C1

In [23]:
```
import pandas as pd
import matplotlib.pyplot as plt
```

In [3]:
```
df=pd.read_csv("1_ionosphere.csv")
df
```

Out[3]:

	1	0	0.99539	-0.05889	0.85243	0.02306	0.83398	-0.37708	1.1	0.03760	...	-0.511
0	1	0	1.00000	-0.18829	0.93035	-0.36156	-0.10868	-0.93597	1.00000	-0.04549	...	-0.265
1	1	0	1.00000	-0.03365	1.00000	0.00485	1.00000	-0.12062	0.88965	0.01198	...	-0.402
2	1	0	1.00000	-0.45161	1.00000	1.00000	0.71216	-1.00000	0.00000	0.00000	...	0.906
3	1	0	1.00000	-0.02401	0.94140	0.06531	0.92106	-0.23255	0.77152	-0.16399	...	-0.651
4	1	0	0.02337	-0.00592	-0.09924	-0.11949	-0.00763	-0.11824	0.14706	0.06637	...	-0.015
...	...	...	...	...	...	...	...	...	...	...	...	
345	1	0	0.83508	0.08298	0.73739	-0.14706	0.84349	-0.05567	0.90441	-0.04622	...	-0.042
346	1	0	0.95113	0.00419	0.95183	-0.02723	0.93438	-0.01920	0.94590	0.01606	...	0.013
347	1	0	0.94701	-0.00034	0.93207	-0.03227	0.95177	-0.03431	0.95584	0.02446	...	0.031
348	1	0	0.90608	-0.01657	0.98122	-0.01989	0.95691	-0.03646	0.85746	0.00110	...	-0.020
349	1	0	0.84710	0.13533	0.73638	-0.06151	0.87873	0.08260	0.88928	-0.09139	...	-0.151

350 rows × 35 columns

In [14]:
```
g1={"g":{'g':1,'b':2}}
df=df.replace(g1)
df
```

Out[14]:

	1	0	0.99539	-0.05889	0.85243	0.02306	0.83398	-0.37708	1.1	0.03760	...	-0.511
0	1	0	1.00000	-0.18829	0.93035	-0.36156	-0.10868	-0.93597	1.00000	-0.04549	...	-0.265
1	1	0	1.00000	-0.03365	1.00000	0.00485	1.00000	-0.12062	0.88965	0.01198	...	-0.402
2	1	0	1.00000	-0.45161	1.00000	1.00000	0.71216	-1.00000	0.00000	0.00000	...	0.906
3	1	0	1.00000	-0.02401	0.94140	0.06531	0.92106	-0.23255	0.77152	-0.16399	...	-0.651
4	1	0	0.02337	-0.00592	-0.09924	-0.11949	-0.00763	-0.11824	0.14706	0.06637	...	-0.015
...	...	...	...	...	...	...	...	...	...	...	...	
345	1	0	0.83508	0.08298	0.73739	-0.14706	0.84349	-0.05567	0.90441	-0.04622	...	-0.042
346	1	0	0.95113	0.00419	0.95183	-0.02723	0.93438	-0.01920	0.94590	0.01606	...	0.013
347	1	0	0.94701	-0.00034	0.93207	-0.03227	0.95177	-0.03431	0.95584	0.02446	...	0.031
348	1	0	0.90608	-0.01657	0.98122	-0.01989	0.95691	-0.03646	0.85746	0.00110	...	-0.020
349	1	0	0.84710	0.13533	0.73638	-0.06151	0.87873	0.08260	0.88928	-0.09139	...	-0.151

350 rows × 35 columns

In [7]:
```
from sklearn.preprocessing import StandardScaler
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
```

In [17]:
```
x1=df.drop(["g"],axis=1)
y1=df["g"]
x_train,x_test,y_train,y_test=train_test_split(x1,y1,test_size=0.3)
```

In [18]:
```
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

Out[18]:
```
RandomForestClassifier()
```

In [19]:
```
parameter={'max_depth':[1,2,3,4,5],
           "min_samples_leaf":[5,10,15,20,25],
           "n_estimators":[10,20,30,40,50]}
```

In [20]:
```
from sklearn.model_selection import GridSearchCV

grid_search = GridSearchCV(estimator=rfc,param_grid=parameter,cv=2,scoring="ac
grid_search.fit(x_train,y_train)
```

Out[20]:
```
GridSearchCV(cv=2, estimator=RandomForestClassifier(),
             param_grid={'max_depth': [1, 2, 3, 4, 5],
                         'min_samples_leaf': [5, 10, 15, 20, 25],
                         'n_estimators': [10, 20, 30, 40, 50]},
             scoring='accuracy')
```

In [21]:
```
grid_search.best_score_
```

Out[21]:
```
0.9265293882447021
```

In [26]:
```
rfc_best=grid_search.best_estimator_
```

In [29]:
```
from sklearn.tree import plot_tree

plt.figure(figsize=(80,40))
plot_tree(rfc_best.estimators_[5],feature_names=x1.columns,class_names=['Yes',
```

Out[29]:
```
[Text(1420.3636363636363, 1956.96, '0.02306 <= -0.77\ngini = 0.431\nsamples =
160\nvalue = [168, 77]\nclass = Yes'),
 Text(1014.5454545454545, 1522.0800000000002, 'gini = 0.0\nsamples = 15\nvalu
e = [0, 20]\nclass = No'),
 Text(1826.1818181818182, 1522.0800000000002, '-0.17755 <= -0.326\ngini = 0.3
78\nsamples = 145\nvalue = [168, 57]\nclass = Yes'),
 Text(811.6363636363636, 1087.2, '0.85243.1 <= 0.702\ngini = 0.34\nsamples =
16\nvalue = [5, 18]\nclass = No'),
 Text(405.8181818181818, 652.3200000000002, 'gini = 0.0\nsamples = 7\nvalue =
[0, 12]\nclass = No'),
 Text(1217.4545454545455, 652.3200000000002, 'gini = 0.496\nsamples = 9\nvalu
e = [5, 6]\nclass = No'),
 Text(2840.7272727272725, 1087.2, '0.42267 <= 0.135\ngini = 0.312\nsamples =
129\nvalue = [163, 39]\nclass = Yes'),
 Text(2029.090909090909, 652.3200000000002, '0.56811 <= -0.051\ngini = 0.499
\nsamples = 37\nvalue = [29, 26]\nclass = Yes'),
 Text(1623.2727272727273, 217.44000000000005, 'gini = 0.191\nsamples = 17\nva
lue = [25, 3]\nclass = Yes'),
 Text(2434.909090909091, 217.44000000000005, 'gini = 0.252\nsamples = 20\nval
ue = [4, 23]\nclass = No'),
 Text(3652.3636363636365, 652.3200000000002, '0.18641 <= 0.995\ngini = 0.161
\nsamples = 92\nvalue = [134, 13]\nclass = Yes'),
 Text(3246.5454545454545, 217.44000000000005, 'gini = 0.1\nsamples = 83\nvalu
e = [125, 7]\nclass = Yes'),
 Text(4058.181818181818, 217.44000000000005, 'gini = 0.48\nsamples = 9\nvalue
= [9, 6]\nclass = Yes')]
```