DATA PRE-PROCESSING

IMPORTING LIBRARIES

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sb
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import LabelEncoder,MinMaxScaler
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import r2_score
from sklearn.metrics import accuracy_score
```

In [ ]:
```

```

IMPORTING DATASET

In [2]:
```
df=pd.read_csv("Chronic_Kidney_Disease.csv") #IMPORTED CHRONIC_KIDNEY_DISEASE FILE
```

EXPLORING THE DATA

In [3]:
```
df
```

Out[3]:

	id	age	bp	sg	al	su	rbc	pc	pcc	ba	...	pcv	wc	r
0	0	48.0	80.0	1.020	1.0	0.0	NaN	normal	notpresent	notpresent	...	44	7800	5.
1	1	7.0	50.0	1.020	4.0	0.0	NaN	normal	notpresent	notpresent	...	38	6000	Na
2	2	62.0	80.0	1.010	2.0	3.0	normal	normal	notpresent	notpresent	...	31	7500	Na
3	3	48.0	70.0	1.005	4.0	0.0	normal	abnormal	present	notpresent	...	32	6700	3.
4	4	51.0	80.0	1.010	2.0	0.0	normal	normal	notpresent	notpresent	...	35	7300	4.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	.
395	395	55.0	80.0	1.020	0.0	0.0	normal	normal	notpresent	notpresent	...	47	6700	4.
396	396	42.0	70.0	1.025	0.0	0.0	normal	normal	notpresent	notpresent	...	54	7800	6.
397	397	12.0	80.0	1.020	0.0	0.0	normal	normal	notpresent	notpresent	...	49	6600	5.
398	398	17.0	60.0	1.025	0.0	0.0	normal	normal	notpresent	notpresent	...	51	7200	5.
399	399	58.0	80.0	1.025	0.0	0.0	normal	normal	notpresent	notpresent	...	53	6800	6.

400 rows × 26 columns

In [4]:
```
df.head()
```

Out[4]:

	id	age	bp	sg	al	su	rbc	pc	pcc	ba	...	pcv	wc	rc	h
0	0	48.0	80.0	1.020	1.0	0.0	NaN	normal	notpresent	notpresent	...	44	7800	5.2	y
1	1	7.0	50.0	1.020	4.0	0.0	NaN	normal	notpresent	notpresent	...	38	6000	NaN	
2	2	62.0	80.0	1.010	2.0	3.0	normal	normal	notpresent	notpresent	...	31	7500	NaN	
3	3	48.0	70.0	1.005	4.0	0.0	normal	abnormal	present	notpresent	...	32	6700	3.9	y
4	4	51.0	80.0	1.010	2.0	0.0	normal	normal	notpresent	notpresent	...	35	7300	4.6	

5 rows × 26 columns

In [5]:
```
df.tail()
```

Out[5]:

	id	age	bp	sg	al	su	rbc	pc	pcc	ba	...	pcv	wc	rc	h
395	395	55.0	80.0	1.020	0.0	0.0	normal	normal	notpresent	notpresent	...	47	6700	4.9	
396	396	42.0	70.0	1.025	0.0	0.0	normal	normal	notpresent	notpresent	...	54	7800	6.2	
397	397	12.0	80.0	1.020	0.0	0.0	normal	normal	notpresent	notpresent	...	49	6600	5.4	
398	398	17.0	60.0	1.025	0.0	0.0	normal	normal	notpresent	notpresent	...	51	7200	5.9	
399	399	58.0	80.0	1.025	0.0	0.0	normal	normal	notpresent	notpresent	...	53	6800	6.1	

5 rows × 26 columns

In [6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 26 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   id              400 non-null    int64  
 1   age             391 non-null    float64
 2   bp              388 non-null    float64
 3   sg              353 non-null    float64
 4   al              354 non-null    float64
 5   su              351 non-null    float64
 6   rbc             248 non-null    object 
 7   pc              335 non-null    object 
 8   pcc             396 non-null    object 
 9   ba              396 non-null    object 
 10  bgr             356 non-null    float64
 11  bu              381 non-null    float64
 12  sc              383 non-null    float64
 13  sod             313 non-null    float64
 14  pot             312 non-null    float64
 15  hemo            348 non-null    float64
 16  pcv             330 non-null    object 
 17  wc              295 non-null    object 
```

```
 18  rc              270 non-null    object
 19  htn             398 non-null    object
 20  dm              398 non-null    object
 21  cad             398 non-null    object
 22  appet           399 non-null    object
 23  pe              399 non-null    object
 24  ane             399 non-null    object
 25  classification  400 non-null    object
dtypes: float64(11), int64(1), object(14)
memory usage: 81.4+ KB
```

In [7]:
```
df.describe()
```

Out[7]:

	id	age	bp	sg	al	su	bgr	
count	400.000000	391.000000	388.000000	353.000000	354.000000	351.000000	356.000000	381.(
mean	199.500000	51.483376	76.469072	1.017408	1.016949	0.450142	148.036517	57.4
std	115.614301	17.169714	13.683637	0.005717	1.352679	1.099191	79.281714	50.5
min	0.000000	2.000000	50.000000	1.005000	0.000000	0.000000	22.000000	1.5
25%	99.750000	42.000000	70.000000	1.010000	0.000000	0.000000	99.000000	27.(
50%	199.500000	55.000000	80.000000	1.020000	0.000000	0.000000	121.000000	42.(
75%	299.250000	64.500000	80.000000	1.020000	2.000000	0.000000	163.000000	66.(
max	399.000000	90.000000	180.000000	1.025000	5.000000	5.000000	490.000000	391.(

In [8]:
```
df.isnull().any()
```

Out[8]:
```
id                False
age                True
bp                 True
sg                 True
al                 True
su                 True
rbc                True
pc                 True
```

```
pcc               True
ba                True
bgr               True
bu                True
sc                True
sod               True
pot               True
hemo              True
pcv               True
wc                True
rc                True
htn               True
dm                True
cad               True
appet             True
pe                True
ane               True
classification    False
dtype: bool
```

In [9]:
```
df.shape
```

Out[9]:
```
(400, 26)
```

In [ ]:
```

```

handling missing data

In [10]:
```
df.isnull().any()
```

Out[10]:
```
id                False
age                True
bp                 True
sg                 True
al                 True
```

```
su                 True
rbc                True
pc                 True
pcc                True
ba                 True
bgr                True
bu                 True
sc                 True
sod                True
pot                True
hemo               True
pcv                True
wc                 True
rc                 True
htn                True
dm                 True
cad                True
appet              True
pe                 True
ane                True
classification    False
dtype: bool
```

In [11]:

```
#Create a list of columns to retain
columns_to_retain = ["sg", "al", "sc", "hemo",
                            "pcv", "wbcc", "rbcc", "htn", "classification"
]

#columns_to_retain = df.columns, Drop the columns that are not in colum
ns_to_retain
df = df.drop([col for col in df.columns if not col in columns_to_retain
], axis=1)

# Drop the rows with na or missing values
df = df.dropna(axis=0)
df
```

Out[11]:

	sg	al	sc	hemo	pcv	htn	classification

0	1.020	1.0	1.2	15.4	44	yes	ckd
1	1.020	4.0	0.8	11.3	38	no	ckd

	sg	al	sc	hemo	pcv	htn	classification
2	1.010	2.0	1.8	9.6	31	no	ckd
3	1.005	4.0	3.8	11.2	32	yes	ckd
4	1.010	2.0	1.4	11.6	35	no	ckd
...	...	...	...	...	...	...	...
395	1.020	0.0	0.5	15.7	47	no	notckd
396	1.025	0.0	1.2	16.5	54	no	notckd
397	1.020	0.0	0.6	15.8	49	no	notckd
398	1.025	0.0	1.0	14.2	51	no	notckd
399	1.025	0.0	1.1	15.8	53	no	notckd

287 rows × 7 columns

taking care of missing data

In [12]:
```
df.shape
df["sg"].fillna(df["sg"].mean(), inplace=True)
df["al"].fillna(df["al"].mean(), inplace=True)
df["sc"].fillna(df["sc"].mean(), inplace=True)
df["hemo"].fillna(df["hemo"].mean(), inplace=True)
df["pcv"].fillna(df["pcv"].median(), inplace=True)
df.isnull().any()
```

