# 1.Importing Libraries ¶

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.axes as ax

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

import seaborn as sns
```

# 2.Loading Data

In [2]:
```
data = pd.read_csv(r'C:\Users\G.SAI KRISHNA\Desktop\ML_Projects\ML_GFG\11.Random Forest Cla
data.head()
```

Out[2]:

| | repetition_time | study_time | knowledge_level |
|---|---|---|---|
| **0** | 0.00 | 0.00 | Low |
| **1** | 0.24 | 0.90 | High |
| **2** | 0.25 | 0.33 | Low |
| **3** | 0.65 | 0.30 | High |
| **4** | 0.98 | 0.24 | Low |

In [3]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 258 entries, 0 to 257
Data columns (total 3 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   repetition_time  258 non-null    float64
 1   study_time       258 non-null    float64
 2   knowledge_level  258 non-null    object 
dtypes: float64(2), object(1)
memory usage: 6.2+ KB
```

In [4]:
```python
data.describe()
```

Out[4]:

| | repetition_time | study_time |
|---|---|---|
| **count** | 258.000000 | 258.000000 |
| **mean** | 0.432713 | 0.458539 |
| **std** | 0.248108 | 0.255211 |
| **min** | 0.000000 | 0.000000 |
| **25%** | 0.250000 | 0.250000 |
| **50%** | 0.330000 | 0.500000 |
| **75%** | 0.647500 | 0.660000 |
| **max** | 0.990000 | 0.930000 |

In [5]:
```python
#Counting unique values
data['knowledge_level'].unique()
```

Out[5]:
```
array(['Low', 'High'], dtype=object)
```

In [6]:
```python
data['knowledge_level'].value_counts()
```

Out[6]:
```
High    151
Low     107
Name: knowledge_level, dtype: int64
```

## 3.Data Splitting

In [7]:
```python
x=data.drop(['knowledge_level'],axis=1)
y=data['knowledge_level']
```

In [8]:
```python
x.head()
```

Out[8]:

| | repetition_time | study_time |
|---|---|---|
| **0** | 0.00 | 0.00 |
| **1** | 0.24 | 0.90 |
| **2** | 0.25 | 0.33 |
| **3** | 0.65 | 0.30 |
| **4** | 0.98 | 0.24 |

In [9]:
```
y.head()
```

Out[9]:
```
0     Low
1    High
2     Low
3    High
4     Low
Name: knowledge_level, dtype: object
```

In [10]:
```
y=pd.get_dummies(data,columns=['knowledge_level'])
```

In [11]:
```
y.head()
```

Out[11]:

| | repetition_time | study_time | knowledge_level_High | knowledge_level_Low |
|---|---|---|---|---|
| **0** | 0.00 | 0.00 | 0 | 1 |
| **1** | 0.24 | 0.90 | 1 | 0 |
| **2** | 0.25 | 0.33 | 0 | 1 |
| **3** | 0.65 | 0.30 | 1 | 0 |
| **4** | 0.98 | 0.24 | 0 | 1 |

## 4.Data Scaling

In [12]:
```
scaler_x = StandardScaler()
x = scaler_x.fit_transform(x)
x
```

Out[12]:
```
array([[-1.74744134, -1.80019743],
       [-0.77824063,  1.73315205],
       [-0.73785726, -0.50463595],
       [ 0.87747726, -0.62241427],
       [ 2.21012825, -0.8579709 ],
       [-1.34360771,  0.79092552],
       [-0.57632381,  0.39833113],
       [-0.13210682, -1.76093799],
       [ 1.16016081, -0.81871146],
       [-0.93977408,  1.53685485],
       [-0.53594045,  1.3798171 ],
       [-0.09172345, -0.62241427],
       [ 1.40246099, -0.46537652],
       [-1.1416909 ,  1.73315205],
       [-0.53594045,  0.55536889],
       [-0.33402363,  1.34055766],
       [-1.70705798, -1.60390024],
       [-1.42437444, -0.50463595],
       [-0.65709054, -0.66167371],
```

## 5.Training & Testing Data

In [13]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y['knowledge_level_High'],test_size=0.3
```

In [14]:
```
x_train.shape
```
Out[14]:
```
(180, 2)
```
In [15]:
```
x_test.shape
```
Out[15]:
```
(78, 2)
```
In [16]:
```
y_train.shape
```
Out[16]:
```
(180,)
```
In [17]:
```
y_test.shape
```
Out[17]:
```
(78,)
```

# 6.Decision Tree Classification

## Training the Model

In [18]:
```
rfc = RandomForestClassifier(n_estimators=1000,criterion="entropy",random_state=0)
rfc.fit(x_train,y_train)
```
Out[18]:
```
RandomForestClassifier(criterion='entropy', n_estimators=1000, random_state=0)
```

## Predicting Test Values

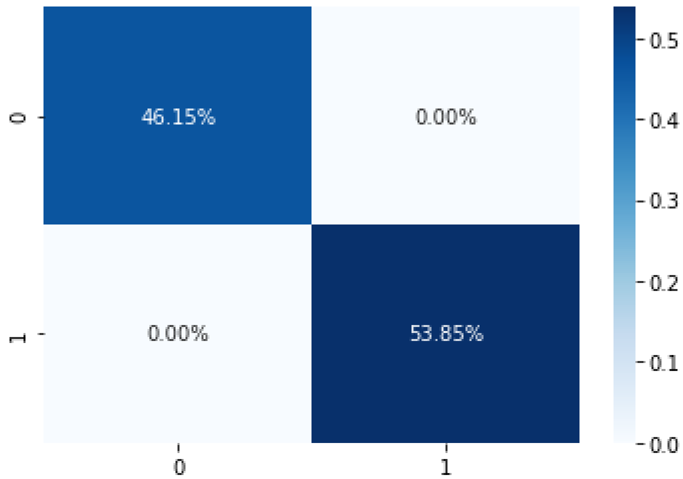
In [19]:
```
y_pred = rfc.predict(x_test)

y_pred
```
Out[19]:
```
array([1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1,
       0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0,
       1, 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0], dtype=uint8)
```

## Visualizing Model Performance

In [20]:
```
cm = confusion_matrix(y_test,y_pred)
cm
```
Out[20]:
```
array([[36,  0],
       [ 0, 42]], dtype=int64)
```

In [21]:
```
sns.heatmap(cm/np.sum(cm), annot=True,fmt='.2%', cmap='Blues')
```

Out[21]: <matplotlib.axes._subplots.AxesSubplot at 0x19b388138b0>




In [22]:
```
print("Accuracy : "+str(accuracy_score(y_test,y_pred)*100)+"%")
```

```
Accuracy : 100.0%
```

## ColorMapping

In [23]:
```
from matplotlib.colors import ListedColormap
x_set,y_set = x_test,y_test
x1,x2 = np.meshgrid(np.arange(start=x_set[:,0].min()-1,stop=x_set[:,0].max()+1,step=0.01),
                    np.arange(start=x_set[:,1].min()-1,stop=x_set[:,1].max()+1,step=0.01))
x1
```

Out[23]:
```
array([[-2.70705798, -2.69705798, -2.68705798, ...,  3.22294202,
         3.23294202,  3.24294202],
       [-2.70705798, -2.69705798, -2.68705798, ...,  3.22294202,
         3.23294202,  3.24294202],
       [-2.70705798, -2.69705798, -2.68705798, ...,  3.22294202,
         3.23294202,  3.24294202],
       ...,
       [-2.70705798, -2.69705798, -2.68705798, ...,  3.22294202,
         3.23294202,  3.24294202],
       [-2.70705798, -2.69705798, -2.68705798, ...,  3.22294202,
         3.23294202,  3.24294202],
       [-2.70705798, -2.69705798, -2.68705798, ...,  3.22294202,
         3.23294202,  3.24294202]])
```

In [24]:
```
x2
```

Out[24]:
```
array([[-2.76093799, -2.76093799, -2.76093799, ..., -2.76093799,
        -2.76093799, -2.76093799],
       [-2.75093799, -2.75093799, -2.75093799, ..., -2.75093799,
        -2.75093799, -2.75093799],
       [-2.74093799, -2.74093799, -2.74093799, ..., -2.74093799,
        -2.74093799, -2.74093799],
       ...,
       [ 2.58906201,  2.58906201,  2.58906201, ...,  2.58906201,
         2.58906201,  2.58906201],
       [ 2.59906201,  2.59906201,  2.59906201, ...,  2.59906201,
         2.59906201,  2.59906201],
       [ 2.60906201,  2.60906201,  2.60906201, ...,  2.60906201,
         2.60906201,  2.60906201]])
```

In [25]:
```
plt.contourf(x1,x2,rfc.predict(np.array([x1.ravel(),x2.ravel()]).T).reshape(x1.shape),alpha
plt.xlim(x1.min(),x1.max())
plt.ylim(x2.min(),x2.max())

for i,j in enumerate(np.unique(y_set)):
    plt.scatter(x_set[y_set == j,0],x_set[y_set == j,1],c=ListedColormap(('red','green'))(

plt.xlabel('r time')
plt.ylabel('s time')
plt.legend()
plt.show()
```

```
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as
value-mapping will have precedence in case its length matches with *x* & *y*.  Please use
the *color* keyword-argument or provide a 2-D array with a single row if you intend to sp
ecify the same RGB or RGBA value for all points.
*c* argument looks like a single numeric RGB or RGBA sequence, which should be avoided as
value-mapping will have precedence in case its length matches with *x* & *y*.  Please use
the *color* keyword-argument or provide a 2-D array with a single row if you intend to sp
ecify the same RGB or RGBA value for all points.
```