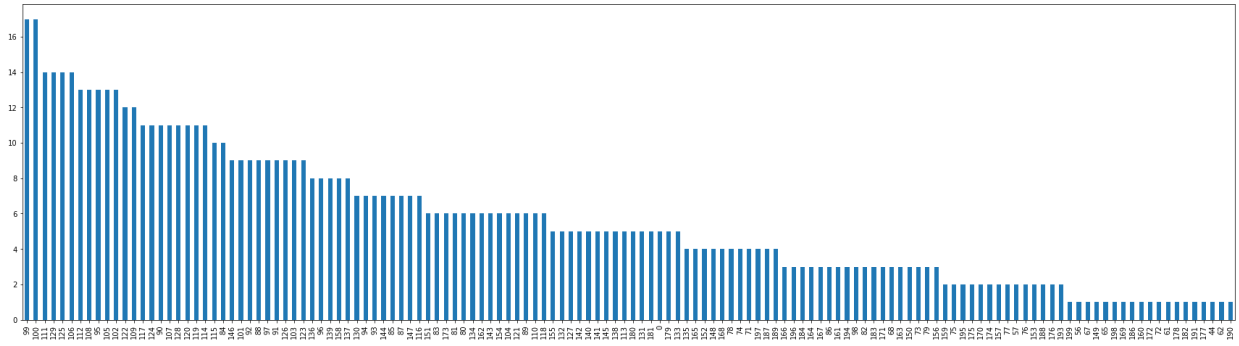
	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigr
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	
mean	3.845052	120.894531	72.405184	29.153420	155.548223	31.992578	
std	3.369578	31.972618	12.096346	8.790942	85.021108	7.884160	
min	0.000000	0.000000	24.000000	7.000000	14.000000	0.000000	
25%	1.000000	99.000000	64.000000	25.000000	121.500000	27.300000	
50%	3.000000	117.000000	72.202592	29.153420	155.548223	32.000000	
75%	6.000000	140.250000	80.000000	32.000000	155.548223	36.600000	
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	

In [26]:
```
dataset_imp.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    float64
 3   SkinThickness             768 non-null    float64
 4   Insulin                   768 non-null    float64
 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(5), int64(4)
memory usage: 54.1 KB
```

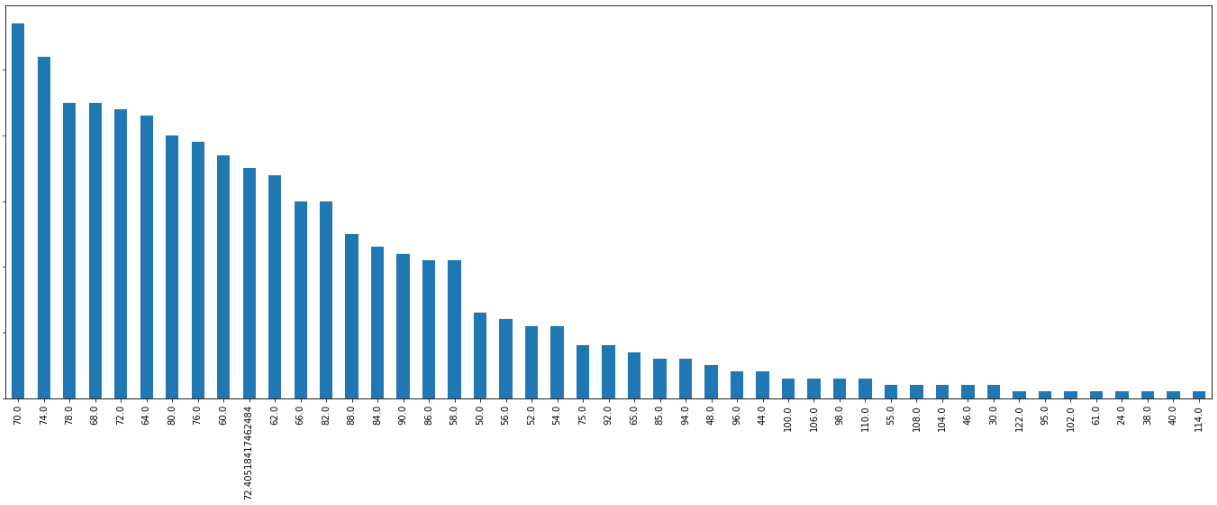
In [27]:
```
dataset_imp['Glucose'].value_counts().plot.bar(figsize=(30,8))
```

Out[27]:
```
<AxesSubplot:>
```



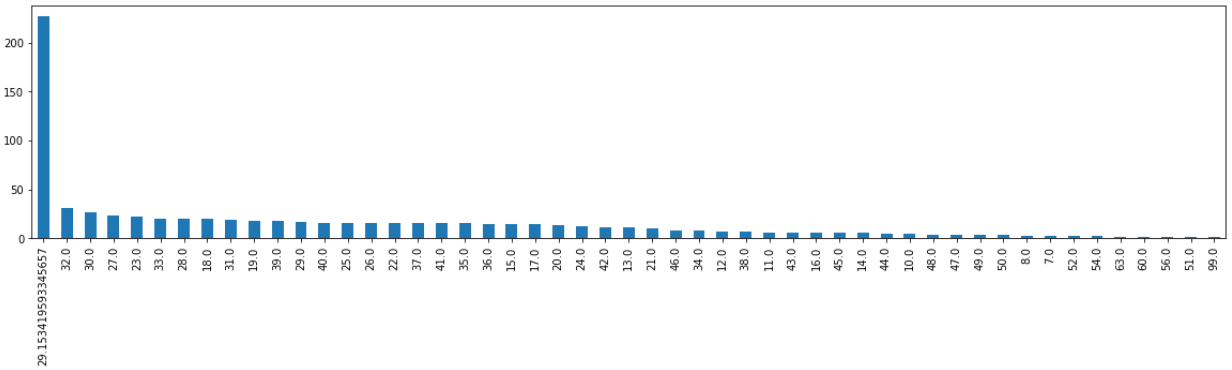
In [28]:
```
dataset_imp['BloodPressure'].value_counts().plot.bar(figsize=(24,8))
```

Out[28]:
```
<AxesSubplot:>
```



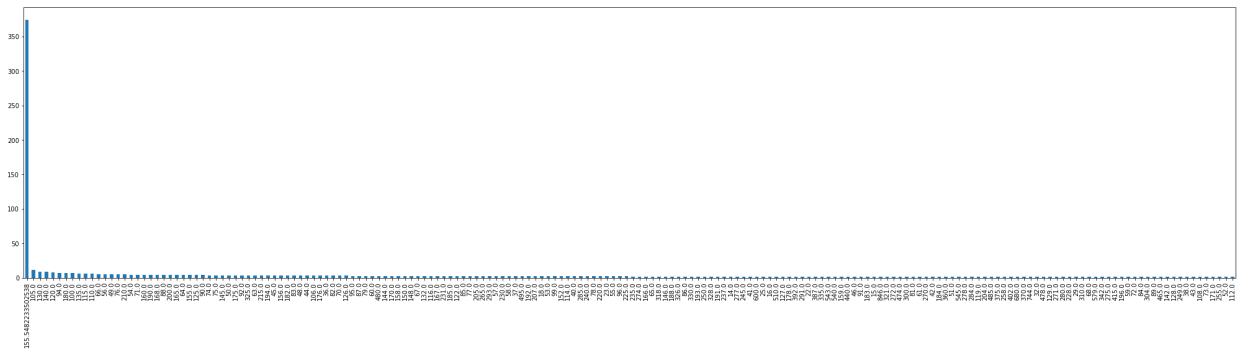
In [29]:
```
dataset_imp['SkinThickness'].value_counts().plot.bar(figsize=(20,4))
```

Out[29]: <AxesSubplot:>



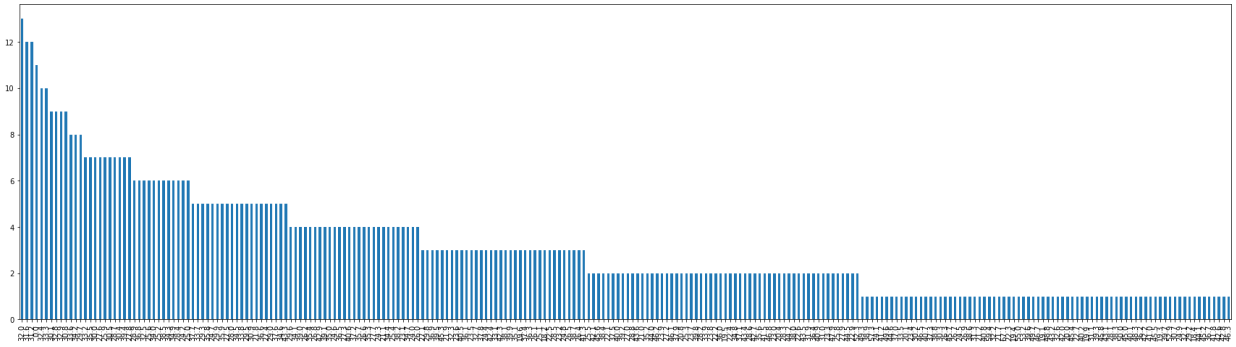
In [30]:
```
dataset_imp['Insulin'].value_counts().plot.bar(figsize=(35,8))
```

Out[30]: <AxesSubplot:>



In [31]:
```
dataset_imp['BMI'].value_counts().plot.bar(figsize=(30,8))
```

Out[31]: <AxesSubplot:>



Project Task: Week 2 - Data Exploration and Analysis, Plots.

In [32]:
```
Positive=dataset_imp[dataset_imp['Outcome']==1]
```

In [33]:
```
Positive.head()
```

Out[33]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	A
0	6	148	72.0	35.00000	155.548223	33.6	0.627	
2	8	183	64.0	29.15342	155.548223	23.3	0.672	
4	0	137	40.0	35.00000	168.000000	43.1	2.288	
6	3	78	50.0	32.00000	88.000000	31.0	0.248	
8	2	197	70.0	45.00000	543.000000	30.5	0.158	

In [34]:
```
Negative=dataset_imp[dataset_imp['Outcome']==0]
```

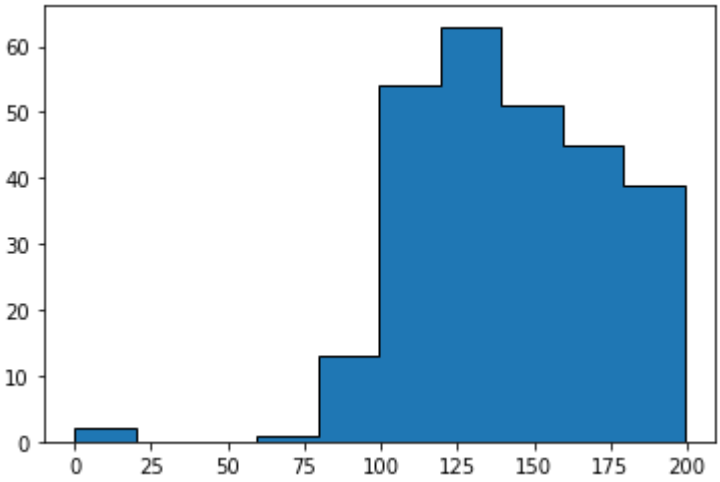
In [35]:
```
Negative.head()
```

Out[35]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction
1	1	85	66.000000	29.00000	155.548223	26.6	0.351
3	1	89	66.000000	23.00000	94.000000	28.1	0.167
5	5	116	74.000000	29.15342	155.548223	25.6	0.201
7	10	115	72.405184	29.15342	155.548223	35.3	0.134
10	4	110	92.000000	29.15342	155.548223	37.6	0.191

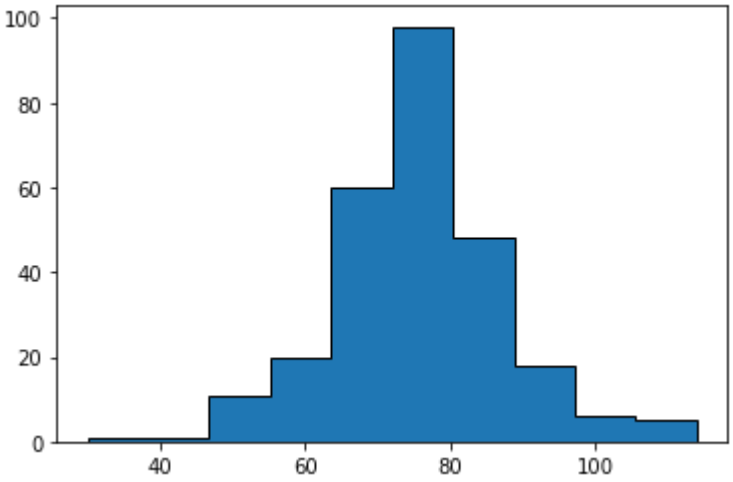
In [36]:
```
plt.hist(Positive['Glucose'],histtype='stepfilled',edgecolor='Black')
```

Out[36]:
```
(array([ 2.,  0.,  0.,  1., 13., 54., 63., 51., 45., 39.]),
 array([  0. ,  19.9,  39.8,  59.7,  79.6,  99.5, 119.4, 139.3, 159.2,
        179.1, 199. ]),
 [<matplotlib.patches.Polygon at 0x20e9e575940>])
```



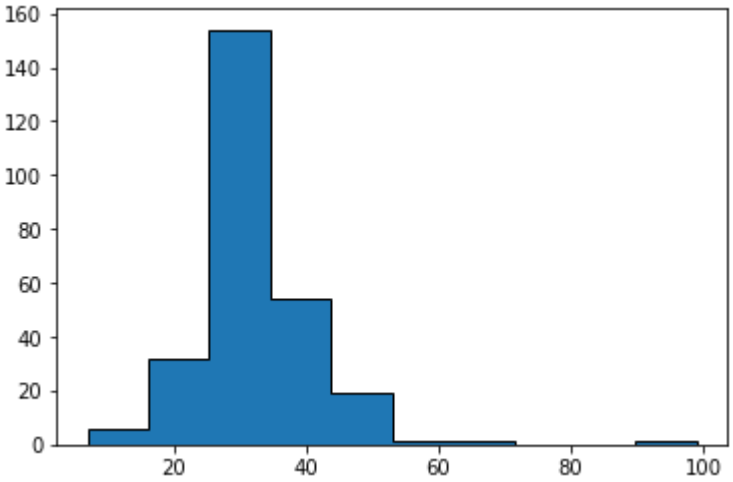
In [37]:
```
plt.hist(Positive['BloodPressure'],histtype='stepfilled',edgecolor='Black')
```

Out[37]:
```
(array([ 1.,  1., 11., 20., 60., 98., 48., 18.,  6.,  5.]),
 array([ 30. ,  38.4,  46.8,  55.2,  63.6,  72. ,  80.4,  88.8,  97.2,
        105.6, 114. ]),
 [<matplotlib.patches.Polygon at 0x20e9e5edc40>])
```



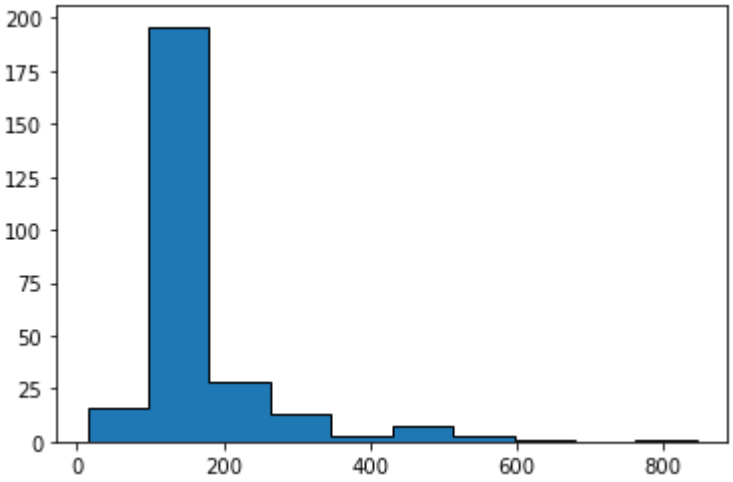
In [38]:
```
plt.hist(Positive['SkinThickness'],histtype='stepfilled',edgecolor='Black')
```

Out[38]:
```
(array([  6.,  32., 154.,  54.,  19.,   1.,   1.,   0.,   0.,   1.]),
 array([ 7. , 16.2, 25.4, 34.6, 43.8, 53. , 62.2, 71.4, 80.6, 89.8, 99. ]),
 [<matplotlib.patches.Polygon at 0x20e9eab2df0>])
```



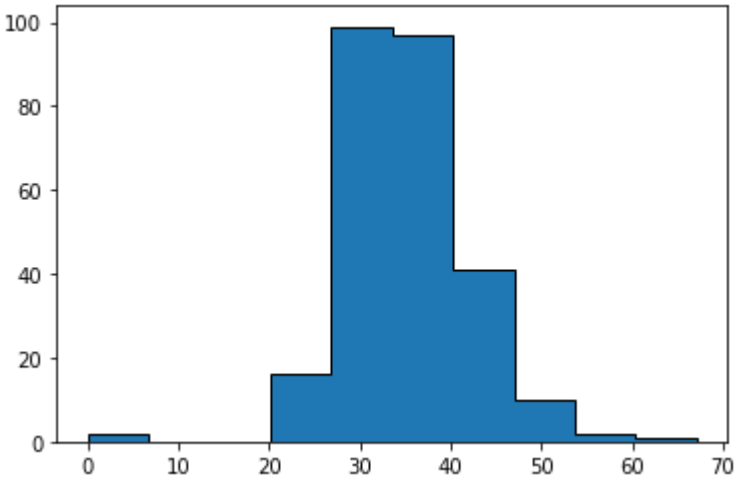
In [39]:
```
plt.hist(Positive['Insulin'],histtype='stepfilled',edgecolor='Black')
```

Out[39]:
```
(array([ 16., 196.,  28.,  13.,   3.,   7.,   3.,   1.,   0.,   1.]),
 array([ 14. ,  97.2, 180.4, 263.6, 346.8, 430. , 513.2, 596.4, 679.6,
        762.8, 846. ]),
 [<matplotlib.patches.Polygon at 0x20e9eb1a6d0>])
```



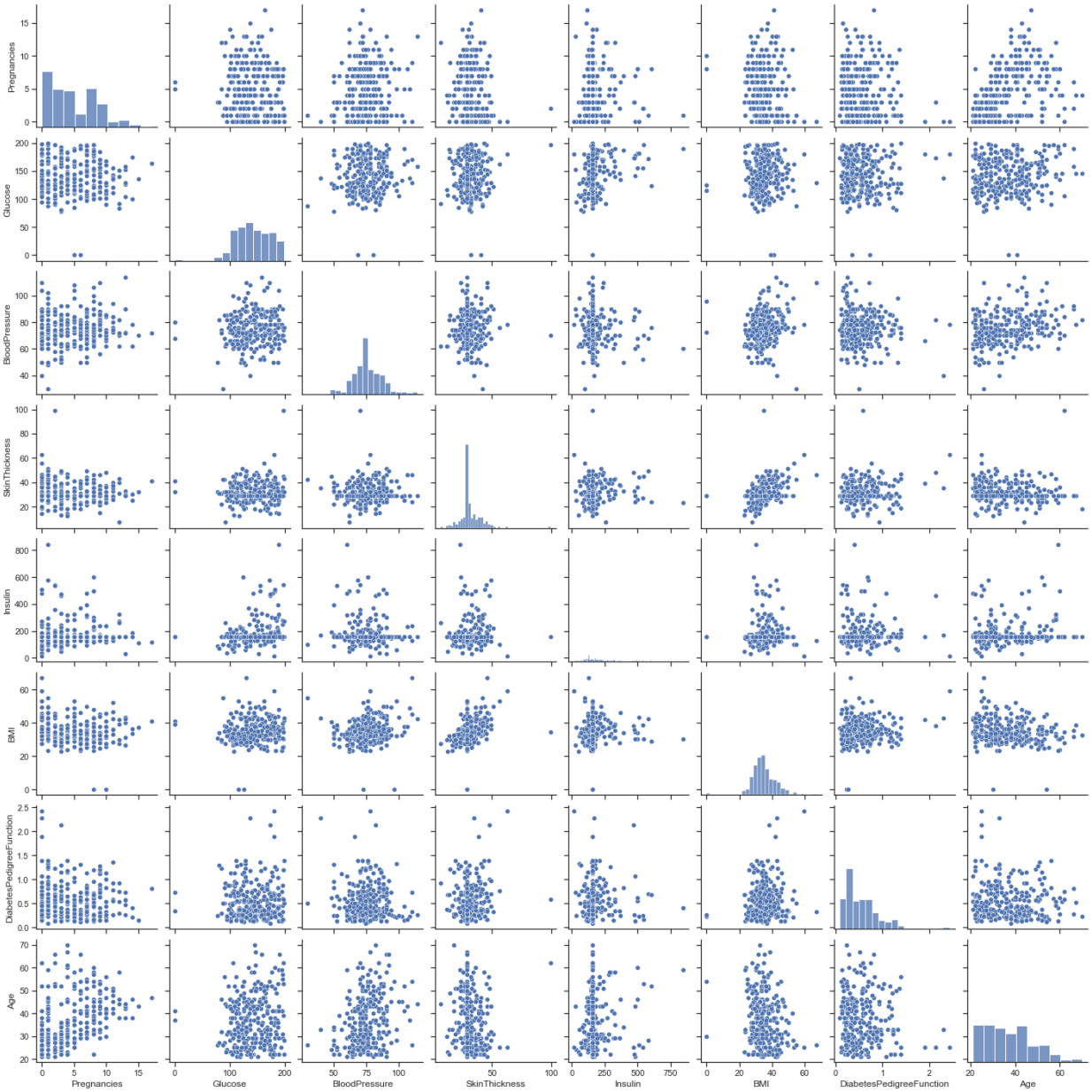
In [40]:
```
plt.hist(Positive['BMI'],histtype='stepfilled',edgecolor='Black')
```

Out[40]:
```
(array([ 2.,  0.,  0., 16., 99., 97., 41., 10.,  2.,  1.]),
 array([ 0.  ,  6.71, 13.42, 20.13, 26.84, 33.55, 40.26, 46.97, 53.68,
        60.39, 67.1 ]),
 [<matplotlib.patches.Polygon at 0x20e9eb7af70>])
```

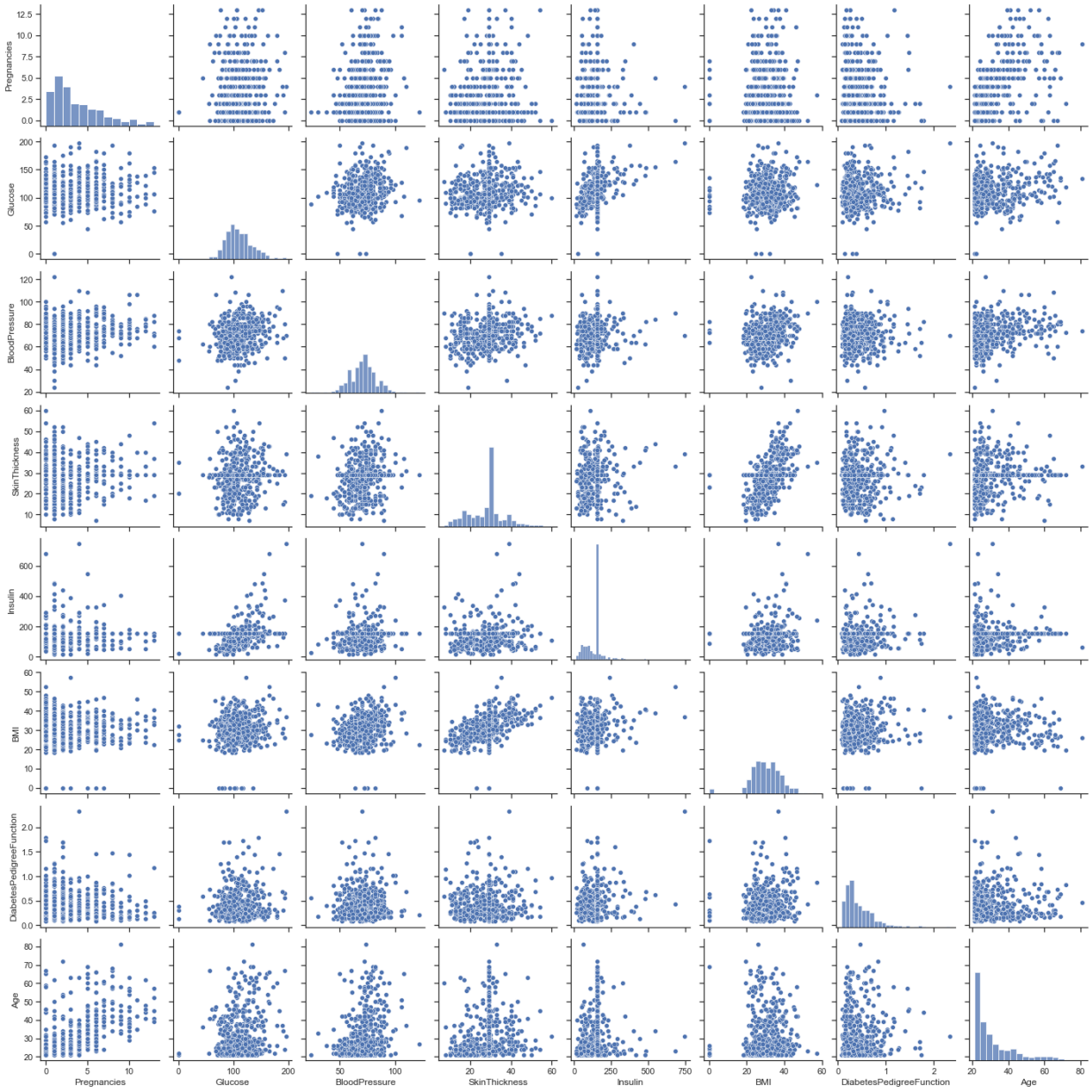


In [41]:
```
sns.set(style="ticks", color_codes=True)
g = sns.pairplot(dataset_imp,hue="Outcome")
```

In [42]:
```
sns.set(style="ticks", color_codes=True)
g = sns.pairplot(Positive[['Pregnancies','Glucose','BloodPressure','SkinThickness','In
```



In [43]:
```
sns.set(style="ticks", color_codes=True)
g = sns.pairplot(Negative[['Pregnancies','Glucose','BloodPressure','SkinThickness','In
```



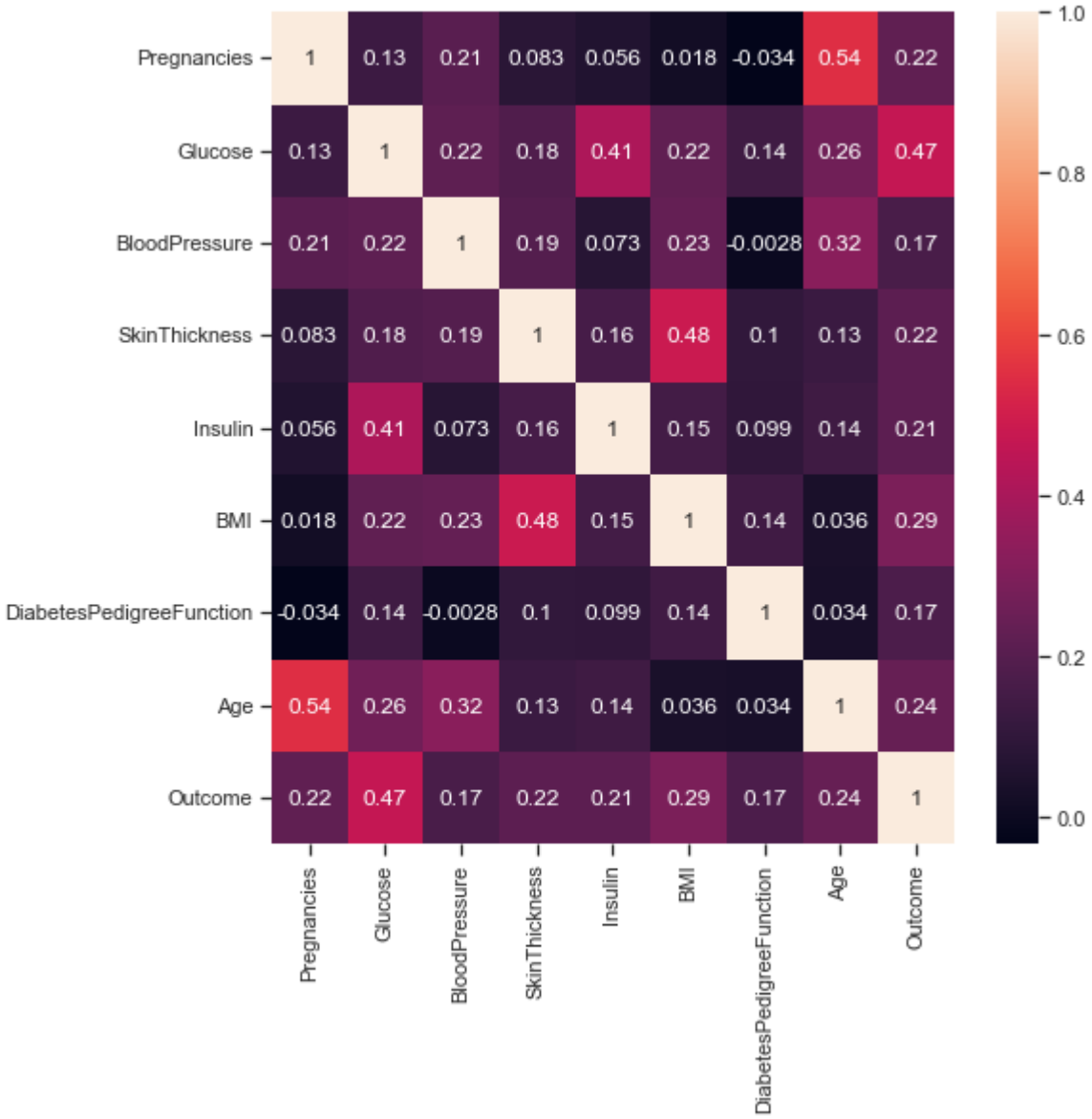
In [44]:
```
dataset_imp.corr()
```

Out[44]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	D
Pregnancies	1.000000	0.129459	0.208522	0.082989	0.056027	0.017683	
Glucose	0.129459	1.000000	0.217728	0.182455	0.407699	0.221071	
BloodPressure	0.208522	0.217728	1.000000	0.192816	0.072517	0.233123	
SkinThickness	0.082989	0.182455	0.192816	1.000000	0.158139	0.480496	
Insulin	0.056027	0.407699	0.072517	0.158139	1.000000	0.149468	
BMI	0.017683	0.221071	0.233123	0.480496	0.149468	1.000000	
DiabetesPedigreeFunction	-0.033523	0.137337	-0.002763	0.100966	0.098634	0.140647	
Age	0.544341	0.263514	0.324595	0.127872	0.136734	0.036242	
Outcome	0.221898	0.466581	0.166074	0.215299	0.214411	0.292695	

In [45]:
```
plt.subplots(figsize=(8,8))
sns.heatmap(dataset_imp.corr(),annot=True)
```

Out[45]:
```
<AxesSubplot:>
```



Correlation Results :

1)There are not much multicolinearity 2)Pregnancies and Age have some positive corelation 3)Glucose has some postive corelation with the outcome variable 4)Skin thickness and BMI has some positive corelation 5)Insulin and Glucose has some positive corelation

Project Task: Week 3 - Data Modelling

In [47]:
```
features = dataset_imp.iloc[:,[0,1,2,3,4,5,6,7]].values
label = dataset_imp.iloc[:,8].values
```

Train test split

In [133…
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(features,label,test_size=0.2,random_s
```

Logistic Regression Model

In [100…
```
#Create model
from sklearn.linear_model import LogisticRegression
logRegModel = LogisticRegression()
logRegModel.fit(x_train,y_train)
```

```
C:\Users\Satyajeet Himanshu\anaconda3\lib\site-packages\sklearn\linear_model\_logisti
c.py:814: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Out[100]:
```
LogisticRegression()
```

In [178…
```
y_pred = logRegModel.predict(x_test)
```

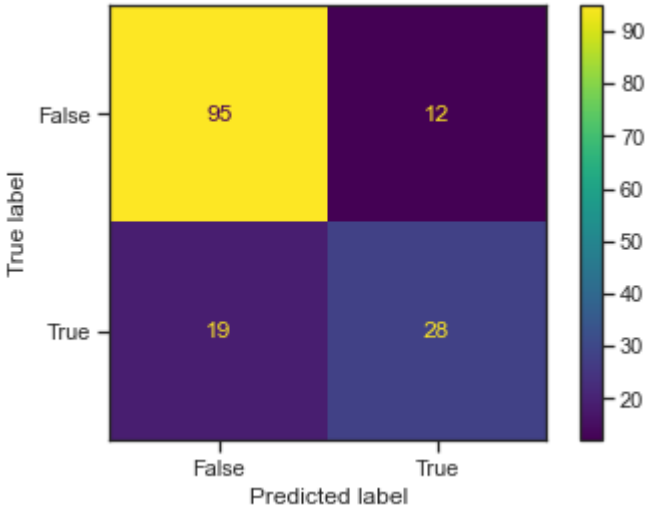
In [179…
```
y_pred
```

Out[179]:
```
array([1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1,
       1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1,
       1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1,
       1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1,
       0, 0, 1, 0, 1, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0,
       0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0],
      dtype=int64)
```

In [180…
```
y_test
```

Out[180]:
```
array([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, 0, 1, 1, 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, 0, 1, 0,
       1, 0, 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, 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],
      dtype=int64)
```

In [182…
```
import matplotlib.pyplot as plt
from sklearn import metrics
confusion_matrix = metrics.confusion_matrix(y_test,y_pred)
confusion_matrix = metrics.ConfusionMatrixDisplay(confusion_matrix = confusion_matrix,
confusion_matrix.plot()
plt.show()
```



In [183…
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred)
```

Out[183]:
```
0.7987012987012987
```

In [184…
```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.83      0.89      0.86       107
           1       0.70      0.60      0.64        47

    accuracy                           0.80       154
   macro avg       0.77      0.74      0.75       154
weighted avg       0.79      0.80      0.79       154
```

Decision Tree Model

In [134…
```
from sklearn.tree import DecisionTreeClassifier
dtree=DecisionTreeClassifier()
dtree.fit(x_train,y_train)
```

Out[134]:
```
DecisionTreeClassifier()
```

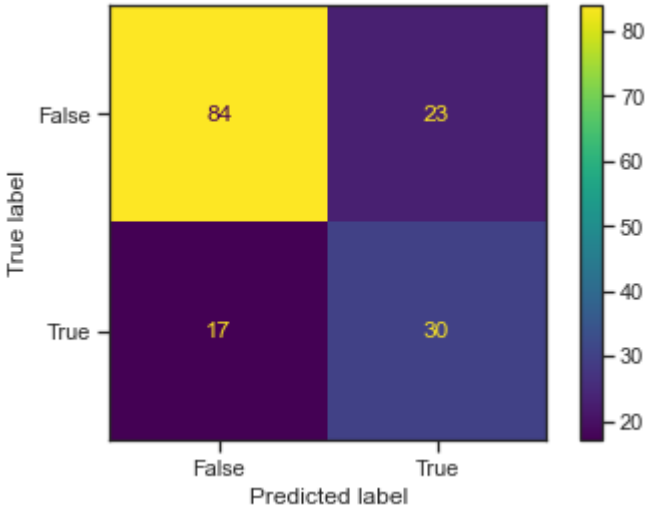
In [185…
```
y_pred2 = dtree.predict(x_test)
```

In [186…
```
y_pred2
```

Out[186]:
```
array([1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0,
       0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0,
       1, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 0,
       0, 0, 0, 1, 0, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 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, 0,
       1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0],
      dtype=int64)
```

In [187…
```
import matplotlib.pyplot as plt
```

```
from sklearn import metrics
confusion_matrix = metrics.confusion_matrix(y_test,y_pred2)
confusion_matrix = metrics.ConfusionMatrixDisplay(confusion_matrix = confusion_matrix,
confusion_matrix.plot()
plt.show()
```



In [189…
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred2)
```

Out[189]:
```
0.7402597402597403
```

In [190…
```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred2))
```

```
              precision    recall  f1-score   support

           0       0.83      0.79      0.81       107
           1       0.57      0.64      0.60        47

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

Random Forest Model

In [191…
```
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier(n_estimators=60)
rfc.fit(x_train,y_train)
```

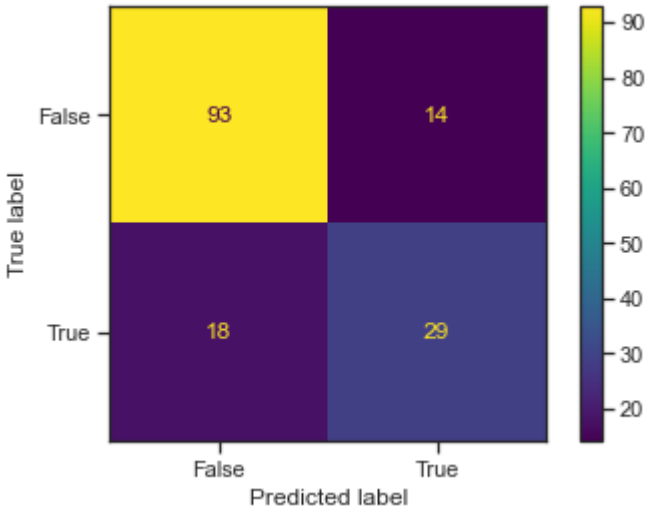
Out[191]:
```
RandomForestClassifier(n_estimators=60)
```

In [192…
```
y_pred3 = rfc.predict(x_test)
```

In [193…
```
y_pred3
```

Out[193]:
```
array([1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1,
       1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0,
       1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       0, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
       0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0],
      dtype=int64)
```

In [195…
```
import matplotlib.pyplot as plt
from sklearn import metrics
confusion_matrix = metrics.confusion_matrix(y_test,y_pred3)
confusion_matrix = metrics.ConfusionMatrixDisplay(confusion_matrix = confusion_matrix,
confusion_matrix.plot()
plt.show()
```



In [197…
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred3)
```

Out[197]:
```
0.7922077922077922
```

In [198…
```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred2))
```

```
              precision    recall  f1-score   support

           0       0.83      0.79      0.81       107
           1       0.57      0.64      0.60        47

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

KNN Model

In [170…
```
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=3)
knn.fit(x_train,y_train)
```

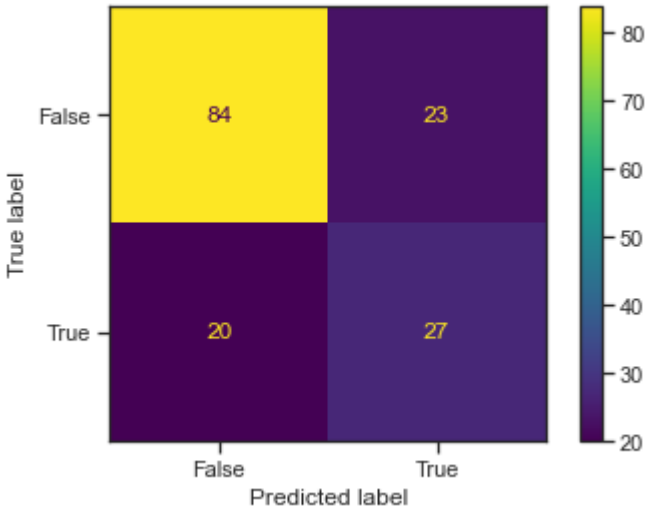
Out[170]:
```
KNeighborsClassifier(n_neighbors=3)
```

In [173…
```
y_pred4 = knn.predict(x_test)
```

In [174…
```
y_pred4
```

Out[174]:
```
array([1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 0, 1,
       1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 1,
       1, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       0, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0,
       0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0],
      dtype=int64)
```

In [175…
```
import matplotlib.pyplot as plt
from sklearn import metrics
confusion_matrix = metrics.confusion_matrix(y_test,y_pred4)
confusion_matrix = metrics.ConfusionMatrixDisplay(confusion_matrix = confusion_matrix,
confusion_matrix.plot()
plt.show()
```



In [176…
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred3)
```

Out[176]:
```
0.8116883116883117
```

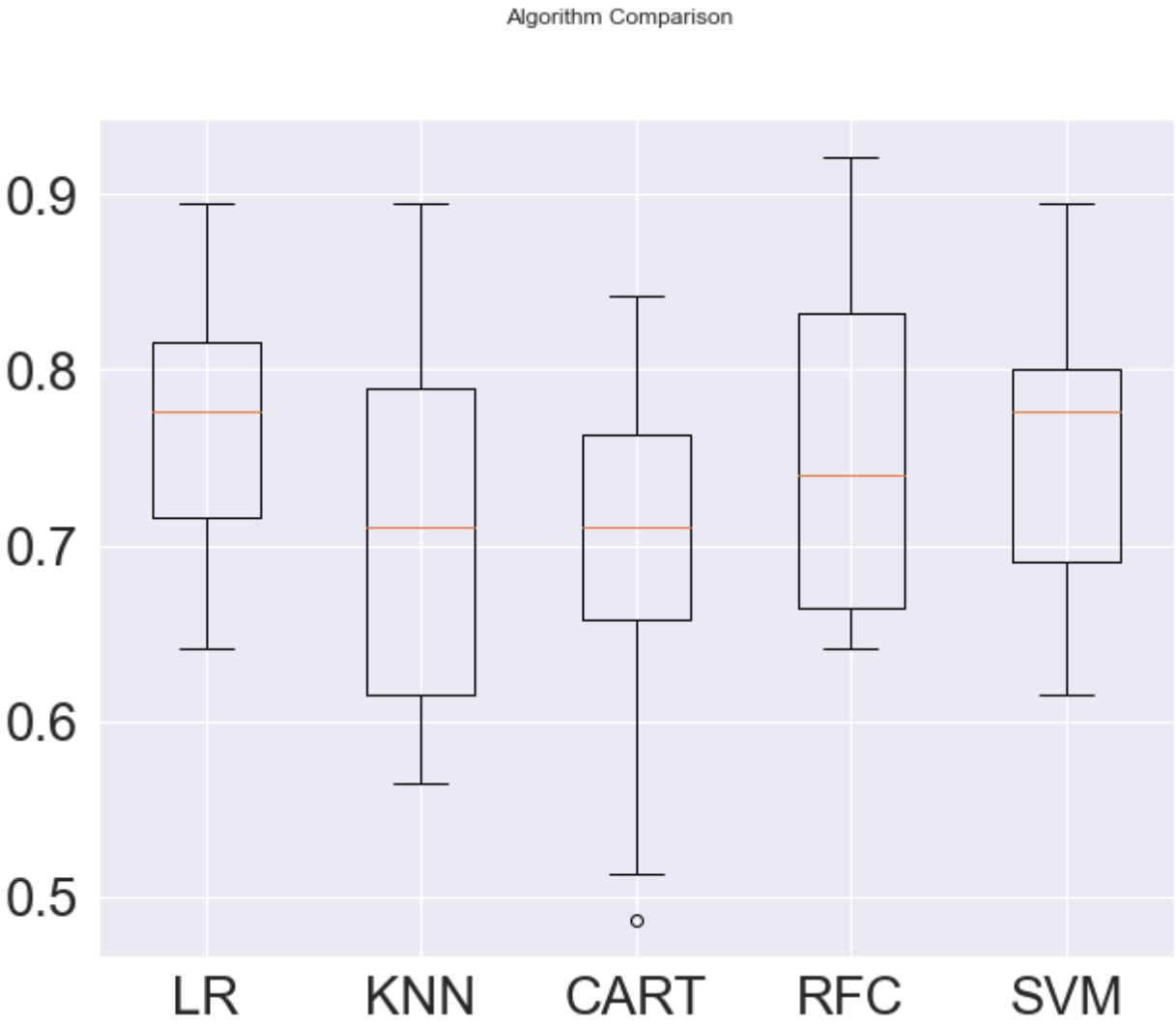
In [177…
```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred2))
```

```
              precision    recall  f1-score   support

           0       0.83      0.79      0.81       107
           1       0.57      0.64      0.60        47

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

In [232…
```
# Compare Algorithms
import pandas
import matplotlib.pyplot as plt
from sklearn import model_selection
```

```
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
# load dataset

array = dataset_imp.values
X = array[:,0:8]
Y = array[:,8]
# prepare configuration for cross validation test harness
seed = 7
# prepare models
models = []
models.append(('LR', LogisticRegression()))
models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier()))
models.append(('RFC', RandomForestClassifier()))
models.append(('SVM', SVC()))
# evaluate each model in turn
results = []
names = []
scoring = 'accuracy'
for name, model in models:
    kfold = model_selection.KFold(n_splits=20, random_state=None)
    cv_results = model_selection.cross_val_score(model, X, Y, cv=kfold, scoring=scorin
    results.append(cv_results)
    names.append(name)
    msg = "%s: %f (%f)" % (name, cv_results.mean(), cv_results.std())
    print(msg)
# boxplot algorithm comparison
fig = plt.figure(figsize=(10,8))
fig.suptitle('Algorithm Comparison')
ax = fig.add_subplot(111)
plt.boxplot(results)
ax.set_xticklabels(names)
plt.show()
```

```
LR: 0.764642 (0.067946)
KNN: 0.708839 (0.089025)
CART: 0.695918 (0.090867)
RFC: 0.760931 (0.098413)
SVM: 0.758266 (0.075581)
```



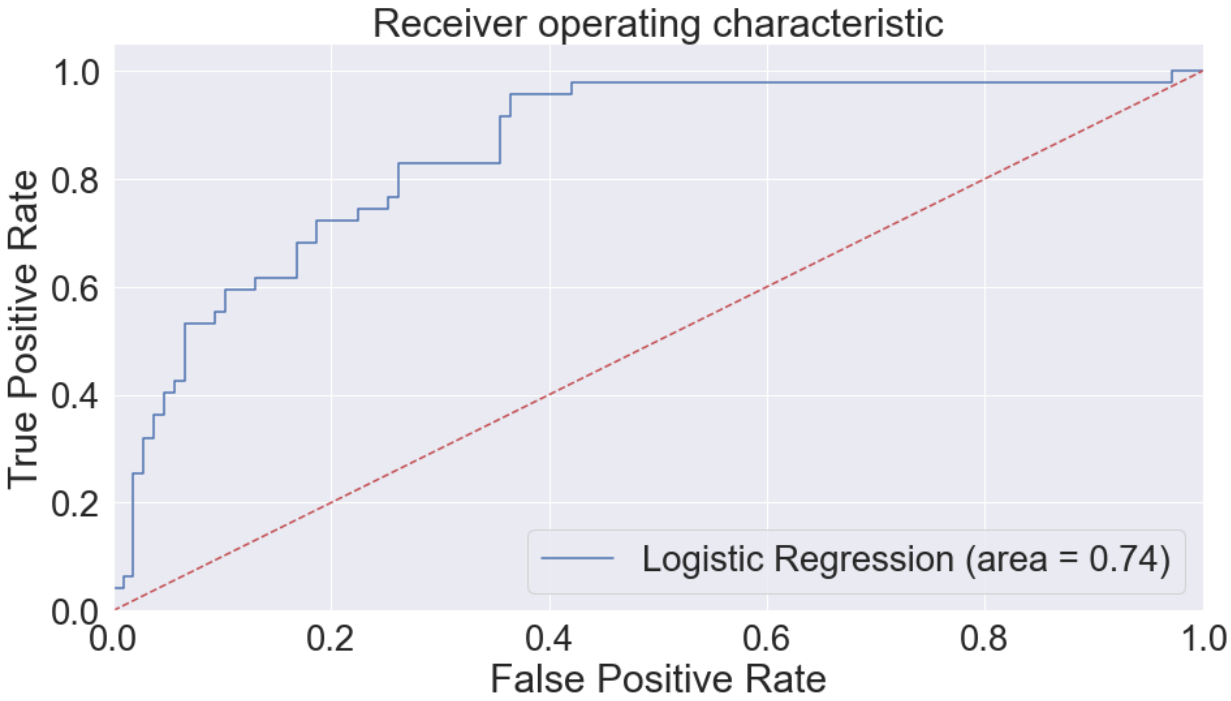
Project Task: Week 4 - Data Modelling

Logistic Regression

In [255…

```
from sklearn.metrics import roc_auc_score
from sklearn.metrics import roc_curve
logit_roc_auc = roc_auc_score(y_test, logRegModel.predict(x_test))
fpr, tpr, thresholds = roc_curve(y_test, logRegModel.predict_proba(x_test)[:,1])
plt.figure(figsize=(15,8))
plt.plot(fpr, tpr, label='Logistic Regression (area = %0.2f)' % logit_roc_auc)
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic')
plt.legend(loc="lower right")
plt.savefig('Log_ROC')
print('AUC: %.3f' % logit_roc_auc)
plt.show()
```

```
AUC: 0.742
```

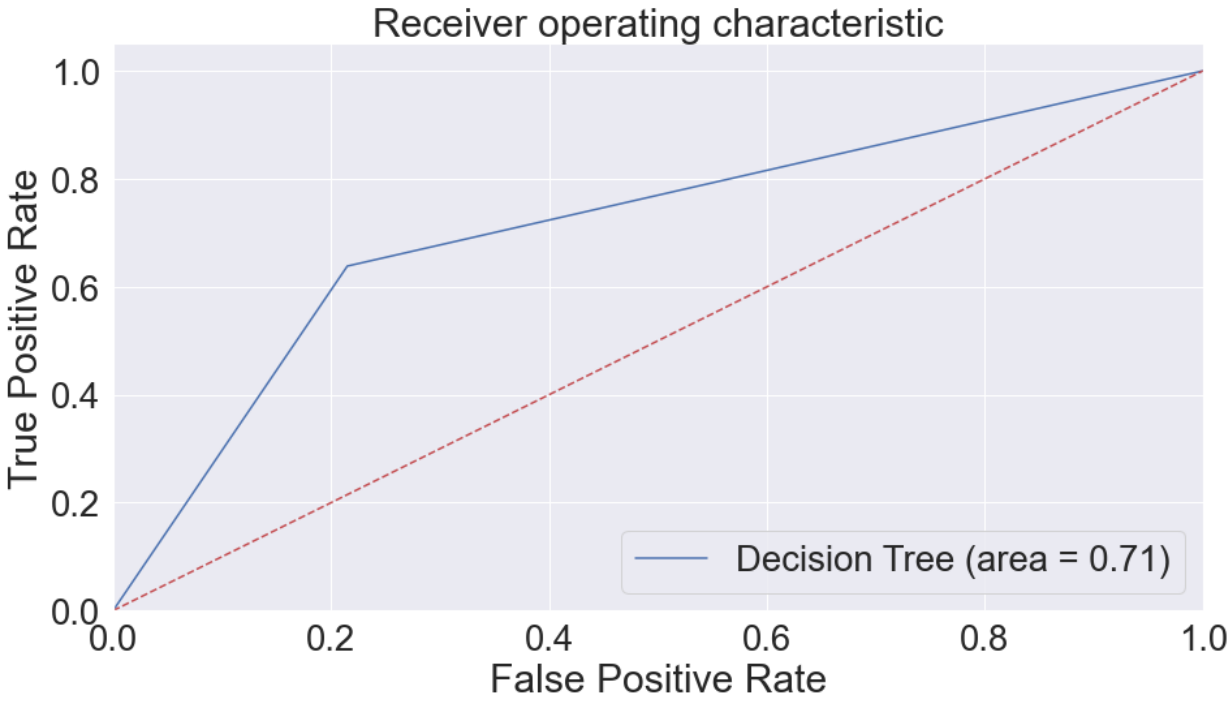


Decision Tree Model

In [254…

```
from sklearn.metrics import roc_auc_score
from sklearn.metrics import roc_curve
dt_roc_auc = roc_auc_score(y_test, dtree.predict(X_test))
fpr, tpr, thresholds = roc_curve(y_test, dtree.predict_proba(x_test)[:,1])
plt.figure(figsize=(15,8))
plt.plot(fpr, tpr, label='Decision Tree (area = %0.2f)' % dt_roc_auc)
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic')
plt.legend(loc="lower right")
plt.savefig('DT_ROC')
print('AUC: %.3f' % dt_roc_auc)
plt.show()
```

```
AUC: 0.712
```

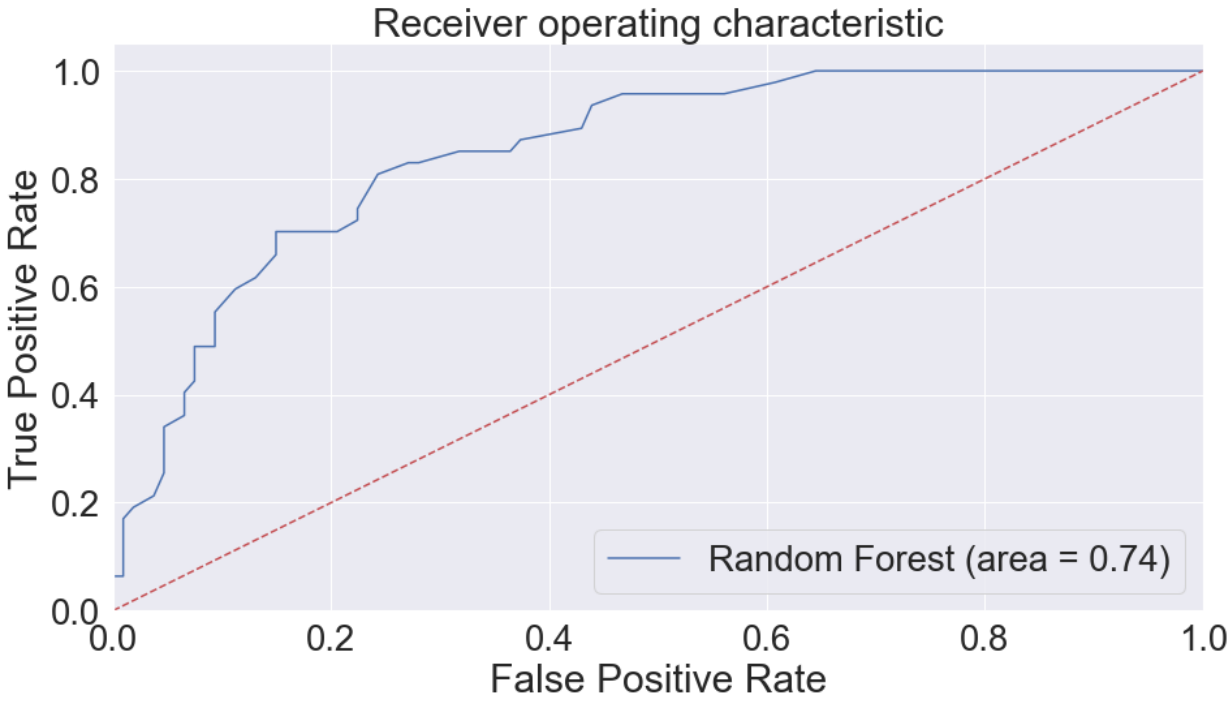


Random Forest Model

In [253…

```
from sklearn.metrics import roc_auc_score
from sklearn.metrics import roc_curve
rf_roc_auc = roc_auc_score(y_test, rfc.predict(x_test))
fpr, tpr, thresholds = roc_curve(y_test, rfc.predict_proba(x_test)[:,1])
plt.figure(figsize=(15,8))
plt.plot(fpr, tpr, label='Random Forest (area = %0.2f)' % rf_roc_auc)
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic')
plt.legend(loc="lower right")
plt.savefig('RF_ROC')
print('AUC: %.3f' % rf_roc_auc)
plt.show()
```

```
AUC: 0.743
```

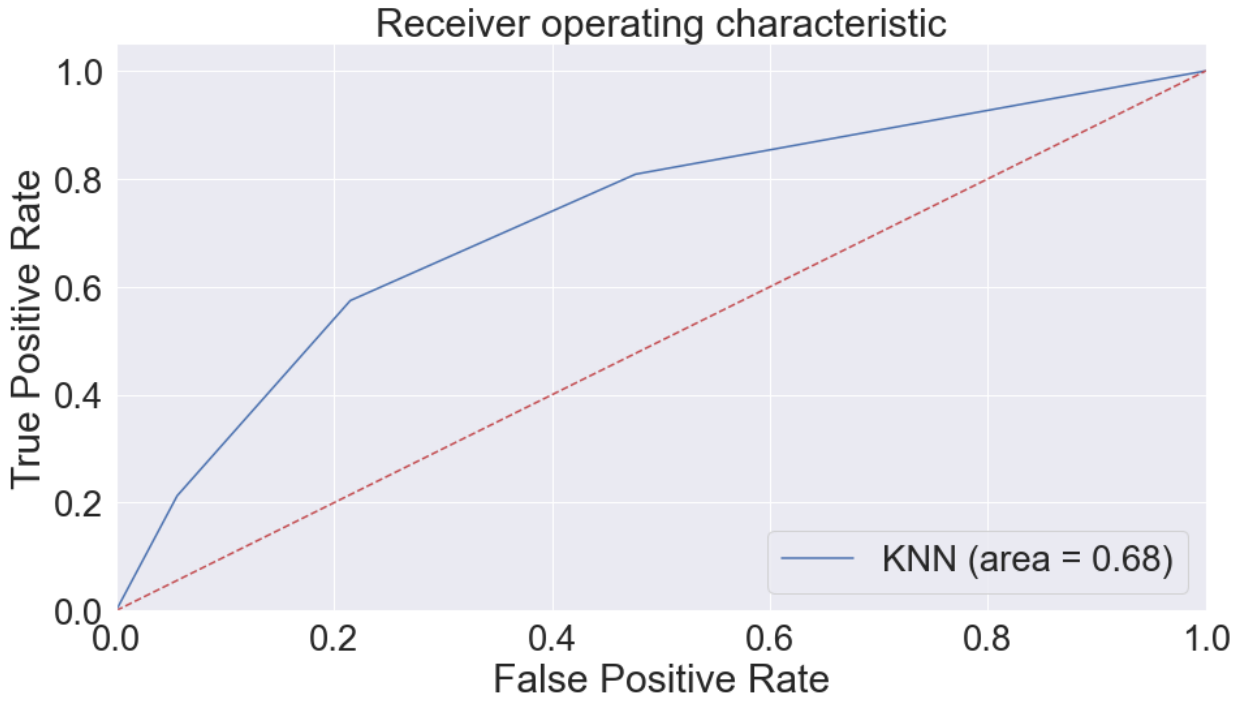


KNN Model

In [252…

```
from sklearn.metrics import roc_auc_score
from sklearn.metrics import roc_curve
rf_roc_auc = roc_auc_score(y_test, knn.predict(x_test))
fpr, tpr, thresholds = roc_curve(y_test, knn.predict_proba(x_test)[:,1])
plt.figure(figsize=(15,8))
plt.plot(fpr, tpr, label='KNN (area = %0.2f)' % rf_roc_auc)
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic')
plt.legend(loc="lower right")
plt.savefig('RF_ROC')
print('AUC: %.3f' % rf_roc_auc)
plt.show()
```

```
AUC: 0.680
```


Receiver operating characteristic
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
KNN (area = 0.68)

In [ ]: