

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

```
In [2]: df=pd.read_csv(r"C5_health care diabetes.csv")
df
```

Out[2]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction
0	6	148	72	35	0	33.6	0.62
1	1	85	66	29	0	26.6	0.35
2	8	183	64	0	0	23.3	0.67
3	1	89	66	23	94	28.1	0.16
4	0	137	40	35	168	43.1	2.28
...
763	10	101	76	48	180	32.9	0.17
764	2	122	70	27	0	36.8	0.34
765	5	121	72	23	112	26.2	0.24
766	1	126	60	0	0	30.1	0.34
767	1	93	70	31	0	30.4	0.31

768 rows × 9 columns



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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Pregnancies           768 non-null   int64
1   Glucose               768 non-null   int64
2   BloodPressure         768 non-null   int64
3   SkinThickness         768 non-null   int64
4   Insulin               768 non-null   int64
5   BMI                  768 non-null   float64
6   DiabetesPedigreeFunction 768 non-null   float64
7   Age                  768 non-null   int64
8   Outcome              768 non-null   int64
dtypes: float64(2), int64(7)
memory usage: 54.1 KB
```

```
In [4]: df=df.dropna()
```


```
In [5]: df.isnull().sum()
```

```
Out[5]: Pregnancies      0
         Glucose          0
         BloodPressure    0
         SkinThickness     0
         Insulin          0
         BMI              0
         DiabetesPedigreeFunction  0
         Age              0
         Outcome          0
         dtype: int64
```

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

```
Out[6]:
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Diabetes
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	



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

```
Out[7]: Index(['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
              'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome'],
              dtype='object')
```

```
In [8]: df['Outcome'].value_counts()
```

```
Out[8]: 0    500
         1    268
         Name: Outcome, dtype: int64
```

```
In [9]: df1=df[['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
               'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome']]
```

```
In [10]: x=df1.drop('Outcome',axis=1)
         y=df1['Outcome']
```

```
In [11]: from sklearn.model_selection import train_test_split
         x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.70)
```

```
In [12]: from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

```
Out[12]: RandomForestClassifier()
```

```
In [13]: parameters={'max_depth':[1,2,3,4,5],
                    'min_samples_leaf':[5,10,15,20,25],
                    'n_estimators':[10,20,30,40,50]}
```

```
In [14]: from sklearn.model_selection import GridSearchCV
grid_search=GridSearchCV(estimator=rfc,param_grid=parameters,cv=2,scoring="accuracy")
grid_search.fit(x_train,y_train)
```

```
Out[14]: 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 [15]: grid_search.best_score_
```

```
Out[15]: 0.7690520446096654
```

```
In [16]: rfc_best=grid_search.best_estimator_
```

```
In [17]: from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rfc_best.estimators_[5],feature_names=x.columns,class_names=['Yes','No'])
```

```
Out[17]: [Text(2590.7142857142853, 1993.2, 'Insulin <= 143.0\ngini = 0.459\nsamples = 344\nvalue = [345, 192]\nclass = Yes'),
Text(1434.8571428571427, 1630.8000000000002, 'Age <= 31.5\ngini = 0.431\nsamples = 273\nvalue = [291, 133]\nclass = Yes'),
Text(797.1428571428571, 1268.4, 'BMI <= 44.9\ngini = 0.294\nsamples = 150\nvalue = [183, 40]\nclass = Yes'),
Text(637.7142857142857, 906.0, 'BMI <= 26.35\ngini = 0.261\nsamples = 145\nvalue = [181, 33]\nclass = Yes'),
Text(318.85714285714283, 543.5999999999999, 'BloodPressure <= 54.5\ngini = 0.027\nsamples = 46\nvalue = [72, 1]\nclass = Yes'),
Text(159.42857142857142, 181.19999999999982, 'gini = 0.111\nsamples = 13\nvalue = [16, 1]\nclass = Yes'),
Text(478.2857142857142, 181.19999999999982, 'gini = 0.0\nsamples = 33\nvalue = [56, 0]\nclass = Yes'),
Text(956.5714285714284, 543.5999999999999, 'SkinThickness <= 5.0\ngini = 0.351\nsamples = 99\nvalue = [109, 32]\nclass = Yes'),
Text(797.1428571428571, 181.19999999999982, 'gini = 0.498\nsamples = 22\nvalue = [14, 16]\nclass = No'),
Text(1116.0, 181.19999999999982, 'gini = 0.247\nsamples = 77\nvalue = [95, 16]\nclass = Yes'),
Text(956.5714285714284, 906.0, 'gini = 0.346\nsamples = 5\nvalue = [2, 7]\nclass = No'),
Text(2072.5714285714284, 1268.4, 'Glucose <= 146.5\ngini = 0.497\nsamples = 123\nvalue = [108, 93]\nclass = Yes'),
Text(1753.7142857142856, 906.0, 'Insulin <= 107.5\ngini = 0.444\nsamples = 89\nvalue = [98, 49]\nclass = Yes'),
Text(1594.2857142857142, 543.5999999999999, 'BMI <= 27.25\ngini = 0.432\nsamples = 80\nvalue = [93, 43]\nclass = Yes'),
Text(1434.8571428571427, 181.19999999999982, 'gini = 0.0\nsamples = 21\nvalue = [37, 0]\nclass = Yes'),
Text(1753.7142857142856, 181.19999999999982, 'gini = 0.491\nsamples = 59\nvalue = [56, 43]\nclass = Yes'),
Text(1913.1428571428569, 543.5999999999999, 'gini = 0.496\nsamples = 9\nvalue = [5, 6]\nclass = No'),
Text(2391.428571428571, 906.0, 'SkinThickness <= 30.5\ngini = 0.302\nsamples = 34\nvalue = [10, 44]\nclass = No'),
Text(2232.0, 543.5999999999999, 'BloodPressure <= 77.0\ngini = 0.24\nsamples = 26\nvalue = [6, 37]\nclass = No'),
Text(2072.5714285714284, 181.19999999999982, 'gini = 0.444\nsamples = 13\nvalue = [6, 12]\nclass = No'),
Text(2391.428571428571, 181.19999999999982, 'gini = 0.0\nsamples = 13\nvalue = [0, 25]\nclass = No'),
Text(2550.8571428571427, 543.5999999999999, 'gini = 0.463\nsamples = 8\nvalue = [4, 7]\nclass = No'),
Text(3746.5714285714284, 1630.8000000000002, 'Glucose <= 165.5\ngini = 0.499\nsamples = 71\nvalue = [54, 59]\nclass = No'),
Text(3347.9999999999995, 1268.4, 'BMI <= 31.4\ngini = 0.488\nsamples = 56\nvalue = [53, 39]\nclass = Yes'),
Text(3029.142857142857, 906.0, 'DiabetesPedigreeFunction <= 0.746\ngini = 0.227\nsamples = 13\nvalue = [20, 3]\nclass = Yes'),
Text(2869.7142857142853, 543.5999999999999, 'gini = 0.0\nsamples = 8\nvalue = [15, 0]\nclass = Yes'),
Text(3188.5714285714284, 543.5999999999999, 'gini = 0.469\nsamples = 5\nvalue = [5, 3]\nclass = Yes'),
Text(3666.8571428571427, 906.0, 'BloodPressure <= 65.0\ngini = 0.499\nsamples = 43\nvalue = [33, 36]\nclass = No'),
Text(3507.428571428571, 543.5999999999999, 'gini = 0.278\nsamples = 8\nvalue
```

[illegible]