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

In [2]:
```
df=pd.read_csv('Admission_Predict.csv',sep=',')
```

In [5]:
```
df
```

Out[5]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65
...	...	...	...	...	...	...	...	...	...
395	396	324	110	3	3.5	3.5	9.04	1	0.82
396	397	325	107	3	3.0	3.5	9.11	1	0.84
397	398	330	116	4	5.0	4.5	9.45	1	0.91
398	399	312	103	3	3.5	4.0	8.78	0	0.67
399	400	333	117	4	5.0	4.0	9.66	1	0.95

400 rows × 9 columns

In [7]:
```
df.columns
```

Out[7]:
```
Index(['Serial No.', 'GRE Score', 'TOEFL Score', 'University Rating', 'SOP',
       'LOR ', 'CGPA', 'Research', 'Chance of Admit '],
      dtype='object')
```

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

Out[9]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65

In [11]:
```
df.shape
```

Out[11]:
```
(400, 9)
```

In [13]:
```
df.columns=df.columns.str.rstrip()
```

In [15]:
```
df.columns
```

Out[15]:
```
Index(['Serial No.', 'GRE Score', 'TOEFL Score', 'University Rating', 'SOP',
       'LOR', 'CGPA', 'Research', 'Chance of Admit'],
      dtype='object')
```

In [17]:
```
df.isnull().sum()
```

Out[17]:
```
Serial No.           0
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
dtype: int64
```

In [19]:
```
# replace values in in Chance of Admit column by 0 or 1 based on threshold value
df.loc[df['Chance of Admit'] >=0.80,'Chance of Admit']=1
df.loc[df['Chance of Admit'] < 0.80,'Chance of Admit']=0
```

In [21]:
```
df['Chance of Admit']
```

Out[21]:
```
0      1.0
1      0.0
2      0.0
3      1.0
4      0.0
      ...
395    1.0
396    1.0
397    1.0
398    0.0
399    1.0
Name: Chance of Admit, Length: 400, dtype: float64
```

In [23]:
```
df=df.drop('Serial No.',axis=1)
```

In [25]:
```
df
```

Out[25]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	337	118	4	4.5	4.5	9.65	1	1.0
1	324	107	4	4.0	4.5	8.87	1	0.0
2	316	104	3	3.0	3.5	8.00	1	0.0
3	322	110	3	3.5	2.5	8.67	1	1.0
4	314	103	2	2.0	3.0	8.21	0	0.0
...	...	...	...	...	...	...	...	...
395	324	110	3	3.5	3.5	9.04	1	1.0
396	325	107	3	3.0	3.5	9.11	1	1.0
397	330	116	4	5.0	4.5	9.45	1	1.0
398	312	103	3	3.5	4.0	8.78	0	0.0
399	333	117	4	5.0	4.0	9.66	1	1.0

400 rows × 8 columns

In [27]:
```
X = df.iloc[:,0:7].values
y=df.iloc[:,7].values
```

In [29]:
```
X
```

Out[29]:
```
array([[337.  , 118.  ,   4.  , ...,   4.5 ,   9.65,   1.  ],
       [324.  , 107.  ,   4.  , ...,   4.5 ,   8.87,   1.  ],
       [316.  , 104.  ,   3.  , ...,   3.5 ,   8.  ,   1.  ],
       ...,
       [330.  , 116.  ,   4.  , ...,   4.5 ,   9.45,   1.  ],
       [312.  , 103.  ,   3.  , ...,   4.  ,   8.78,   0.  ],
       [333.  , 117.  ,   4.  , ...,   4.  ,   9.66,   1.  ]])
```

In [31]:
```
y
```

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

In [33]:
```
from sklearn.model_selection import train_test_split,StratifiedKFold,cross_val_s
X_train,X_test,y_train,y_test= train_test_split(X,y,test_size=0.25,random_state=
```

In [34]:
```
print(X_train.shape,end='  ')
print(X_test.shape)
```

```
(300, 7)  (100, 7)
```

In [35]:
```
from sklearn.tree import DecisionTreeClassifier


import matplotlib.pyplot as plt
```

In [36]:
```
model = DecisionTreeClassifier(criterion='entropy')
model.fit(X_train,y_train)
y_pred=model.predict(X_test)
```

In [39]:
```
from sklearn.metrics import confusion_matrix
```

In [40]:
```
matrix=confusion_matrix(y_test,y_pred,labels=[0.0,1.0])
```

In [41]:
```
matrix
```

Out[41]:
```
array([[64,  7],
       [ 7, 22]], dtype=int64)
```

In [42]:
```
from sklearn.metrics import accuracy_score
```

In [49]:
```
acc = accuracy_score(y_test,y_pred)
print('Accuracy of Decision Tree model =  ',acc)
```

```
Accuracy of Decision Tree model =   0.86
```

In [51]:
```
from sklearn.metrics import classification_report
cr =classification_report(y_test,y_pred)
print('Classification Report ', cr )
```

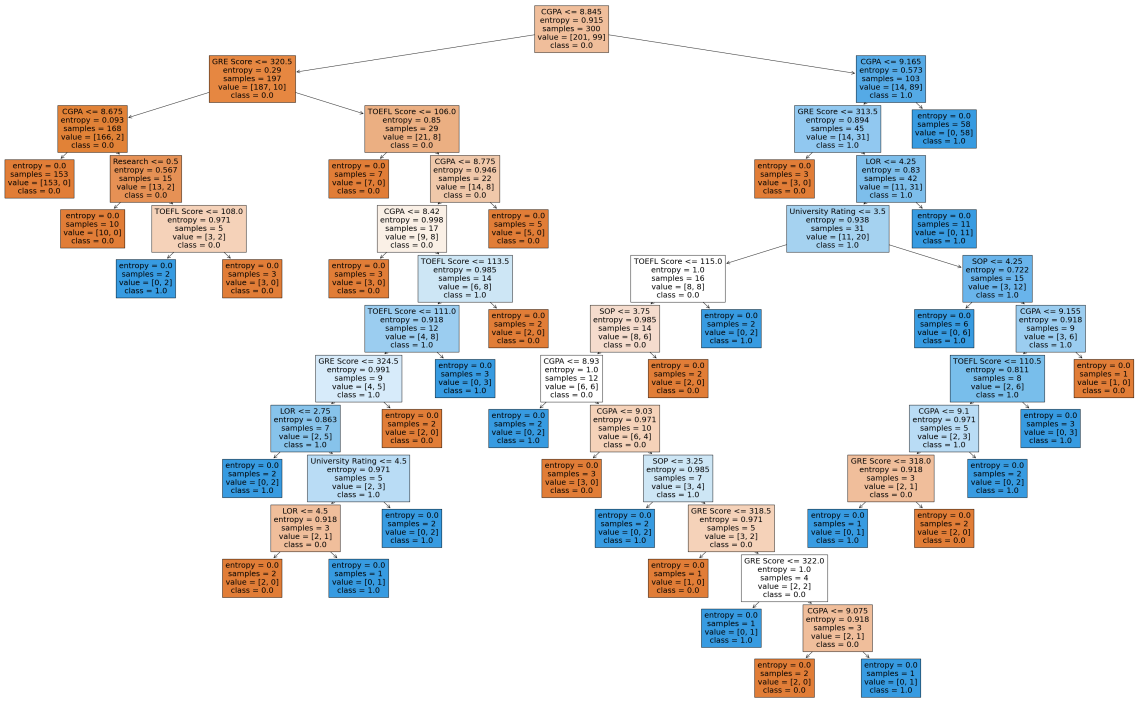
```
Classification Report                precision    recall  f1-score   support

         0.0       0.90      0.90      0.90        71
         1.0       0.76      0.76      0.76        29

    accuracy                           0.86       100
   macro avg       0.83      0.83      0.83       100
weighted avg       0.86      0.86      0.86       100
```

In [53]:
```
feature_names=df.columns[0:7]
print(feature_names,end=' ')
class_names=[str(x) for x in model.classes_]
class_names
```

```
Index(['GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'LOR', 'CGPA',
       'Research'],
      dtype='object')
```

Out[53]:
```
['0.0', '1.0']
```

In [55]:
```
from sklearn.tree import plot_tree
fig=plt.figure(figsize=(50,30))
plot_tree(model,feature_names=feature_names,class_names=class_names,filled=True)
plt.savefig('tree_visualization.png')
```



In [ ]:
```
```

In [57]:
```
pip install graphviz
```

```
Collecting graphviz
  Downloading graphviz-0.20.3-py3-none-any.whl.metadata (12 kB)
Downloading graphviz-0.20.3-py3-none-any.whl (47 kB)
   ---------------------------------------- 0.0/47.1 kB ? eta -:--:--
   -------- ------------------------------- 10.2/47.1 kB ? eta -:--:--
   ---------------------------------------- 47.1/47.1 kB 594.9 kB/s eta 0:00:00
Installing collected packages: graphviz
Successfully installed graphviz-0.20.3
Note: you may need to restart the kernel to use updated packages.
```

In [58]:
```
import graphviz
from sklearn import tree
dot_data = tree.export_graphviz(model,out_file=None, feature_names=feature_names
graph=graphviz.Source(dot_data,format="png")
```

In [59]:
```
sf = StratifiedKFold(n_splits=5,shuffle=True,random_state=0)
```

In [60]:
```
depth=[1,2,3,4,5,6,7,8,9,10]

for d in depth :
    score = cross_val_score(tree.DecisionTreeClassifier(criterion='entropy',max_
    print("Average score for depth {} is {}  :".format(d,score.mean()))
```

```
Average score for depth 1 is 0.9199999999999999  :
Average score for depth 2 is 0.9199999999999999  :
Average score for depth 3 is 0.9233333333333332  :
Average score for depth 4 is 0.9033333333333333  :
Average score for depth 5 is 0.8833333333333334  :
Average score for depth 6 is 0.9  :
Average score for depth 7 is 0.89  :
Average score for depth 8 is 0.8866666666666667  :
Average score for depth 9 is 0.9  :
Average score for depth 10 is 0.9033333333333333  :
```

In [61]:
```
score.mean()
```

Out[61]:
```
0.9033333333333333
```

In [62]:
```
maxdepth=[]
gini_acc=[]
entropy_acc=[]

for i in range(1,11):
    dtree=DecisionTreeClassifier(criteria='gini',max_depth=i)
    dtree.fit(X_train,y_train)
    pred=dtree.predict(y_test,pred)
    gini_acc.append(accuracy_score(y_test,y_pred))
    maxdepth.append(i)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[62], line 6
      3 entropy_acc=[]
      5 for i in range(1,11):
----> 6     dtree=DecisionTreeClassifier(criteria='gini',max_depth=i)
      7     dtree.fit(X_train,y_train)
      8     pred=dtree.predict(y_test,pred)

TypeError: DecisionTreeClassifier.__init__() got an unexpected keyword argument
'criteria'
```

In [ ]: