MANOJ KUMAR - 2048015

importing the libraries

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix

from sklearn.tree import DecisionTreeClassifier
from sklearn.svm import SVC
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import roc_curve, auc, confusion_matrix, classification_report,
```

import Dataset

In [2]:

```
dataset = pd.read_csv('kidney_disease.csv')
```

In [3]:

```
dataset.head()
```

Out[3]:

	id	age	bp	sg	al	su	rbc	pc	pcc	ba	...	pcv	wc	rc
0	0	48.0	80.0	1.020	1.0	0.0	NaN	normal	notpresent	notpresent	...	44	7800	5.2
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
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 [4]:

```
dataset.shape
```

Out[4]:

```
(400, 26)
```

In [5]:

```
dataset.dtypes
```

Out[5]:

```
id                int64
age             float64
bp              float64
sg              float64
al              float64
su              float64
rbc              object
pc               object
pcc              object
ba               object
bgr             float64
bu              float64
sc              float64
sod             float64
pot             float64
hemo            float64
pcv              object
wc               object
rc               object
htn              object
dm               object
cad              object
appet            object
pe               object
ane              object
classification   object
dtype: object
```

Cleaning and preprocessing of data for training

In [6]:

```
dataset[['htn','dm','cad','pe','ane']]=dataset[['htn','dm','cad','pe','ane']].replac
dataset[['rbc','pc']] = dataset[['rbc','pc']].replace(to_replace={'abnormal':1,'norm
dataset[['pcc','ba']] = dataset[['pcc','ba']].replace(to_replace={'present':1,'notpr
dataset[['appet']] = dataset[['appet']].replace(to_replace={'good':1,'poor':0,'no':n
dataset['classification']=dataset['classification'].replace(to_replace={'ckd':1.0,'c
dataset.rename(columns={'classification':'class'},inplace=True)
```

In [7]:

```
# Further cleaning
dataset['pe'] = dataset['pe'].replace(to_replace='good',value=0) # Not having pedal
dataset['appet'] = dataset['appet'].replace(to_replace='no',value=0)
dataset['cad'] = dataset['cad'].replace(to_replace='\tno',value=0)
dataset['dm'] = dataset['dm'].replace(to_replace={'\tno':0,'\tyes':1,' yes':1, '':np
dataset.drop('id',axis=1,inplace=True)
```

In [8]:

```
dataset.head()
```

Out[8]:

	age	bp	sg	al	su	rbc	pc	pcc	ba	bgr	...	pcv	wc	rc	htn	dm	cad	a
0	48.0	80.0	1.020	1.0	0.0	NaN	0.0	0.0	0.0	121.0	...	44	7800	5.2	1.0	1.0	0.0	
1	7.0	50.0	1.020	4.0	0.0	NaN	0.0	0.0	0.0	NaN	...	38	6000	NaN	0.0	0.0	0.0	
2	62.0	80.0	1.010	2.0	3.0	0.0	0.0	0.0	0.0	423.0	...	31	7500	NaN	0.0	1.0	0.0	
3	48.0	70.0	1.005	4.0	0.0	0.0	1.0	1.0	0.0	117.0	...	32	6700	3.9	1.0	0.0	0.0	
4	51.0	80.0	1.010	2.0	0.0	0.0	0.0	0.0	0.0	106.0	...	35	7300	4.6	0.0	0.0	0.0	

5 rows × 25 columns

In [9]:

```
# '?' character remove process in the dataset
for i in ['rc','wc','pcv']:
    dataset[i] = dataset[i].str.extract('(\d+)').astype(float)
```

In [10]:

```
# Filling missing numeric data in the dataset with mean
for i in ['age','bp','sg','al','su','bgr','bu','sc','sod','pot','hemo','rc','wc','pc
    dataset[i].fillna(dataset[i].mean(),inplace=True)
```

In [11]:

```
dataset.isnull().sum()
```

Out[11]:

```
age        0
bp         0
sg         0
al         0
su         0
rbc      152
pc        65
pcc        4
ba         4
bgr        0
bu         0
sc         0
sod        0
pot        0
hemo       0
pcv        0
wc         0
rc         0
htn        2
dm         2
cad        2
appet      1
pe         1
ane        1
class      0
dtype: int64
```

In [12]:

```
dataset = dataset.dropna(axis=1)
```

In [13]:

```
dataset.shape
```

Out[13]:

```
(400, 15)
```

In [14]:

```
dataset.isnull().sum()
```

Out[14]:

```
age       0
bp        0
sg        0
al        0
su        0
bgr       0
bu        0
sc        0
sod       0
pot       0
hemo      0
pcv       0
wc        0
rc        0
class     0
dtype: int64
```

In [15]:

```
dataset.head()
```

Out[15]:

	age	bp	sg	al	su	bgr	bu	sc	sod	pot	hemo	pcv	wc
0	48.0	80.0	1.020	1.0	0.0	121.000000	36.0	1.2	137.528754	4.627244	15.4	44.0	7800.0
1	7.0	50.0	1.020	4.0	0.0	148.036517	18.0	0.8	137.528754	4.627244	11.3	38.0	6000.0
2	62.0	80.0	1.010	2.0	3.0	423.000000	53.0	1.8	137.528754	4.627244	9.6	31.0	7500.0
3	48.0	70.0	1.005	4.0	0.0	117.000000	56.0	3.8	111.000000	2.500000	11.2	32.0	6700.0
4	51.0	80.0	1.010	2.0	0.0	106.000000	26.0	1.4	137.528754	4.627244	11.6	35.0	7300.0

In [16]:

```
#Data preprocessing
X = dataset.iloc[:,:-1].values
y = dataset.iloc[:,-1].values
```

In [17]:

```
# Feature Scaling
sc = StandardScaler()
X = sc.fit_transform(X)
```

In [18]:

```
#Splitting the dataset in to training and testing set
X_train , X_test , y_train , y_test   = train_test_split(X,y,test_size = 0.2 , randc
```

Logistic Regression

In [19]:

```
# Training the Logistic Regression model on the Training set
lg = LogisticRegression(random_state = 0)
lg.fit(X_train, y_train)
```

Out[19]:

```
LogisticRegression(random_state=0)
```

In [20]:

```
#predictin the test result
y_pred_lg = lg.predict(X_test)
```

In [21]:

```
#calculate accuracy
score_lg = accuracy_score(y_pred_lg,y_test)
score_lg
```

Out[21]:

```
0.9875
```

In [22]:

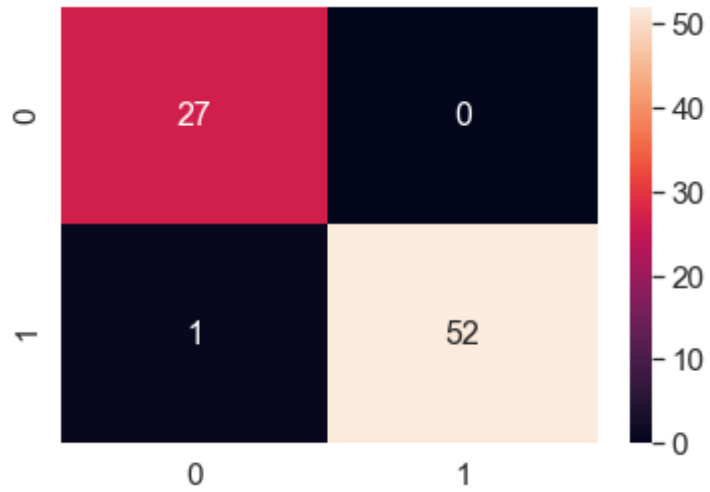
```
print("train score - " + str(lg.score(X_train, y_train)))
print("test score - " + str(lg.score(X_test, y_test)))
```

```
train score - 0.984375
test score - 0.9875
```

In [23]:

```
#Making the Confusion Matrix
from sklearn.metrics import confusion_matrix
cm_lg = confusion_matrix(y_test,y_pred_lg)
sns.set(font_scale=1.4) # for label size
sns.heatmap(cm_lg, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [24]:

```
print(classification_report(y_test, y_pred_lg))
```

```
              precision    recall  f1-score   support

         0.0       0.96      1.00      0.98        27
         1.0       1.00      0.98      0.99        53

    accuracy                           0.99        80
   macro avg       0.98      0.99      0.99        80
weighted avg       0.99      0.99      0.99        80
```

Decision Tree Classifier

In [25]:

```
#fitting Decision Tree to the training set
dtc = DecisionTreeClassifier(criterion='entropy',random_state=0)
dtc.fit(X_train,y_train)
```

Out[25]:

```
DecisionTreeClassifier(criterion='entropy', random_state=0)
```

In [26]:

```
#predictin the test result
y_pred_dtc = dtc.predict(X_test)
```

In [27]:

```
#calculate accuracy
score_dtc = accuracy_score(y_pred_dtc,y_test)
score_dtc
```

Out[27]:

```
0.925
```

In [28]:

```
print("train score - " + str(dtc.score(X_train, y_train)))
print("test score - " + str(dtc.score(X_test, y_test)))
```

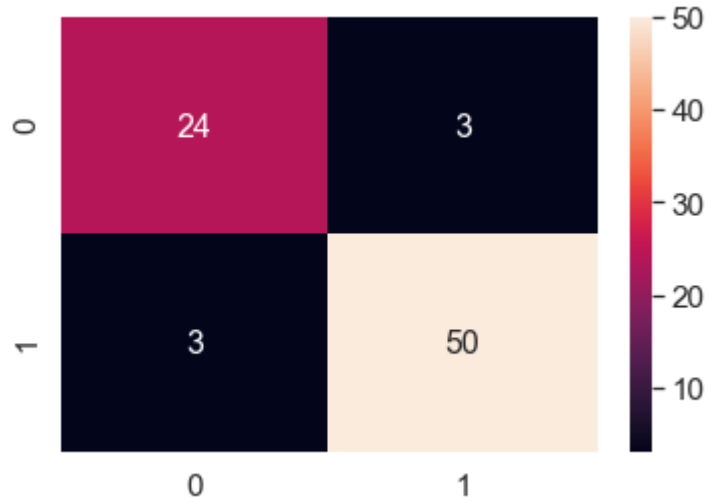
```
train score - 1.0
test score - 0.925
```

In [29]:

```
#Making the Confusion Matrix
cm_dtc = confusion_matrix(y_test,y_pred_dtc)

sns.set(font_scale=1.4) # for label size
sns.heatmap(cm_dtc, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [30]:

```
print(classification_report(y_test, y_pred_dtc))
```

```
              precision    recall  f1-score   support

         0.0       0.89      0.89      0.89        27
         1.0       0.94      0.94      0.94        53

    accuracy                           0.93        80
   macro avg       0.92      0.92      0.92        80
weighted avg       0.93      0.93      0.93        80
```

K Nearest Neighbors Classifier

In [31]:

```
#fitting KNN to the training set
knn= KNeighborsClassifier(n_neighbors=5 , metric='minkowski',p=2  )
knn.fit(X_train,y_train)
```

Out[31]:

```
KNeighborsClassifier()
```

In [32]:

```
#predictin the test result
y_pred_knn = knn.predict(X_test)
```

In [33]:

```
#calculate accuracy
score_dtc = accuracy_score(y_pred_knn,y_test)
score_dtc
```

Out[33]:

```
0.9875
```

In [34]:

```
print("train score - " + str(knn.score(X_train, y_train)))
print("test score - " + str(knn.score(X_test, y_test)))
```

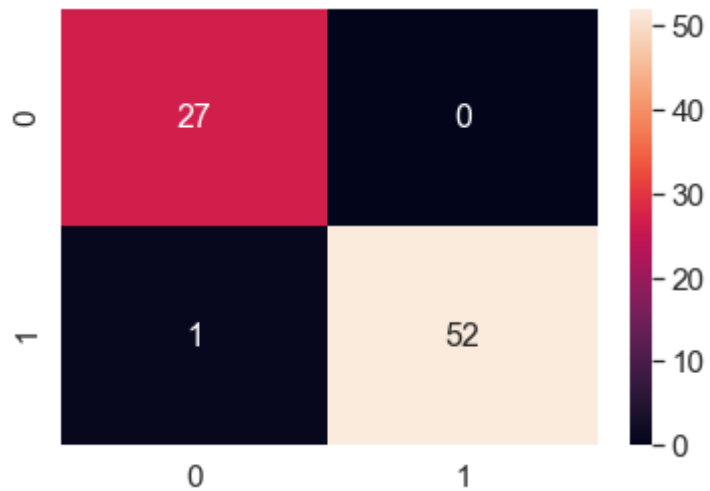
```
train score - 0.971875
test score - 0.9875
```

In [35]:

```
#Making the Confusion Matrix
cm_knn = confusion_matrix(y_test,y_pred_knn)

sns.set(font_scale=1.4) # for label size
sns.heatmap(cm_knn, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [36]:

```
print(classification_report(y_test, y_pred_knn))
```

```
              precision    recall  f1-score   support

         0.0       0.96      1.00      0.98        27
         1.0       1.00      0.98      0.99        53

    accuracy                           0.99        80
   macro avg       0.98      0.99      0.99        80
weighted avg       0.99      0.99      0.99        80
```

Support Vector Machine

In [37]:

```
#fitting SVM to the training set
svm = SVC(kernel='linear', random_state=0)
svm.fit(X_train,y_train)
```

Out[37]:

```
SVC(kernel='linear', random_state=0)
```

In [38]:

```
#predictin the test result
y_pred_svm = svm.predict(X_test)
```

In [39]:

```
score_svm = accuracy_score(y_pred_svm,y_test)
score_svm
```

Out[39]:

```
0.975
```

In [40]:

```
print("train score - " + str(svm.score(X_train, y_train)))
print("test score - " + str(svm.score(X_test, y_test)))
```

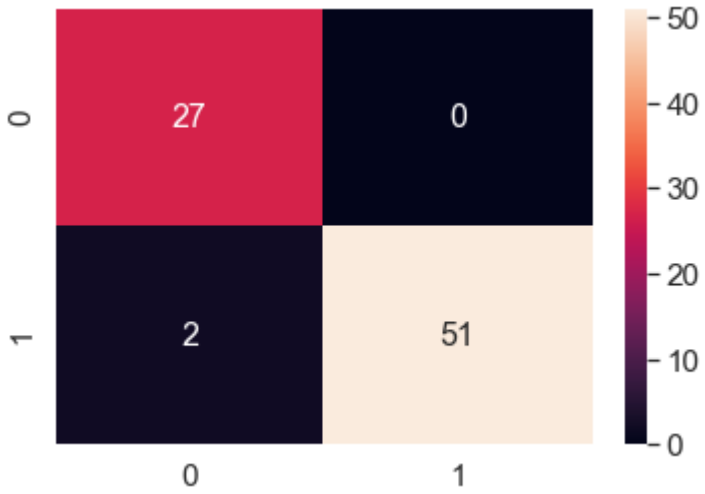
```
train score - 0.984375
test score - 0.975
```

In [41]:

```
#Making the Confusion Matrix
cm_svm = confusion_matrix(y_test,y_pred_svm)

sns.set(font_scale=1.4) # for label size
sns.heatmap(cm_svm, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [42]:

```
print(classification_report(y_test, y_pred_svm))
```

```
              precision    recall  f1-score   support

         0.0       0.93      1.00      0.96        27
         1.0       1.00      0.96      0.98        53

    accuracy                           0.97        80
   macro avg       0.97      0.98      0.97        80
weighted avg       0.98      0.97      0.98        80
```

kernal SVM

In [43]:

```
#fitting kernal SVM to the training set
ksvm = SVC(kernel='rbf', random_state=0 )
ksvm.fit(X_train,y_train)
```

Out[43]:

```
SVC(random_state=0)
```

In [44]:

```
#predictin the test result
y_pred_ksvm = ksvm.predict(X_test)
```

In [45]:

```
#calculate accuracy
score_ksvm = accuracy_score(y_pred_ksvm,y_test)
score_ksvm
```

Out[45]:

```
1.0
```

In [46]:

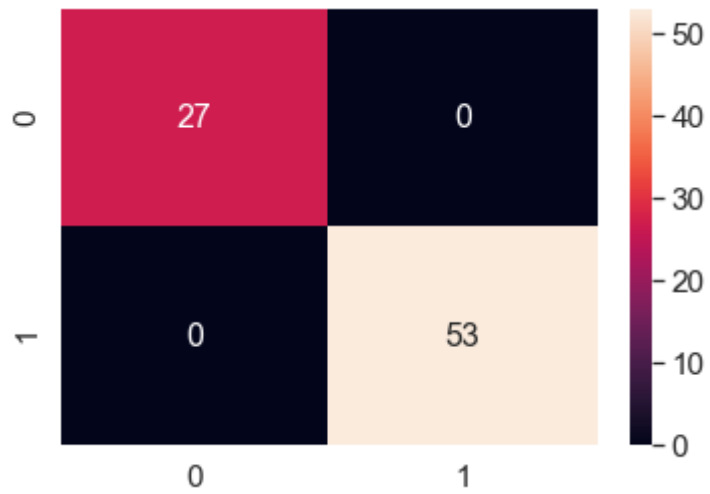
```
print("train score - " + str(ksvm.score(X_train, y_train)))
print("test score - " + str(ksvm.score(X_test, y_test)))
```

```
train score - 0.9875
test score - 1.0
```

In [47]:

```
#Making the Confusion Matrix
cm_ksvm = confusion_matrix(y_test,y_pred_ksvm)
sns.set(font_scale=1.4) # for label size
sns.heatmap(cm_ksvm, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [48]:

```
print(classification_report(y_test, y_pred_ksvm))
```

```
              precision    recall  f1-score   support

         0.0       1.00      1.00      1.00        27
         1.0       1.00      1.00      1.00        53

    accuracy                           1.00        80
   macro avg       1.00      1.00      1.00        80
weighted avg       1.00      1.00      1.00        80
```

Random Forest classification

In [49]:

```
#fitting Random Forest classification to the training set
rfc = RandomForestClassifier(n_estimators=10 , criterion='entropy',random_state=0)
rfc.fit(X_train,y_train)
```

Out[49]:

```
RandomForestClassifier(criterion='entropy', n_estimators=10, random_st
ate=0)
```

In [50]:

```
#predictin the test result
y_pred_rfc = rfc.predict(X_test)
```

In [51]:

```
#calculate accuracy
score_rfc = accuracy_score(y_pred_rfc,y_test)
score_rfc
```

Out[51]:

```
1.0
```

In [52]:

```
print("train score - " + str(rfc.score(X_train, y_train)))
print("test score - " + str(rfc.score(X_test, y_test)))
```

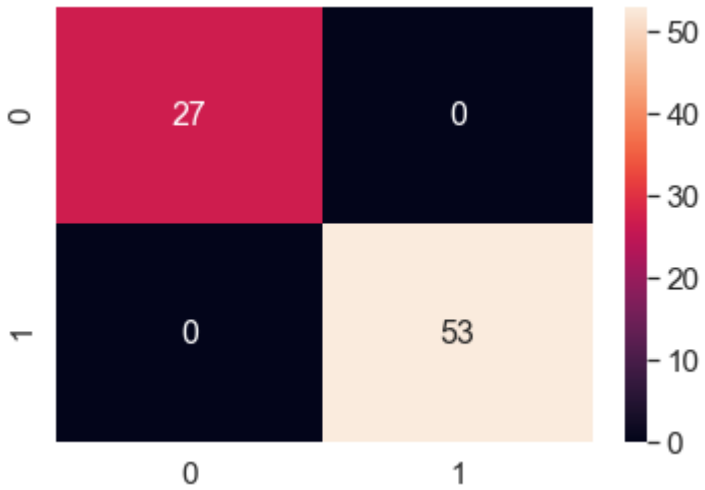
```
train score - 1.0
test score - 1.0
```

In [53]:

```
#Making the Confusion Matrix
cm = confusion_matrix(y_test,y_pred_rfc)

sns.set(font_scale=1.4) # for label size
sns.heatmap(cm, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [54]:

```
print(classification_report(y_test, y_pred_rfc))
```

```
              precision    recall  f1-score   support

         0.0       1.00      1.00      1.00        27
         1.0       1.00      1.00      1.00        53

    accuracy                           1.00        80
   macro avg       1.00      1.00      1.00        80
weighted avg       1.00      1.00      1.00        80
```

Kernal Navie Bayes

In [55]:

```
#fitting kernal Navie bayes to the training set
knb = GaussianNB()
knb.fit(X_train,y_train)
```

Out[55]:

```
GaussianNB()
```

In [56]:

```
#predictin the test result
y_pred_knb = knb.predict(X_test)
```

In [57]:

```
#calculate accuracy
score_knb = accuracy_score(y_pred_knb,y_test)
score_knb
```

Out[57]:

```
0.9
```

In [58]:

```
print("train score - " + str(knb.score(X_train, y_train)))
print("test score - " + str(knb.score(X_test, y_test)))
```

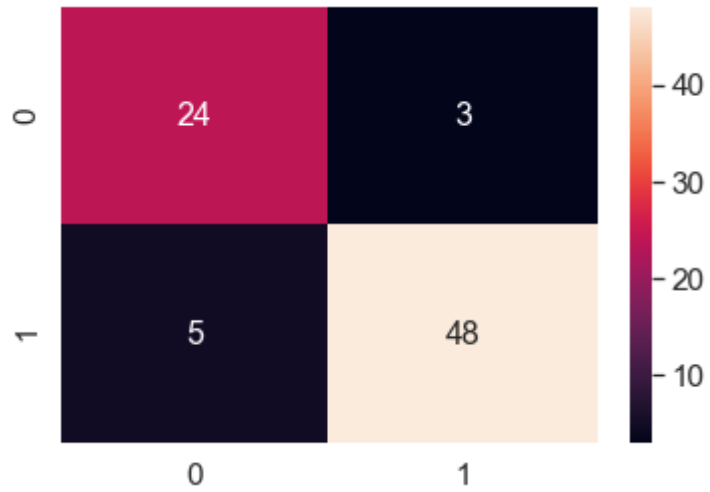
```
train score - 0.959375
test score - 0.9
```

In [59]:

```
#Making the Confusion Matrix
cm_knb = confusion_matrix(y_test,y_pred_knb)

sns.set(font_scale=1.4) # for label size
sns.heatmap(cm_knb, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



In [60]:

```
print(classification_report(y_test, y_pred_knb))
```

```
              precision    recall  f1-score   support

         0.0       0.83      0.89      0.86        27
         1.0       0.94      0.91      0.92        53

    accuracy                           0.90        80
   macro avg       0.88      0.90      0.89        80
weighted avg       0.90      0.90      0.90        80
```

In [ ]:

```

```