```
In [81]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

In [139]: df=pd.read_csv(r"C:\USERS\user\Downloads\C4_framingham - C4_framingham.csv")

Out[139]:

male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHyp
1	39	4.0	0	0.0	0.0	0	0
0	46	2.0	0	0.0	0.0	0	0
1	48	1.0	1	20.0	0.0	0	0
0	61	3.0	1	30.0	0.0	0	1
0	46	3.0	1	23.0	0.0	0	0
1	50	1.0	1	1.0	0.0	0	1
1	51	3.0	1	43.0	0.0	0	0
0	48	2.0	1	20.0	NaN	0	0
0	44	1.0	1	15.0	0.0	0	0
0	52	2.0	0	0.0	0.0	0	0
	1 0 1 0 1 1 0	1 39 0 46 1 48 0 61 0 46 1 50 1 51 0 48 0 44	1 39 4.0 0 46 2.0 1 48 1.0 0 61 3.0 0 46 3.0 1 50 1.0 1 51 3.0 0 48 2.0 0 44 1.0	1 39 4.0 0 0 46 2.0 0 1 48 1.0 1 0 61 3.0 1 0 46 3.0 1 1 50 1.0 1 1 51 3.0 1 0 48 2.0 1 0 44 1.0 1	1 39 4.0 0 0.0 0 46 2.0 0 0.0 1 48 1.0 1 20.0 0 61 3.0 1 30.0 0 46 3.0 1 23.0 1 50 1.0 1 1.0 1 51 3.0 1 43.0 0 48 2.0 1 20.0 0 44 1.0 1 15.0	1 39 4.0 0 0.0 0.0 0 46 2.0 0 0.0 0.0 1 48 1.0 1 20.0 0.0 0 61 3.0 1 30.0 0.0 0 46 3.0 1 23.0 0.0 1 50 1.0 1 1.0 0.0 1 51 3.0 1 43.0 0.0 0 48 2.0 1 20.0 NaN 0 44 1.0 1 15.0 0.0	0 46 2.0 0 0.0 0.0 0 1 48 1.0 1 20.0 0.0 0 0 61 3.0 1 30.0 0.0 0 0 46 3.0 1 23.0 0.0 0 1 50 1.0 1 1.0 0.0 0 0 1 51 3.0 1 43.0 0.0 0 0 0 48 2.0 1 20.0 NaN 0 0 44 1.0 1 15.0 0.0 0

4238 rows × 16 columns

```
In [140]:
```

In [141]: df=df.head(21)

Out[141]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHyp	C
0	1	39	4.0	0	0.0	0.0	0	0	_
1	0	46	2.0	0	0.0	0.0	0	0	
2	1	48	1.0	1	20.0	0.0	0	0	
3	0	61	3.0	1	30.0	0.0	0	1	
4	0	46	3.0	1	23.0	0.0	0	0	
5	0	43	2.0	0	0.0	0.0	0	1	
6	0	63	1.0	0	0.0	0.0	0	0	
7	0	45	2.0	1	20.0	0.0	0	0	
8	1	52	1.0	0	0.0	0.0	0	1	
9	1	43	1.0	1	30.0	0.0	0	1	
10	0	50	1.0	0	0.0	0.0	0	0	
11	0	43	2.0	0	0.0	0.0	0	0	
12	1	46	1.0	1	15.0	0.0	0	1	
13	0	41	3.0	0	0.0	1.0	0	1	
14	0	39	2.0	1	9.0	0.0	0	0	
15	0	38	2.0	1	20.0	0.0	0	1	
16	1	48	3.0	1	10.0	0.0	0	1	
17	0	46	2.0	1	20.0	0.0	0	0	
18	0	38	2.0	1	5.0	0.0	0	0	
19	1	41	2.0	0	0.0	0.0	0	0	
20	0	42	2.0	1	30.0	0.0	0	0	

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Out[142]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHyp c
0	1	39	4.0	0	0.0	0.0	0	0
1	0	46	2.0	0	0.0	0.0	0	0
2	1	48	1.0	1	20.0	0.0	0	0
3	0	61	3.0	1	30.0	0.0	0	1
4	0	46	3.0	1	23.0	0.0	0	0
5	0	43	2.0	0	0.0	0.0	0	1
6	0	63	1.0	0	0.0	0.0	0	0
7	0	45	2.0	1	20.0	0.0	0	0
8	1	52	1.0	0	0.0	0.0	0	1
9	1	43	1.0	1	30.0	0.0	0	1
10	0	50	1.0	0	0.0	0.0	0	0
11	0	43	2.0	0	0.0	0.0	0	0
12	1	46	1.0	1	15.0	0.0	0	1
13	0	41	3.0	0	0.0	1.0	0	1
14	0	39	2.0	1	9.0	0.0	0	0
15	0	38	2.0	1	20.0	0.0	0	1
16	1	48	3.0	1	10.0	0.0	0	1
17	0	46	2.0	1	20.0	0.0	0	0
18	0	38	2.0	1	5.0	0.0	0	0
19	1	41	2.0	0	0.0	0.0	0	0
20	0	42	2.0	1	30.0	0.0	0	0

```
In [143]:
Out[143]: 85.0
                    3
                    2
          70.0
          78.0
                    2
                    2
          76.0
          103.0
                    1
          88.0
                    1
          99.0
                    1
          79.0
                    1
          77.0
                    1
          72.0
                    1
          84.0
                    1
          64.0
                    1
          61.0
                    1
          65.0
                    1
          89.0
                    1
          Name: glucose, dtype: int64
In [124]: x=a.drop('glucose',axis=1)
```

```
In [144]: g1={"glucose":{'NaN':1}}
    a=a.replace(g1)
```

male age education currentSmoker cigsPerDay BPMeds prevalentStroke

\		_				_	-	•	
0	1	39	4.0		0	0.	0 0	.0	0
1	0	46	2.0		0	0.	0 0	.0	0
2	1	48	1.0		1	20.	0 0	.0	0
3	0	61	3.0		1	30.	0 0	.0	0
4	0	46	3.0		1	23.	0 0	.0	0
5	0	43	2.0		0	0.	0 0	.0	0
6	0	63	1.0		0	0.	0 0	.0	0
7	0	45	2.0		1	20.	0 0	.0	0
8	1	52	1.0		0	0.	0 0	.0	0
9	1	43	1.0		1	30.	0 0	.0	0
10	0	50	1.0		0	0.	0 0	.0	0
11	0	43	2.0		0	0.	0 0	.0	0
12	1	46	1.0		1	15.	0 0	.0	0
13	0	41	3.0		0	0.	0 1	.0	0
14	0	39	2.0		1	9.	0 0	.0	0
15	0	38	2.0		1	20.	0 0	.0	0
16	1	48	3.0		1	10.	0 0	.0	0
17	0	46	2.0		1	20.	0 0	.0	0
18	0	38	2.0		1	5.	0 0	.0	0
19	1	41	2.0		0	0.	0 0	.0	0
20	0	42	2.0		1	30.	0 0	.0	0
	preva]	LentHyp	diabetes	totChol	sysBP	diaBP	BMI	heartRate	glucose
\	preva]				-				_
0	preva]	0	0	195.0	106.0	70.0	26.97	80.0	77.0
0 1	preva]	0	0 0	195.0 250.0	106.0 121.0	70.0 81.0	26.97 28.73	80.0 95.0	77.0 76.0
0 1 2	preva]	0 0 0	0 0 0	195.0 250.0 245.0	106.0 121.0 127.5	70.0 81.0 80.0	26.97 28.73 25.34	80.0 95.0 75.0	77.0 76.0 70.0
0 1 2 3	preva]	0 0 0 1	0 0 0	195.0 250.0 245.0 225.0	106.0 121.0 127.5 150.0	70.0 81.0 80.0 95.0	26.97 28.73 25.34 28.58	80.0 95.0 75.0 65.0	77.0 76.0 70.0 103.0
0 1 2 3 4	preval	0 0 0 1 0	0 0 0 0	195.0 250.0 245.0 225.0 285.0	106.0 121.0 127.5 150.0 130.0	70.0 81.0 80.0 95.0 84.0	26.97 28.73 25.34 28.58 23.10	80.0 95.0 75.0 65.0 85.0	77.0 76.0 70.0 103.0 85.0
0 1 2 3 4 5	preval	0 0 0 1 0	0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0	106.0 121.0 127.5 150.0 130.0 180.0	70.0 81.0 80.0 95.0 84.0 110.0	26.97 28.73 25.34 28.58 23.10 30.30	80.0 95.0 75.0 65.0 85.0 77.0	77.0 76.0 70.0 103.0 85.0 99.0
0 1 2 3 4 5 6	preval	0 0 0 1 0 1	0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11	80.0 95.0 75.0 65.0 85.0 77.0 60.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0
0 1 2 3 4 5 6 7	preval	0 0 0 1 0 1 0	0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0
0 1 2 3 4 5 6 7 8	preval	0 0 0 1 0 1 0	0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5	70.0 81.0 80.0 95.0 84.0 110.0 71.0 89.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0
0 1 2 3 4 5 6 7 8	preval	0 0 0 1 0 1 0 0	0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0 225.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 71.0 89.0 107.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0
0 1 2 3 4 5 6 7 8 9 10	preval	0 0 0 1 0 1 0 0	0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0 225.0 254.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 71.0 89.0 107.0 76.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0
0 1 2 3 4 5 6 7 8 9 10 11	preval	0 0 0 1 0 1 0 0 1 1	0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0 225.0 247.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 89.0 107.0 76.0 88.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 72.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0
0 1 2 3 4 5 6 7 8 9 10 11 12	preval	0 0 0 1 0 1 0 1 1 0 0	0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0 225.0 254.0 294.0	106.0 121.0 127.5 150.0 130.0 180.0 100.0 141.5 162.0 133.0 131.0 142.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 89.0 107.0 76.0 88.0 94.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 98.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13	preval	0 0 0 1 0 1 0 0 1 1 0 0	0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 205.0 313.0 260.0 225.0 254.0 294.0 332.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0 142.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 71.0 89.0 107.0 76.0 88.0 94.0 88.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 72.0 98.0 65.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0 64.0 84.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14	preval	0 0 0 1 0 1 0 0 1 1 0 0	0 0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0 225.0 247.0 294.0 332.0 226.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0 142.0 124.0 114.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 89.0 107.0 76.0 88.0 94.0 88.0 64.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31 22.35	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 98.0 65.0 85.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0 64.0 84.0 NaN
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	preval	0 0 0 1 0 1 0 0 1 1 0 0	0 0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 228.0 205.0 313.0 260.0 225.0 247.0 294.0 332.0 226.0 221.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0 142.0 114.0 140.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 71.0 89.0 107.0 76.0 88.0 94.0 88.0 90.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31 22.35 21.35	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 98.0 65.0 85.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0 64.0 84.0 NaN
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	preval	0 0 0 1 0 1 0 0 1 1 0 0 1	0 0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 205.0 313.0 260.0 225.0 254.0 294.0 332.0 226.0 221.0 232.0	106.0 121.0 127.5 150.0 130.0 180.0 141.5 162.0 133.0 142.0 124.0 114.0 140.0 138.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 89.0 107.0 76.0 88.0 94.0 88.0 90.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31 22.35 21.35 22.37	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 98.0 65.0 85.0 95.0 64.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0 64.0 84.0 NaN 70.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	preval	0 0 0 1 0 1 0 0 1 1 0 0 1 1 0 0	0 0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 205.0 313.0 260.0 225.0 254.0 294.0 332.0 226.0 232.0 291.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0 142.0 124.0 114.0 140.0 138.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 71.0 76.0 88.0 94.0 88.0 90.0 90.0 78.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31 22.35 21.35 22.37 23.38	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 72.0 98.0 65.0 85.0 95.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0 64.0 84.0 NaN 70.0 72.0 89.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	preval	0 0 0 1 0 1 0 0 1 1 0 0 1 1 0 0	0 0 0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 205.0 313.0 260.0 225.0 247.0 294.0 332.0 226.0 221.0 291.0 195.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0 142.0 114.0 140.0 138.0 112.0 112.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 89.0 107.0 76.0 88.0 94.0 90.0 90.0 90.0 78.0 84.5	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31 22.35 21.35 22.37 23.38 23.24	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 98.0 65.0 85.0 95.0 64.0 80.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 79.0 88.0 76.0 61.0 64.0 84.0 NaN 70.0 72.0 89.0 78.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	preval	0 0 0 1 0 1 0 0 1 1 0 0 1 1 0 0	0 0 0 0 0 0 0 0	195.0 250.0 245.0 225.0 285.0 205.0 313.0 260.0 225.0 254.0 294.0 332.0 226.0 232.0 291.0	106.0 121.0 127.5 150.0 130.0 180.0 138.0 100.0 141.5 162.0 133.0 131.0 142.0 124.0 114.0 140.0 138.0	70.0 81.0 80.0 95.0 84.0 110.0 71.0 71.0 76.0 88.0 94.0 88.0 90.0 90.0 78.0	26.97 28.73 25.34 28.58 23.10 30.30 33.11 21.68 26.36 23.61 22.91 27.64 26.31 31.31 22.35 21.35 22.37 23.38	80.0 95.0 75.0 65.0 85.0 77.0 60.0 79.0 76.0 93.0 75.0 72.0 98.0 65.0 85.0 95.0	77.0 76.0 70.0 103.0 85.0 99.0 85.0 78.0 79.0 88.0 76.0 61.0 64.0 84.0 NaN 70.0 72.0 89.0

TenYearCHD 0 0 1 0 2 0 3 1

```
4
                       0
          5
                       0
          6
                       1
          7
          8
                       0
          9
                       0
          10
          11
          12
          13
          14
          15
                       1
          16
          17
          18
          19
                       0
          20
In [145]: from sklearn.model selection import train test split
In [146]: from sklearn.ensemble import RandomForestClassifier
          rfc=RandomForestClassifier()
Out[146]: RandomForestClassifier()
In [147]: parameters={'max_depth':[1,2,3,4,5],
                      'min_samples_leaf':[5,10,15,20,25],
In [148]: from sklearn.model_selection import GridSearchCV
          grid_search=GridSearchCV(estimator=rfc,param_grid=parameters,cv=2,scoring="acc
Out[148]: 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 [149]:
Out[149]: 0.58333333333333333
```

gini = 0.49 samples = 6 value = [3, 4] class = No

In []:

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