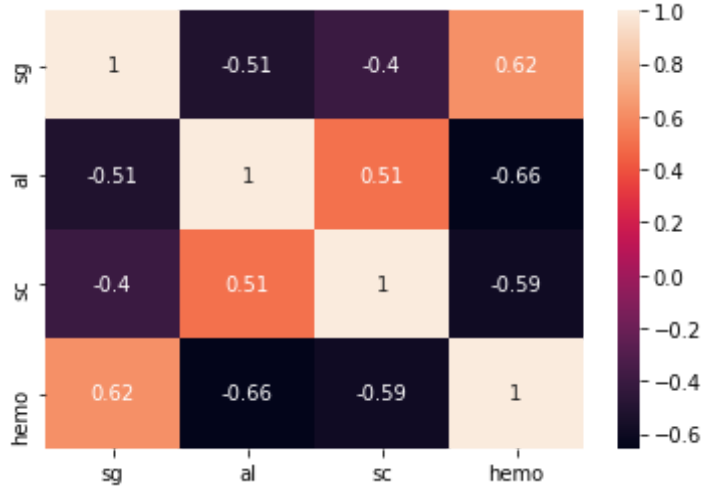
Out[12]:
```
sg                False
al                False
sc                False
hemo              False
pcv               False
htn               False
```

```
classification    False
dtype: bool
```

data visualization (before prediction)

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

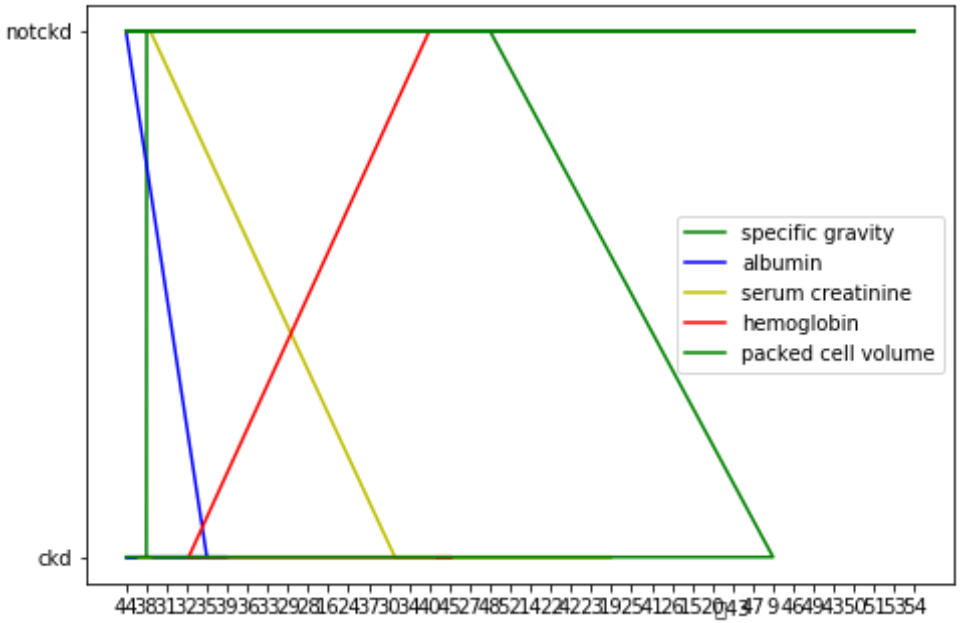
Out[13]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x25da6a28c88>
```



In [14]:
```
fig1=plt.figure()
ax=fig1.add_axes([0,0,1,1])
ax.plot(df['sg'],df['classification'],color='g',label='specific gravit
y')#starting green line
ax.plot(df['al'],df['classification'],color='b',label='albumin')
ax.plot(df['sc'],df['classification'],color='y',label='serum creatinin
e')
ax.plot(df['hemo'],df['classification'],color='r',label='hemoglobin')
ax.plot(df['pcv'],df['classification'],color='g',label='packed cell vol
ume')
ax.legend()
```

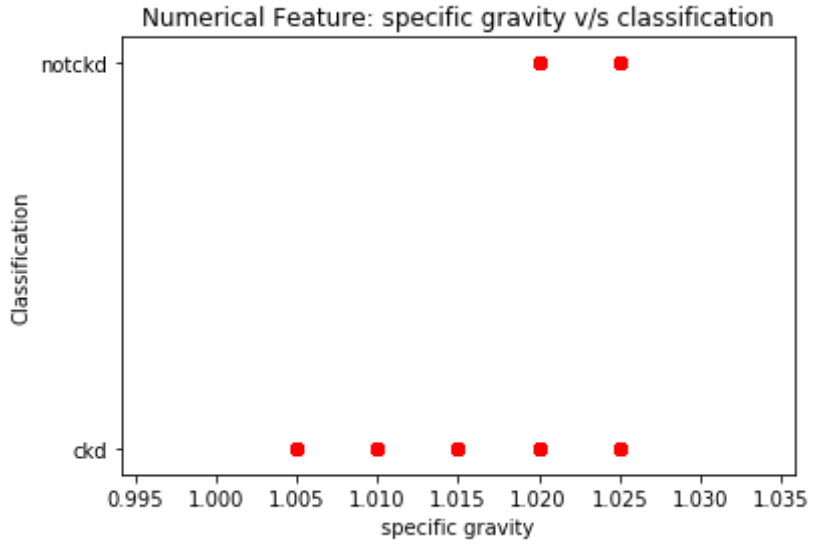
Out[14]:
```
<matplotlib.legend.Legend at 0x25da720d748>
```

```
C:\Users\MARRIPELLI SAIKIRAN\anaconda3\lib\site-packages\matplotlib\backends\backend_agg.py:211: RuntimeWarning: Glyph 9 missing from current font.
  font.set_text(s, 0.0, flags=flags)
C:\Users\MARRIPELLI SAIKIRAN\anaconda3\lib\site-packages\matplotlib\backends\backend_agg.py:180: RuntimeWarning: Glyph 9 missing from current font.
  font.set_text(s, 0, flags=flags)
```



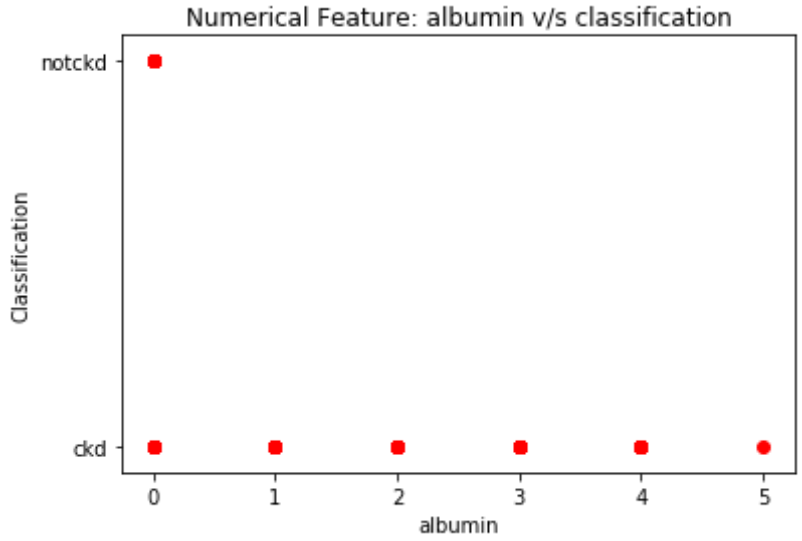
In [15]:
```
plt.scatter(df['sg'], df['classification'],color='red')
plt.title('Numerical Feature: specific gravity v/s classification')
plt.xlabel('specific gravity')
plt.ylabel('Classification')
```

Out[15]:
```
Text(0, 0.5, 'Classification')
```



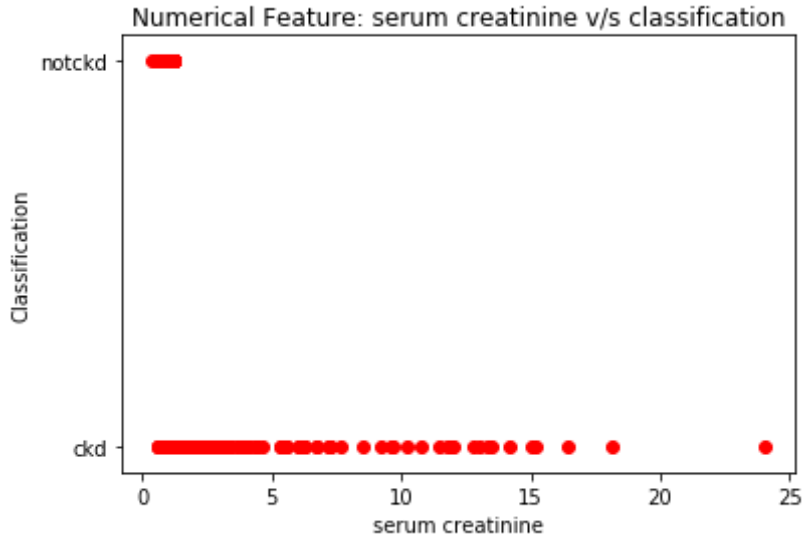
In [16]:
```
plt.scatter(df['al'], df['classification'],color='red')
plt.title('Numerical Feature: albumin v/s classification')
plt.xlabel('albumin')
plt.ylabel('Classification')
```

Out[16]:
```
Text(0, 0.5, 'Classification')
```



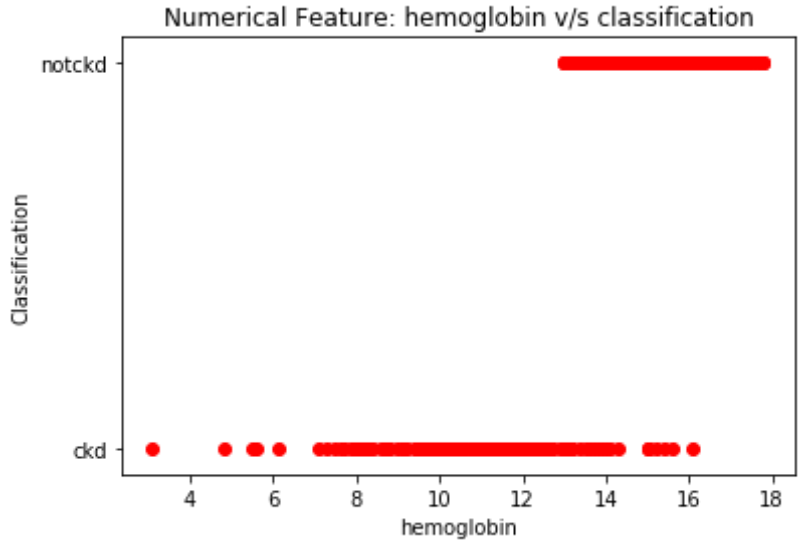
In [17]:
```
plt.scatter(df['sc'], df['classification'],color='red')
plt.title('Numerical Feature: serum creatinine v/s classification')
plt.xlabel('serum creatinine')
plt.ylabel('Classification')
```

Out[17]:
```
Text(0, 0.5, 'Classification')
```



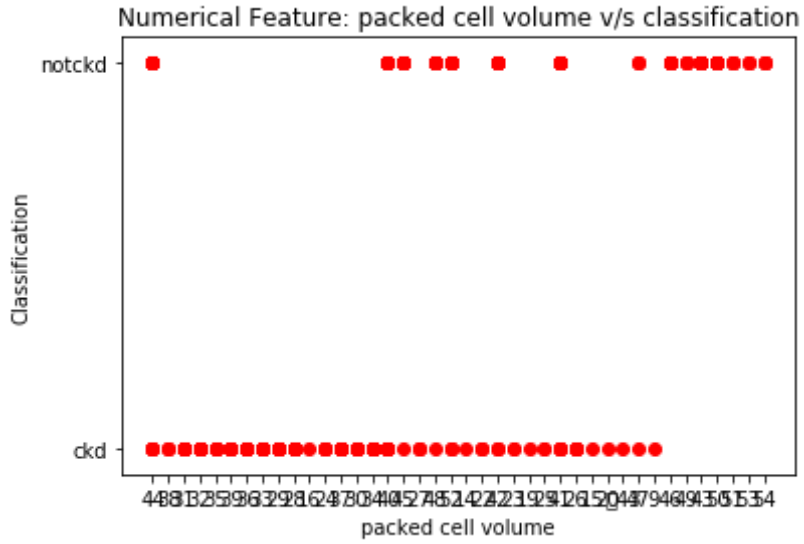
In [18]:
```
plt.scatter(df['hemo'], df['classification'],color='red')
plt.title('Numerical Feature: hemoglobin v/s classification')
plt.xlabel('hemoglobin')
plt.ylabel('Classification')
```

Out[18]:
```
Text(0, 0.5, 'Classification')
```



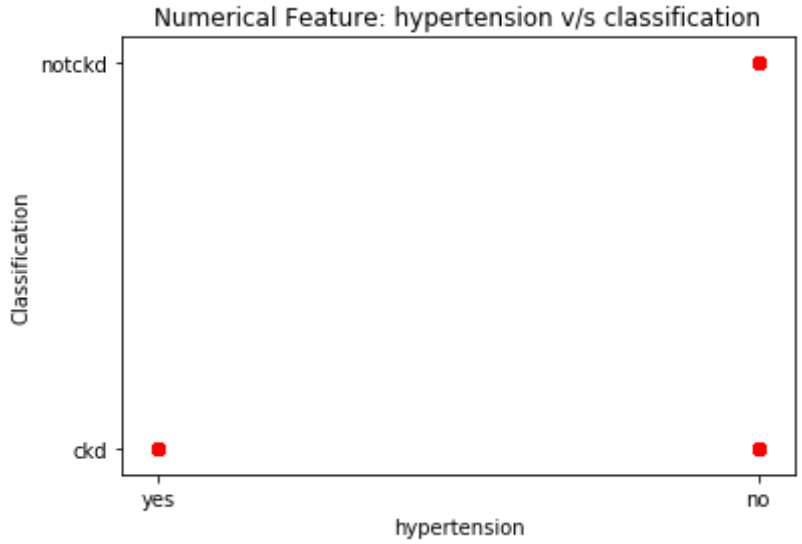
In [19]:
```
plt.scatter(df['pcv'], df['classification'],color='red')
plt.title('Numerical Feature: packed cell volume v/s classification')
plt.xlabel('packed cell volume')
plt.ylabel('Classification')
```

Out[19]:
```
Text(0, 0.5, 'Classification')
```



In [20]:
```
plt.scatter(df['htn'], df['classification'],color='red')
plt.title('Numerical Feature: hypertension v/s classification')
plt.xlabel('hypertension')
plt.ylabel('Classification')
```

Out[20]:
```
Text(0, 0.5, 'Classification')
```



separating data into dependent and independent

In [21]:
```
x = df.iloc[:,0:6].values
x
```

Out[21]:
```
array([[1.02, 1.0, 1.2, 15.4, '44', 'yes'],
       [1.02, 4.0, 0.8, 11.3, '38', 'no'],
       [1.01, 2.0, 1.8, 9.6, '31', 'no'],
       ...,
       [1.02, 0.0, 0.6, 15.8, '49', 'no'],
       [1.025, 0.0, 1.0, 14.2, '51', 'no'],
       [1.025, 0.0, 1.1, 15.8, '53', 'no']], dtype=object)
```

In [22]:
```
y=df.iloc[:,6:].values
y
```

Out[22]:
```
array([['ckd'],
       ['ckd'],
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       ['notckd']], dtype=object)
```

In [ ]:

one hot encoding

In [23]:
```
ct=ColumnTransformer([("on",OneHotEncoder(),[5])],remainder="passthrough")
x=ct.fit_transform(x)
x
```

Out[23]:
```
array([[0.0, 1.0, 1.02, ..., 1.2, 15.4, '44'],
       [1.0, 0.0, 1.02, ..., 0.8, 11.3, '38'],
       [1.0, 0.0, 1.01, ..., 1.8, 9.6, '31'],
       ...,
       [1.0, 0.0, 1.02, ..., 0.6, 15.8, '49'],
       [1.0, 0.0, 1.025, ..., 1.0, 14.2, '51'],
       [1.0, 0.0, 1.025, ..., 1.1, 15.8, '53']], dtype=object)
```

removing dummy variables in x

In [24]:
```
x=x[:,1:]
x
```

Out[24]:
```
array([[1.0, 1.02, 1.0, 1.2, 15.4, '44'],
       [0.0, 1.02, 4.0, 0.8, 11.3, '38'],
       [0.0, 1.01, 2.0, 1.8, 9.6, '31'],
       ...,
       [0.0, 1.02, 0.0, 0.6, 15.8, '49'],
       [0.0, 1.025, 0.0, 1.0, 14.2, '51'],
       [0.0, 1.025, 0.0, 1.1, 15.8, '53']], dtype=object)
```

#label encoding

In [25]:
```
le=LabelEncoder()
y=le.fit_transform(y)
y
```

```
C:\Users\MARRIPELLI SAIKIRAN\anaconda3\lib\site-packages\sklearn\prepro
cessing\_label.py:251: DataConversionWarning: A column-vector y was pas
sed when a 1d array was expected. Please change the shape of y to (n_sa
mples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[25]:
```
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, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
```

```
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1])
```

feature scaling

In [26]:
```
""" MIN MAX SCALER """

min_max_scaler = preprocessing.MinMaxScaler(feature_range =(0, 1))

# Scaled feature
x= min_max_scaler.fit_transform(x)
x.round()
```

Out[26]:
```
array([[1., 1., 0., 0., 1., 1.],
       [0., 1., 1., 0., 1., 1.],
       [0., 0., 0., 0., 0., 0.],
       ...,
       [0., 1., 0., 0., 1., 1.],
       [0., 1., 0., 0., 1., 1.],
       [0., 1., 0., 0., 1., 1.]])
```

In [ ]:

In [ ]:

splitting the data into training and testing

sets

In [27]:
```
x_train, x_test, y_train, y_test = train_test_split(x,y, test_size=0.2,
 random_state=0)
```

APPLYING SUITABLE CLASSIFICATION ALGORITHM

In [28]:
```
rfc = RandomForestClassifier (criterion = 'entropy',random_state = 0)
```

training and testing the model

In [29]:
```
x_test
```

Out[29]:
```
array([[1.        , 0.25      , 0.2       , 0.05932203, 0.70748299,
        0.68888889],
       [0.        , 1.        , 0.        , 0.00847458, 0.89795918,
        0.86666667],
       [1.        , 0.75      , 0.2       , 0.02542373, 0.50340136,
        0.51111111],
       [0.        , 0.75      , 0.        , 0.01271186, 0.68707483,
        0.77777778],
       [0.        , 0.75      , 0.        , 0.02118644, 0.91836735,
        0.75555556],
       [0.        , 0.5       , 0.2       , 0.24152542, 0.29931973,
        0.4       ],
       [0.        , 0.5       , 0.4       , 0.08898305, 0.68707483,
        0.71111111],
       [0.        , 0.75      , 0.        , 0.02118644, 0.97959184,
        0.68888889],
       [1.        , 1.        , 0.        , 0.03813559, 0.65306122,
        0.62222222],
       [1.        , 0.25      , 0.6       , 0.09745763, 0.63945578,
        0.62222222],
```

```
[0.        , 1.        , 0.        , 0.00423729, 0.91836735,
 0.68888889],
[0.        , 0.75      , 0.        , 0.00847458, 0.93197279,
 0.71111111],
[1.        , 0.5       , 0.6       , 0.0720339 , 0.44897959,
 0.42222222],
[1.        , 0.5       , 0.8       , 0.22033898, 0.34013605,
 0.31111111],
[0.        , 0.25      , 0.        , 0.05084746, 0.57823129,
 0.6       ],
[0.        , 0.75      , 0.        , 0.00423729, 0.92517007,
 0.95555556],
[0.        , 0.75      , 0.        , 0.00423729, 0.82312925,
 0.68888889],
[0.        , 0.75      , 0.        , 0.03389831, 0.68707483,
 0.71111111],
[0.        , 1.        , 0.        , 0.00847458, 0.68027211,
 0.8       ],
[0.        , 0.5       , 0.        , 0.01694915, 0.59183673,
 0.55555556],
[1.        , 0.25      , 0.8       , 0.54661017, 0.        ,
 0.        ],
[0.        , 0.75      , 0.        , 0.00423729, 0.71428571,
 0.77777778],
[1.        , 0.25      , 0.        , 0.06779661, 0.40136054,
 0.4       ],
[0.        , 0.75      , 0.        , 0.01694915, 0.74829932,
 0.8       ],
[1.        , 0.5       , 0.4       , 0.05508475, 0.63945578,
 0.53333333],
[0.        , 0.25      , 0.8       , 0.05508475, 0.3537415 ,
 0.31111111],
[0.        , 0.75      , 0.        , 0.02966102, 0.86394558,
 0.71111111],
[0.        , 0.75      , 0.        , 0.01694915, 1.        ,
 0.77777778],
[1.        , 0.5       , 0.        , 0.04661017, 0.3877551 ,
 0.35555556],
[0.        , 1.        , 0.        , 0.02966102, 0.86394558,
```

```
 0.97777778],
[0.        , 1.        , 0.        , 0.01271186, 0.97278912,
 0.95555556],
[1.        , 0.5       , 0.6       , 0.06355932, 0.52380952,
 0.53333333],
[1.        , 0.5       , 0.6       , 0.02966102, 0.61904762,
 0.66666667],
[0.        , 0.75      , 0.        , 0.02966102, 0.94557823,
 0.91111111],
[1.        , 0.5       , 1.        , 0.53389831, 0.33333333,
 0.33333333],
[0.        , 0.75      , 0.        , 0.00423729, 0.85714286,
 0.84444444],
[0.        , 0.75      , 0.6       , 0.05932203, 0.54421769,
 0.6       ],
[0.        , 0.75      , 0.        , 0.02118644, 0.65306122,
 0.73333333],
[0.        , 0.5       , 0.4       , 0.02966102, 0.63265306,
 0.77777778],
[0.        , 0.25      , 0.2       , 0.09745763, 0.55102041,
 0.6       ],
[1.        , 0.25      , 0.6       , 0.16949153, 0.46938776,
 0.51111111],
[0.        , 1.        , 0.        , 0.01694915, 0.67346939,
 0.88888889],
[0.        , 1.        , 0.        , 0.02542373, 0.85714286,
 0.91111111],
[0.        , 1.        , 0.        , 0.00847458, 0.73469388,
 0.86666667],
[0.        , 0.75      , 0.        , 0.00847458, 0.71428571,
 0.93333333],
[1.        , 0.25      , 0.6       , 0.48305085, 0.34013605,
 0.33333333],
[0.        , 1.        , 0.        , 0.03389831, 0.83673469,
 0.73333333],
[0.        , 1.        , 0.        , 0.02966102, 0.72108844,
 0.8       ],
[0.        , 0.5       , 0.6       , 0.03389831, 0.52380952,
 0.53333333],
```

```
       [0.        , 0.75      , 0.        , 0.02966102, 0.83673469,
        0.73333333],
       [1.        , 0.25      , 0.4       , 0.11864407, 0.67346939,
        0.68888889],
       [0.        , 1.        , 0.        , 0.01271186, 0.67346939,
        1.        ],
       [0.        , 0.75      , 0.        , 0.00847458, 0.91156463,
        0.95555556],
       [0.        , 1.        , 0.        , 0.02542373, 0.82993197,
        0.77777778],
       [0.        , 0.75      , 0.        , 0.03813559, 0.63945578,
        0.62222222],
       [1.        , 0.75      , 0.4       , 0.08474576, 0.70068027,
        0.84444444],
       [0.        , 1.        , 0.        , 0.01271186, 0.79591837,
        0.8       ],
       [1.        , 1.        , 0.        , 0.06355932, 0.46258503,
        0.44444444]])
```

In [30]:
```
x_train
```

Out[30]:
```
array([[0.        , 0.25      , 0.2       , 0.02966102, 0.80952381,
        0.86666667],
       [0.        , 0.75      , 0.        , 0.03389831, 0.89115646,
        0.91111111],
       [0.        , 0.75      , 0.        , 0.03389831, 0.85714286,
        0.77777778],
       ...,
       [1.        , 0.5       , 0.6       , 0.12288136, 0.55782313,
        0.48888889],
       [0.        , 0.25      , 0.4       , 0.12288136, 0.53061224,
        0.62222222],
       [0.        , 1.        , 0.        , 0.02118644, 0.73469388,
        0.86666667]])
```

In [31]:
```
y_test
```

Out[31]:
```
array([0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0,
       1,
```

```
       0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1,
1,
       1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0])
```

In [32]:
```
y_train
```

Out[32]:
```
array([0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0,
0,
       1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0,
0,
       1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1,
0,
       0, 0, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1,
1,
       0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0,
1,
       1, 0, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 0, 1,
1,
       0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0,
1,
       0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0,
0,
       0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0,
0,
       1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 0, 0,
1,
       1, 1, 0, 1, 1, 1, 0, 0, 1])
```

In [33]:
```
rfc.fit(x_train,y_train)
```

Out[33]:
```
RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=Non
e,
                       criterion='entropy', max_depth=None, max_feature
s='auto',
                       max_leaf_nodes=None, max_samples=None,
                       min_impurity_decrease=0.0, min_impurity_split=No
ne,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, n_estimators=100,
```

```
                       n_jobs=None, oob_score=False, random_state=0, ve
rbose=0,
                       warm_start=False)
```

In [34]:
```
rfc.predict(x_test)
```

Out[34]:
```
array([0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0,
1,
       0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 1,
1,
       1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0])
```

In [35]:
```
y_pred=rfc.predict(x_test)
y_pred
```

Out[35]:
```
array([0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0,
1,
       0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 1,
1,
       1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0])
```

In [36]:
```
x_train.shape
```

Out[36]:
```
(229, 6)
```

evaluation metrics

In [37]:
```
r2_score(y_test,y_pred)
```

Out[37]:
```
0.9310344827586207
```

In [38]:
```
accuracy_score(y_test,y_pred)
```

Out[38]:
```
0.9827586206896551
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: