NAME : RETHINAGIRI G

ROLL NO : 225229130

COURSE TITLE : PRACTICAL MACHINE LEARNING LAB

LAB6. Predictive Analytics for Hospitals

Step.1

In [1]:
```
import pandas as pan
```

In [2]:
```
db=pan.read_csv("Diabetes.csv")
```

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

Out[3]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outco
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 [4]:
```
db.size
```

Out[4]: 6912

In [5]:
```
db.shape
```

Out[5]: (768, 9)

In [6]:
```
db.describe()
```

Out[6]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFun
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.00
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	0.47
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.33
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.07
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.24
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.37
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.62
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.42

In [7]:
```
db.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 [8]:
```
type(db)
```

Out[8]:
```
pandas.core.frame.DataFrame
```

In [9]:
```
db.columns
```

Out[9]:
```
Index(['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
       'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome'],
      dtype='object')
```

In [10]:
```
db["Glucose"].value_counts
```

Out[10]:
```
<bound method IndexOpsMixin.value_counts of 0      148
1       85
2      183
3       89
4      137
      ...
763    101
764    122
765    121
766    126
767     93
Name: Glucose, Length: 768, dtype: int64>
```

In [11]:
```
db.count
```

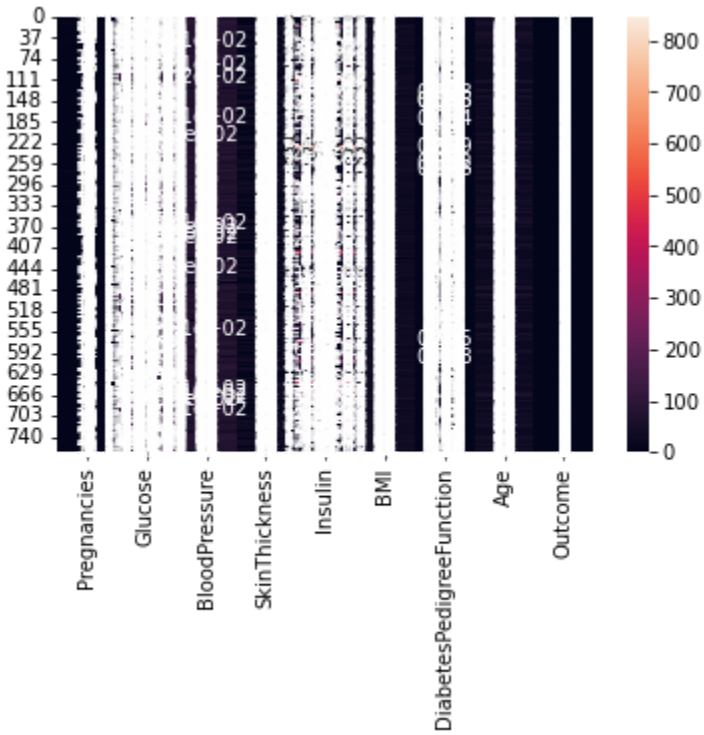
Out[11]:
```
<bound method DataFrame.count of      Pregnancies  Glucose  BloodPressure  SkinThicknes
s  Insulin   BMI  \
0              6      148             72             35        0  33.6
1              1       85             66             29        0  26.6
2              8      183             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

     DiabetesPedigreeFunction  Age  Outcome
0                       0.627   50        1
1                       0.351   31        0
2                       0.672   32        1
3                       0.167   21        0
4                       2.288   33        1
..                        ...  ...      ...
763                     0.171   63        0
764                     0.340   27        0
765                     0.245   30        0
766                     0.349   47        1
767                     0.315   23        0

[768 rows x 9 columns]>
```

Step.2 [Identify relationships between feature]

In [12]:
```
import seaborn as sb
```

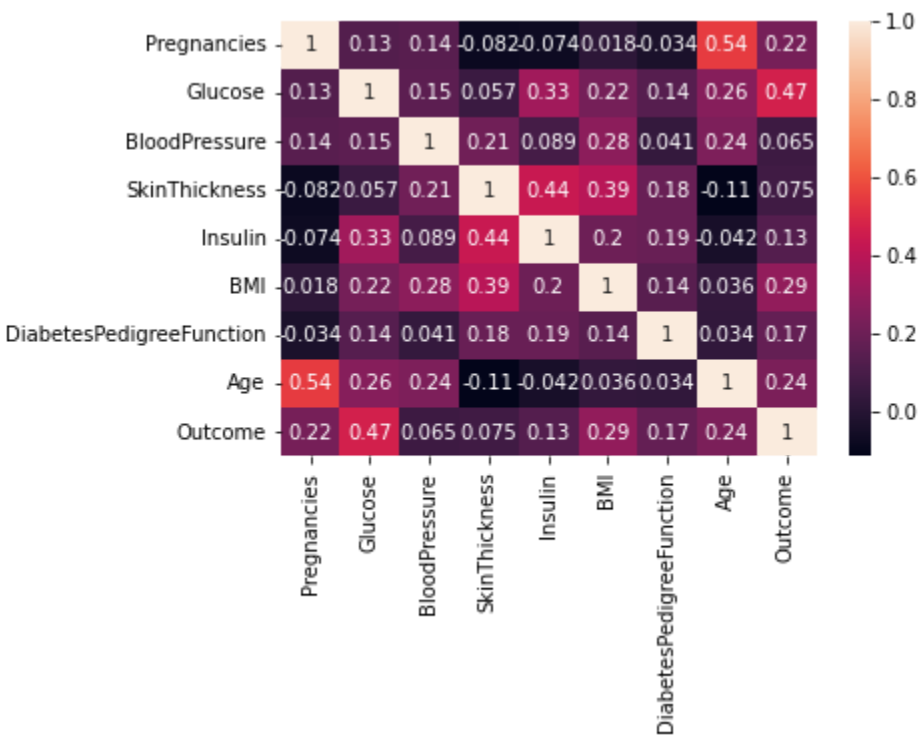
In [13]:
```
sb.heatmap(db,annot=True)
```

Out[13]: <AxesSubplot:>



In [14]:
```
c=db.corr()
sb.heatmap(c,annot=True)
```

Out[14]: <AxesSubplot:>



Step3. [predicton using one feature]

In [15]:

```
X=db[['Age']]
```

In [16]:

```
y=db[["Outcome"]]
```

In [17]:

```
from sklearn.model_selection import train_test_split as tts
X_train,X_test,y_train,y_test=tts(X,y,test_size=.25,random_state=42)
```

In [18]:

```
from sklearn.linear_model import LogisticRegression as LOR
reg=LOR()
reg.fit(X_train,y_train)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[18]:

```
LogisticRegression()
```

In [19]:

```
reg.predict(y_test)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\base.py:493: FutureWarning: The featu
re names should match those that were passed during fit. Starting version 1.2, an error
will be raised.
Feature names unseen at fit time:
- Outcome
Feature names seen at fit time, yet now missing:
- Age

  warnings.warn(message, FutureWarning)
```

Out[19]:

```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int64)
```

In [20]:

```
C=reg.coef_
```

In [21]:

```
C
```

Out[21]:

```
array([[0.05221912]])
```

In [22]:

```
I=reg.intercept_
```

In [23]:
```
I
```

Out[23]:
```
array([-2.39506398])
```

In [24]:
```
lrf=C*60+I

from scipy.special import expit
```

In [25]:
```
if expit(lrf)>0.5:
    print(expit(lrf))
    print("HE WILL BECOME  DIABETIC")
else:
    print("No")
```

```
[[0.67657656]]
HE WILL BECOME  DIABETIC
```

Step.4 [Prediction using many features]

In [26]:
```
X1=db[['Glucose','BMI','Age']]
```

In [27]:
```
y1=db[["Outcome"]]
```

In [28]:
```
X1_train,X1_test,y1_train,y1_test=tts(X1,y1,test_size=.25,random_state=42)
```

In [29]:
```
reg1=LOR()
```

In [30]:
```
reg1.fit(X1_train,y1_train)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[30]:
```
LogisticRegression()
```

In [31]:
```
print(reg1.coef_)
```

```
[[0.03326879 0.09717039 0.04404934]]
```

In [32]:
```
reg1.intercept_
```

Out[32]:
```
array([-9.47396587])
```

In [33]:
```
m=reg1.predict([[150,30,40]])
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not
have valid feature names, but LogisticRegression was fitted with feature names
  warnings.warn(
```

In [34]:
```
expit(m)
```

Out[34]:
```
array([0.73105858])
```

In [35]:
```
pr=reg1.predict_proba([[150,30,40]])
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not
have valid feature names, but LogisticRegression was fitted with feature names
  warnings.warn(
```

In [36]:
```
expit(pr)
```

Out[36]:
```
array([[0.61106495, 0.63371999]])
```

Step.5 [BuildLoR model with all features]

In [37]:
```
X2=db.drop('Outcome',axis=1)
y2=db[['Outcome']]
```

In [38]:
```
reg2=LOR()
```

In [39]:
```
X2_train,X2_test,y2_train,y2_test=tts(X2,y2,
                                      test_size=.25,random_state=42)
```

In [40]:
```
reg2.fit(X2_train,y2_train)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:814: Conver
genceWarning: 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 (https://scikit-learn.or
g/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 (http
s://scikit-learn.org/stable/modules/linear_model.html#logistic-regression)
  n_iter_i = _check_optimize_result(
```

Out[40]:
```
LogisticRegression()
```

In [41]:

```
y2_pred=reg2.predict(X2_test)
```

In [42]:

```
from sklearn.metrics import *
```

In [43]:

```
AUC_value=roc_auc_score(y2_test,y2_pred)
AUC_value
```

Out[43]:

```
0.7122658183103571
```

Step.6 [Forward Selection Procedure]

In [44]:

```
from sklearn.feature_selection import f_regression
```

In [45]:

```
selected_features = []
best_score = 0
```

In [46]:

```
for feature in db.columns:
    X_subset = db[selected_features + [feature]]
    model = LOR().fit(X_subset, y)
    f_score = f_regression(X_subset, y)[0][-1]
    if f_score > best_score:
        selected_features.append(feature)
        best_score = f_score
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConver
sionWarning: A column-vector y was passed when a 1d array was expected. Please change
the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConver
sionWarning: A column-vector y was passed when a 1d array was expected. Please change
the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConver
sionWarning: A column-vector y was passed when a 1d array was expected. Please change
the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConver
sionWarning: A column-vector y was passed when a 1d array was expected. Please change
the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConver
sionWarning: A column-vector y was passed when a 1d array was expected. Please change
the shape of y to (n_samples, ), for example using ravel().
```

In [47]:

```
print(selected_features)
```

```
['Pregnancies', 'Glucose', 'Outcome']
```

In [48]:
```
selected_features
```

Out[48]:
```
['Pregnancies', 'Glucose', 'Outcome']
```

In [49]:
```
def get_auc(var,tar,df):
    fx = df[var]
    fy = df[tar]
    reg4=LOR()
    reg4.fit(fx,fy)
    pred=reg4.predict_proba(fx)[:,1]
    auc_val = roc_auc_score(y,pred)
    return auc_val
get_auc(['Glucose',"BMI"],['Outcome'],db)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[49]:
```
0.8109328358208956
```

In [50]:
```
get_auc(['Pregnancies','BloodPressure','SkinThickness'],
        ['Outcome'],db)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[50]:
```
0.6444962686567164
```

In [51]:
```
def best_next(current,cand,tar,df):
    best_auc=-1
    best_var=None
    for i in cand:
        auc_v = get_auc(current+[i],tar,df)
        if auc_v>=best_auc:
            best_auc=auc_v
            best_var=i
        return best_var
```

In [52]:
```
current=['Insulin','BMI','DiabetesPedigreeFunction','Age']
cand=['Pregnancies','Glucose','BloodPressure','SkinThickness']
tar=['Outcome']
next_var = best_next(current,cand,tar,db)
next_var
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[52]:
```
'Pregnancies'
```

In [53]:

```python
tar =['Outcome']
current=[]
cand=['Pregnancies','Glucose','BloodPressure','SkinThickness','Insulin','BMI','DiabetesP
max_num = 7
num_it = min(max_num,len(cand))
for i in range(0,num_it):
    next_var = best_next(current,cand,tar,db)
    current += [next_var]
    cand.remove(next_var)
    print("variable addd in step "+str(i+1)+' is '+ next_var +" .")
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)

variable addd in step 1 is Pregnancies .
variable addd in step 2 is Glucose .
variable addd in step 3 is BloodPressure .

C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)

variable addd in step 4 is SkinThickness .
variable addd in step 5 is Insulin .

C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)

variable addd in step 6 is BMI .
variable addd in step 7 is DiabetesPedigreeFunction .
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:814: Conver
genceWarning: 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 (https://scikit-learn.or
g/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 (http
s://scikit-learn.org/stable/modules/linear_model.html#logistic-regression)
  n_iter_i = _check_optimize_result(
```

In [54]:
```
current
```

Out[54]:
```
['Pregnancies',
 'Glucose',
 'BloodPressure',
 'SkinThickness',
 'Insulin',
 'BMI',
 'DiabetesPedigreeFunction']
```

In [ ]:
```

```

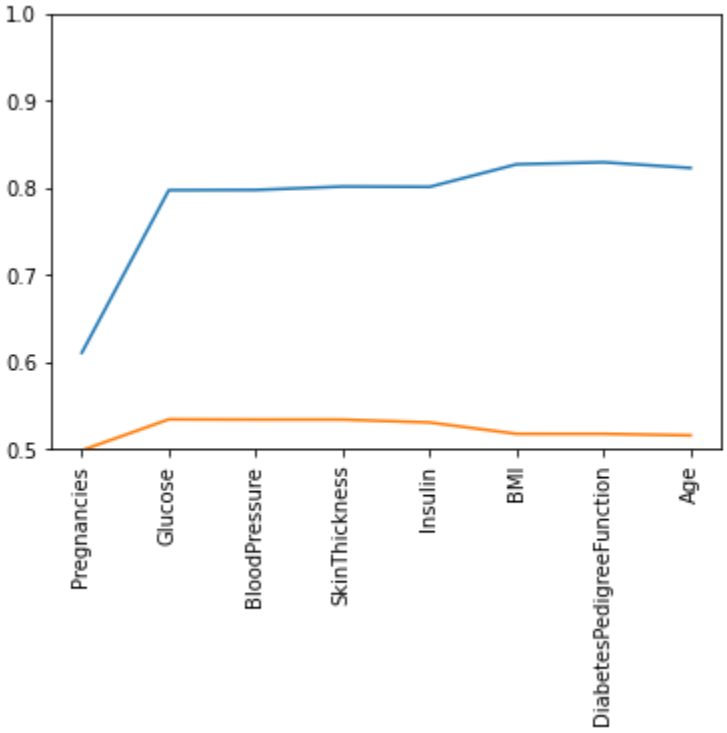
STEP 7 [PLOT LINE GRAPH OF AUC VALUES SELECT CUT-OFF]

In [55]:
```
X2_train,X2_test,y2_train,y2_test = tts(X2,y,stratify=y,test_size=.5,random_state=42)
prediction=reg2.predict_proba(X2_test)
train = pan.concat([X2_train,y2_train],axis =1)
test = pan.concat([X2_test,y2_test],axis =1)
```

In [56]:
```
def auc_train_test (variables,target, train, test):
    X_train = train[variables]
    X_test = test[variables]
    Y_train =train[target]
    Y_test = test[target]
    Lor=LOR()
    Lor.fit(X_train,Y_train)
    prediction_train = Lor.predict_proba(X_train)[:,1]
    prediction_test = Lor.predict_proba(X_test)[:,1]
    auc_train = roc_auc_score(Y_train, prediction_train)
    auc_test = roc_auc_score(Y_train,prediction_test)
    return (auc_train,auc_test)
auc_values_train=[]
auc_values_test=[]
variable_evaluate=[]
for v in X2.columns:
    variable_evaluate.append(v)
    auc_train,auc_test = auc_train_test(variable_evaluate,['Outcome'],train,test)
    auc_values_train.append(auc_train)
    auc_values_test.append(auc_test)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversi
onWarning: A column-vector y was passed when a 1d array was expected. Please change the
shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
C:\Users\user\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:814: Conver
genceWarning: 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 (https://scikit-learn.or
g/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 (http
s://scikit-learn.org/stable/modules/linear_model.html#logistic-regression)
  n_iter_i = _check_optimize_result(
```

In [57]:
```
import numpy as num
import matplotlib.pyplot as mat
x =num.array(range(0,len(auc_values_train)))
my_train = num.array(auc_values_train)
my_test = num.array(auc_values_test)
mat.xticks(x,X2.columns,rotation=90)
mat.plot(x,my_train)
mat.plot(x,my_test)
mat.ylim(0.5,1)
mat.show()
```

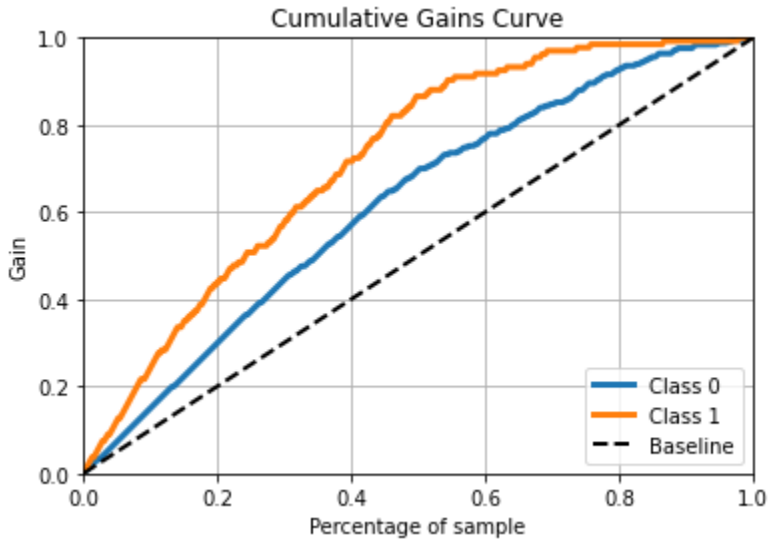


STEP 8 : [DRAW CUMILATIVE GAIN CHART AND LIFT CHART]

In [58]:
```
!pip install scikit-plot
```

```
Requirement already satisfied: scikit-plot in c:\users\user\anaconda3\lib\site-packages
(0.3.7)
Requirement already satisfied: joblib>=0.10 in c:\users\user\anaconda3\lib\site-package
s (from scikit-plot) (1.1.0)
Requirement already satisfied: matplotlib>=1.4.0 in c:\users\user\anaconda3\lib\site-pa
ckages (from scikit-plot) (3.5.1)
Requirement already satisfied: scikit-learn>=0.18 in c:\users\user\anaconda3\lib\site-p
ackages (from scikit-plot) (1.0.2)
Requirement already satisfied: scipy>=0.9 in c:\users\user\anaconda3\lib\site-packages
(from scikit-plot) (1.7.3)
Requirement already satisfied: pyparsing>=2.2.1 in c:\users\user\anaconda3\lib\site-pac
kages (from matplotlib>=1.4.0->scikit-plot) (3.0.4)
Requirement already satisfied: packaging>=20.0 in c:\users\user\anaconda3\lib\site-pack
ages (from matplotlib>=1.4.0->scikit-plot) (21.3)
Requirement already satisfied: numpy>=1.17 in c:\users\user\anaconda3\lib\site-packages
(from matplotlib>=1.4.0->scikit-plot) (1.21.5)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\user\anaconda3\lib\site
-packages (from matplotlib>=1.4.0->scikit-plot) (2.8.2)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\user\anaconda3\lib\site-pa
ckages (from matplotlib>=1.4.0->scikit-plot) (4.25.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\user\anaconda3\lib\site-pa
ckages (from matplotlib>=1.4.0->scikit-plot) (1.3.2)
Requirement already satisfied: cycler>=0.10 in c:\users\user\anaconda3\lib\site-package
s (from matplotlib>=1.4.0->scikit-plot) (0.11.0)
Requirement already satisfied: pillow>=6.2.0 in c:\users\user\anaconda3\lib\site-packag
es (from matplotlib>=1.4.0->scikit-plot) (9.0.1)
Requirement already satisfied: six>=1.5 in c:\users\user\anaconda3\lib\site-packages (f
rom python-dateutil>=2.7->matplotlib>=1.4.0->scikit-plot) (1.16.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\users\user\anaconda3\lib\site
-packages (from scikit-learn>=0.18->scikit-plot) (2.2.0)
```

In [59]:
```
import scikitplot as skplt
skplt.metrics.plot_cumulative_gain(y2_test,prediction)
mat.show()
mat.figure(figsize=(7,7))
skplt.metrics.plot_lift_curve(y2_test, prediction)
mat.show()
```




```
<Figure size 504x504 with 0 Axes>
```