ML02

August 14, 2024

```
[2]:
     import pandas as pd
     df = pd.read_csv("Heart.csv")
     df.head()
[4]:
        Unnamed: 0
                                     ChestPain RestBP
                                                                       RestECG
                                                                                 MaxHR
[4]:
                      Age
                            Sex
                                                           Chol
                                                                 Fbs
     0
                       63
                                                     145
                                                            233
                                                                    1
                                                                              2
                                                                                    150
                              1
                                       typical
     1
                   2
                       67
                              1
                                  asymptomatic
                                                     160
                                                            286
                                                                    0
                                                                              2
                                                                                    108
     2
                                  asymptomatic
                                                                              2
                   3
                       67
                                                     120
                                                            229
                                                                    0
                                                                                    129
     3
                   4
                       37
                              1
                                    nonanginal
                                                     130
                                                            250
                                                                    0
                                                                              0
                                                                                    187
     4
                   5
                                    nontypical
                                                                              2
                                                                                    172
                       41
                                                     130
                                                            204
                                                                    0
        ExAng
                Oldpeak
                          Slope
                                    Ca
                                               Thal
                                                      AHD
                                   0.0
     0
             0
                     2.3
                               3
                                              fixed
                                                       No
     1
             1
                     1.5
                               2
                                   3.0
                                             normal
                                                      Yes
     2
                     2.6
                               2
                                   2.0
             1
                                        reversable
                                                      Yes
                               3
     3
             0
                     3.5
                                   0.0
                                             normal
                                                       No
     4
             0
                     1.4
                                   0.0
                                             normal
                                                       No
[5]: df.tail()
[5]:
           Unnamed: 0
                        Age
                              Sex
                                       ChestPain
                                                    RestBP
                                                             Chol
                                                                    Fbs
                                                                         RestECG
                                                                                    MaxHR
     298
                   299
                          45
                                 1
                                          typical
                                                       110
                                                              264
                                                                      0
                                                                                0
                                                                                      132
     299
                   300
                          68
                                    asymptomatic
                                                        144
                                                              193
                                                                                0
                                                                                      141
                                 1
                                                                      1
     300
                                                                                0
                   301
                          57
                                 1
                                    asymptomatic
                                                       130
                                                              131
                                                                      0
                                                                                      115
                                                                                2
     301
                   302
                          57
                                 0
                                      nontypical
                                                        130
                                                              236
                                                                                      174
                                                                      0
     302
                   303
                                                              175
                          38
                                 1
                                      nonanginal
                                                        138
                                                                                0
                                                                                      173
                   Oldpeak
                             Slope
                                      Ca
                                                  Thal
                                                        AHD
           ExAng
     298
                       1.2
                                  2
                                     0.0
               0
                                           reversable
                                                        Yes
                                  2
     299
               0
                       3.4
                                     2.0
                                           reversable
                                                        Yes
     300
               1
                       1.2
                                  2
                                     1.0
                                           reversable
                                                        Yes
     301
               0
                       0.0
                                  2
                                                        Yes
                                     1.0
                                               normal
     302
               0
                       0.0
                                  1
                                     NaN
                                               normal
                                                          No
[6]: x = df.iloc[:, 1:14]
```

	Age	Sex	Ch	estPa	in RestBP	Chol	Fbs	${\tt RestECG}$	${\tt MaxHR}$	ExAng	\
0	0 63 1			typical		233	1	2	150	0	
1	67	1	asymp	tomat	ic 160	286	0	2	108	1	
2	67	1	asymp	tomat	ic 120	229	0	2	129	1	
3	37	1	non	angin	al 130	250	0	0	187	0	
4	41	0	non	typic	al 130	204	0	2	172	0	
						•••	•••	•••			
298	45	1		typic	al 110	264	0	0	132	0	
299	68	1	asymp	tomat	ic 144	193	1	0	141	0	
300	57	1	asymp	tomat	ic 130	131	0	0	115	1	
301	57	0	non	typic	al 130	236	0	2	174	0	
302	38	1	non	angin	al 138	175	0	0	173	0	
	Oldp	eak	Slope	Ca	Thal	L					
0		2.3	3	0.0	fixed	i					
1		1.5	2	3.0	normal	L					
2		2.6	2	2.0	reversable	e					
3		3.5	3	0.0	normal	L					
4		1.4	1	0.0	normal	L					
					•••						
298		1.2	2	0.0	reversable	Э					
299		3.4	2	2.0	reversable	Э					
300		1.2	2	1.0	reversable	Э					
301		0.0	2	1.0	normal	L					
302		0.0	1	${\tt NaN}$	normal	L					

[303 rows x 13 columns]

[8]: df.isnull

[8]:	<box></box>	method	Data	aFram	e.isn	null of	Unnamed:	0 Age	Sex	ChestPa	ain
	${\tt RestBP}$	Chol	Fbs	Res	tECG	MaxHR \					
	0		1	63	1	typical	145	233	1	2	150
	1		2	67	1	asymptomatic	160	286	0	2	108
	2		3	67	1	asymptomatic	120	229	0	2	129
	3		4	37	1	nonanginal	130	250	0	0	187
	4		5	41	0	nontypical	130	204	0	2	172
		•••	•••					•••	•••		
	298	2	99	45	1	typical	110	264	0	0	132
	299	30	00	68	1	asymptomatic	144	193	1	0	141
	300	30	01	57	1	asymptomatic	130	131	0	0	115
	301	30	02	57	0	nontypical	130	236	0	2	174
	302	30	03	38	1	nonanginal	138	175	0	0	173

ExAng Oldpeak Slope Ca Thal AHD

```
0
         0
                 2.3
                           3 0.0
                                         fixed
                                                 No
1
         1
                 1.5
                           2
                              3.0
                                        normal
                                                 Yes
2
                           2
         1
                 2.6
                              2.0
                                   reversable
                                                 Yes
3
                           3
         0
                 3.5
                              0.0
                                        normal
                                                  No
4
         0
                 1.4
                           1
                              0.0
                                        normal
                                                 No
         0
                 1.2
                           2
298
                              0.0 reversable
                                                Yes
299
         0
                 3.4
                           2
                              2.0
                                   reversable
                                                Yes
300
                 1.2
                           2
         1
                              1.0
                                   reversable
                                                Yes
301
         0
                 0.0
                           2
                              1.0
                                        normal
302
         0
                 0.0
                              NaN
                                        normal
                                                 No
```

[303 rows x 15 columns]>

```
[9]: df.isna()
```

[9]:		Unname	ed: 0	Age	S	ex	Che	stPain	RestBP	Chol	Fbs	RestECG	\
2-3-	0			_								False	•
	1											False	
	2											False	
	3											False	
	4	F	alse	False	Fal	se		False	False	False	False	False	
			•••					•••		•••			
	298									False	False	False	
	299	F	alse	False	Fal	se		False	False	False	False	False	
	300	F	alse	False	Fal	se		False	False	False	False	False	
	301	F	alse	False	Fal	se		False	False	False	False	False	
	302	False		se False		False		False	False	False	False	False	
		${\tt MaxHR}$	ExAn	g 01d _]	peak	Slo	ре	Ca	Thal	AHD			
	0	False	False	e Fa	alse	Fal	se	False	False	False			
	1	False	False	e Fa	alse	Fal	se	False	False	False			
	2	False	False	e Fa	alse	Fal	se	False	False	False			
	3	False	False	e Fa	alse	Fal	se	False	False	False			
	4	False	False	e Fa	alse	Fal	se	False	False	False			
		•••		•••		•••							
	298	False	False	e Fa	alse	Fal	se	False	False	False			
	299	False	False	e Fa	alse	Fal	se	False	False	False			
	300	False	False	e Fa	alse	Fal	se	False	False	False			
	301	False	False	e Fa	alse	Fal	se	False	False	False			
	302	False	False	e Fa	alse	Fal	se	True	False	False			

[303 rows x 15 columns]

[10]: df.isnull()

```
[10]:
           Unnamed: 0
                         Age
                                Sex
                                     ChestPain RestBP
                                                         Chol
                                                                 Fbs
                                                                      RestECG
                      False
      0
                False
                             False
                                         False
                                                 False
                                                       False
                                                              False
                                                                         False
      1
                False
                       False
                             False
                                         False
                                                 False
                                                        False
                                                               False
                                                                        False
      2
                False False False
                                         False
                                                 False False False
                                                                        False
      3
                False False False
                                                 False False False
                                                                        False
                                         False
      4
                False
                      False False
                                         False
                                                 False
                                                        False
                                                               False
                                                                         False
      . .
                       •••
                                           •••
      298
                False
                      False
                              False
                                         False
                                                 False
                                                        False
                                                               False
                                                                        False
      299
                False
                      False
                                                        False
                              False
                                         False
                                                 False
                                                               False
                                                                        False
      300
                False
                       False
                              False
                                         False
                                                 False
                                                        False
                                                               False
                                                                        False
      301
                      False
                                                        False False
                False
                              False
                                         False
                                                 False
                                                                         False
      302
                False
                      False
                             False
                                         False
                                                 False
                                                       False
                                                               False
                                                                         False
           MaxHR
                  ExAng
                        Oldpeak
                                  Slope
                                            Ca
                                                 Thal
                                                         AHD
           False
                  False
                           False
                                  False
                                                False
      0
                                         False
                                                       False
      1
           False False
                           False
                                 False
                                         False
                                                False
                                                       False
      2
           False
                  False
                           False
                                  False
                                         False
                                                False
                                                       False
      3
          False
                  False
                           False False False False
          False
      4
                 False
                           False
                                  False False
                                                False False
          False
      298
                 False
                           False False False
                                               False
                                                       False
      299
          False
                  False
                           False False False
                                                       False
          False False
      300
                           False False False False
      301
          False False
                                 False False
                                               False
                                                       False
                           False
      302 False False
                           False False
                                          True False False
      [303 rows x 15 columns]
[11]: df.loc[:, "Age":"RestBP"]
Γ11]:
                        ChestPain RestBP
           Age
                Sex
                          typical
      0
            63
                  1
                                      145
      1
            67
                     asymptomatic
                                      160
      2
            67
                  1
                     asymptomatic
                                      120
      3
            37
                  1
                       nonanginal
                                      130
      4
            41
                  0
                       nontypical
                                      130
      . .
      298
            45
                  1
                          typical
                                      110
      299
            68
                     asymptomatic
                                      144
      300
            57
                     asymptomatic
                                      130
                  1
      301
            57
                  0
                       nontypical
                                      130
      302
            38
                       nonanginal
                                      138
                  1
      [303 rows x 4 columns]
```

[12]: y = df['Age']

```
[13]: y
[13]: 0
              63
      1
              67
      2
              67
      3
              37
      4
              41
               . .
      298
              45
      299
              68
      300
              57
      301
              57
      302
              38
      Name: Age, Length: 303, dtype: int64
[14]: x = df.iloc[1:11, :]
[15]: x
[15]:
           Unnamed: 0
                              Sex
                                       ChestPain RestBP
                                                             Chol
                                                                         RestECG
                                                                                   MaxHR \
                        Age
                                                                   Fbs
                     2
                          67
                                 1
                                    asymptomatic
                                                       160
                                                              286
                                                                      0
                                                                                2
                                                                                      108
      1
      2
                     3
                         67
                                1
                                    asymptomatic
                                                       120
                                                              229
                                                                      0
                                                                                2
                                                                                      129
      3
                     4
                          37
                                1
                                      nonanginal
                                                       130
                                                              250
                                                                      0
                                                                                0
                                                                                      187
                     5
      4
                         41
                                0
                                      nontypical
                                                       130
                                                              204
                                                                      0
                                                                                2
                                                                                      172
      5
                     6
                         56
                                1
                                      nontypical
                                                       120
                                                              236
                                                                      0
                                                                                0
                                                                                     178
                     7
                                                                      0
                                                                                2
      6
                         62
                                0
                                    asymptomatic
                                                       140
                                                              268
                                                                                      160
      7
                     8
                         57
                                                       120
                                                              354
                                                                      0
                                                                                0
                                                                                     163
                                0
                                    asymptomatic
      8
                     9
                                                              254
                                                                      0
                                                                                2
                                                                                     147
                          63
                                    asymptomatic
                                                       130
                                1
      9
                                                                                2
                    10
                          53
                                                       140
                                                              203
                                                                      1
                                                                                      155
                                    asymptomatic
      10
                    11
                          57
                                 1
                                    asymptomatic
                                                       140
                                                              192
                                                                                0
                                                                                      148
           ExAng
                   Oldpeak Slope
                                      Ca
                                                 Thal
                                                        AHD
      1
               1
                       1.5
                                 2
                                     3.0
                                               normal
                                                        Yes
      2
               1
                       2.6
                                 2
                                     2.0
                                          reversable
                                                        Yes
      3
               0
                       3.5
                                 3
                                     0.0
                                               normal
                                                         No
      4
               0
                       1.4
                                     0.0
                                               normal
                                 1
                                                         No
      5
               0
                       0.8
                                     0.0
                                               normal
                                                         No
                                 1
      6
               0
                       3.6
                                 3
                                     2.0
                                               normal
                                                        Yes
      7
               1
                       0.6
                                     0.0
                                                         No
                                 1
                                               normal
      8
               0
                       1.4
                                 2
                                     1.0
                                          reversable
                                                        Yes
               1
      9
                       3.1
                                 3
                                     0.0
                                          reversable
                                                        Yes
               0
      10
                       0.4
                                 2
                                     0.0
                                                fixed
                                                         No
[16]: z = df[::2]
[17]: z
```

```
[17]:
                                                                       Fbs
                                                                             RestECG
            Unnamed: 0
                           Age
                                Sex
                                          ChestPain
                                                      RestBP
                                                                Chol
                                                                                        MaxHR
                                                          145
                                                                 233
                                                                                    2
                                                                                          150
       0
                       1
                            63
                                   1
                                            typical
                                                                          1
                                                                                    2
       2
                       3
                            67
                                   1
                                      asymptomatic
                                                          120
                                                                 229
                                                                          0
                                                                                          129
       4
                       5
                            41
                                   0
                                         nontypical
                                                          130
                                                                 204
                                                                          0
                                                                                    2
                                                                                          172
       6
                       7
                                                                                    2
                            62
                                      asymptomatic
                                                          140
                                                                 268
                                                                          0
                                                                                          160
                                   0
                                                                                    2
       8
                       9
                            63
                                      asymptomatic
                                                          130
                                                                 254
                                                                          0
                                                                                          147
       . .
                                                                 •••
                            •••
                                                                                    0
       294
                     295
                            63
                                   0
                                      asymptomatic
                                                          124
                                                                 197
                                                                          0
                                                                                          136
       296
                     297
                            59
                                                          164
                                                                 176
                                                                                    2
                                                                                           90
                                   1
                                      asymptomatic
                                                                          1
       298
                                                                                    0
                     299
                            45
                                   1
                                            typical
                                                          110
                                                                 264
                                                                          0
                                                                                          132
       300
                     301
                            57
                                   1
                                                          130
                                                                  131
                                                                          0
                                                                                    0
                                                                                          115
                                      asymptomatic
       302
                     303
                            38
                                   1
                                         nonanginal
                                                          138
                                                                  175
                                                                          0
                                                                                    0
                                                                                          173
            ExAng
                     Oldpeak
                               Slope
                                         Ca
                                                    Thal
                                                           AHD
       0
                 0
                         2.3
                                    3
                                       0.0
                                                   fixed
                                                             No
                                       2.0
       2
                         2.6
                                    2
                 1
                                             reversable
                                                           Yes
       4
                 0
                         1.4
                                    1
                                       0.0
                                                  normal
                                                            No
                 0
                                    3
       6
                         3.6
                                       2.0
                                                  normal
                                                           Yes
       8
                 0
                          1.4
                                    2
                                        1.0
                                             reversable
                                                           Yes
       . .
                         0.0
                                    2
       294
                 1
                                       0.0
                                                  normal
                                                           Yes
       296
                 0
                         1.0
                                    2
                                       2.0
                                                   fixed
                                                           Yes
       298
                 0
                                    2
                                       0.0
                         1.2
                                             reversable
       300
                 1
                         1.2
                                    2
                                       1.0
                                             reversable
                                                           Yes
       302
                 0
                         0.0
                                    1
                                       NaN
                                                  normal
                                                            No
       [152 rows x 15 columns]
[18]:
      y = df[df['Age'] > 60]
       #get
[19]: y
                                                                             RestECG
[19]:
            Unnamed: 0
                           Age
                                Sex
                                          ChestPain
                                                      RestBP
                                                                Chol
                                                                       Fbs
                                                                                        MaxHR
                       1
                            63
                                   1
                                            typical
                                                          145
                                                                 233
                                                                          1
                                                                                    2
                                                                                          150
       0
                       2
                                                                                    2
       1
                            67
                                   1
                                      asymptomatic
                                                                 286
                                                                          0
                                                          160
                                                                                          108
       2
                       3
                                                                                    2
                            67
                                      asymptomatic
                                                          120
                                                                 229
                                                                          0
                                                                                          129
                       7
                                                                                    2
       6
                            62
                                   0
                                      asymptomatic
                                                          140
                                                                 268
                                                                          0
                                                                                          160
                       9
                                                                                    2
       8
                            63
                                   1
                                      asymptomatic
                                                          130
                                                                 254
                                                                          0
                                                                                          147
       . .
                                                                 •••
                                                                                    0
                                                                                          161
       284
                     285
                            61
                                   1
                                      asymptomatic
                                                          148
                                                                 203
                                                                          0
                                                                                    2
       290
                     291
                            67
                                   1
                                         nonanginal
                                                          152
                                                                 212
                                                                          0
                                                                                          150
       293
                     294
                            63
                                   1
                                      asymptomatic
                                                          140
                                                                  187
                                                                          0
                                                                                    2
                                                                                          144
                                                                                    0
       294
                     295
                            63
                                   0
                                      asymptomatic
                                                          124
                                                                  197
                                                                          0
                                                                                          136
       299
                     300
                                                          144
                                                                 193
                                                                                    0
                                                                                          141
                            68
                                   1
                                      asymptomatic
                                                                          1
```

Thal

AHD

ExAng

Oldpeak Slope

Ca

```
1
                1
                        1.5
                                  2
                                      3.0
                                                normal
                                                         Yes
      2
                        2.6
                                  2
                1
                                      2.0
                                           reversable
                                                         Yes
                                   3
      6
                0
                        3.6
                                      2.0
                                                normal
                                                         Yes
      8
                0
                        1.4
                                   2
                                      1.0 reversable
                                                         Yes
      284
                0
                        0.0
                                      1.0
                                          reversable
                                                         Yes
                                  1
      290
                0
                        0.8
                                  2
                                      0.0
                                           reversable
                                                         Yes
      293
                        4.0
                                      2.0
                1
                                   1
                                           reversable
                                                         Yes
      294
                1
                        0.0
                                  2
                                      0.0
                                                normal
                                                         Yes
      299
                0
                        3.4
                                      2.0
                                           reversable
                                                        Yes
      [79 rows x 15 columns]
[20]: z = df.iloc[2:11, 5:11]
[21]: z
[21]:
           Chol
                 Fbs
                       RestECG
                                 {\tt MaxHR}
                                         ExAng
                                                 Oldpeak
            229
      2
                    0
                              2
                                    129
                                              1
                                                      2.6
      3
            250
                    0
                              0
                                    187
                                              0
                                                      3.5
      4
            204
                    0
                              2
                                    172
                                              0
                                                      1.4
      5
            236
                    0
                              0
                                    178
                                              0
                                                      0.8
      6
            268
                    0
                              2
                                    160
                                              0
                                                      3.6
      7
            354
                    0
                              0
                                    163
                                              1
                                                      0.6
                              2
      8
            254
                    0
                                    147
                                              0
                                                      1.4
      9
            203
                              2
                                    155
                                                      3.1
                    1
                                              1
      10
            192
                              0
                                    148
                                              0
                                                      0.4
[22]:
      y = df["AHD"]
[23]: y
[23]: 0
               No
      1
              Yes
      2
              Yes
      3
               No
      4
               No
      298
              Yes
      299
              Yes
      300
              Yes
      301
              Yes
      302
               No
      Name: AHD, Length: 303, dtype: object
[24]: y= df.isnull().any(axis=1)
```

0

2.3

0

0.0

fixed

No

3

```
[25]: y
[25]: 0
              False
       1
              False
       2
              False
       3
              False
       4
              False
       298
              False
       299
              False
       300
              False
       301
              False
       302
                True
       Length: 303, dtype: bool
[26]: df[y]
[26]:
            Unnamed: 0
                          Age
                               Sex
                                         ChestPain
                                                     RestBP
                                                              Chol
                                                                     Fbs
                                                                           RestECG
                                                                                     MaxHR
       87
                           53
                                  0
                                                                       0
                                                                                  2
                     88
                                       nonanginal
                                                         128
                                                                216
                                                                                       115
       166
                    167
                           52
                                                               223
                                                                                  0
                                  1
                                       nonanginal
                                                         138
                                                                       0
                                                                                       169
       192
                    193
                           43
                                  1
                                     asymptomatic
                                                                                  2
                                                                                       143
                                                         132
                                                               247
                                                                        1
       266
                    267
                           52
                                  1
                                     asymptomatic
                                                         128
                                                                204
                                                                        1
                                                                                  0
                                                                                       156
       287
                    288
                           58
                                       nontypical
                                                                220
                                                                                  0
                                                                                       144
                                  1
                                                         125
                                                                       0
       302
                    303
                                                                175
                           38
                                  1
                                       nonanginal
                                                         138
                                                                                  0
                                                                                       173
                    Oldpeak
                              Slope
                                       Ca
                                                          AHD
            ExAng
                                                   Thal
       87
                 0
                         0.0
                                   1
                                      0.0
                                                    NaN
                                                           No
       166
                 0
                         0.0
                                   1
                                      NaN
                                                 normal
                                                           No
       192
                         0.1
                                   2
                 1
                                      NaN
                                            reversable
                                                          Yes
       266
                 1
                         1.0
                                   2
                                      0.0
                                                    NaN
                                                          Yes
       287
                 0
                         0.4
                                   2
                                      NaN
                                            reversable
                                                           No
       302
                         0.0
                                   1
                                      NaN
                                                 normal
                                                           No
[27]:
      df = df.drop('AHD', axis=1)
[28]: df
[28]:
                                         ChestPain
                                                                     Fbs
                                                                           RestECG
                                                                                     MaxHR
            Unnamed: 0
                          Age
                               Sex
                                                     RestBP
                                                              Chol
                                                                                  2
       0
                      1
                           63
                                  1
                                           typical
                                                         145
                                                                233
                                                                       1
                                                                                       150
       1
                      2
                           67
                                  1
                                     asymptomatic
                                                         160
                                                                286
                                                                       0
                                                                                  2
                                                                                       108
       2
                      3
                                     asymptomatic
                                                         120
                                                                229
                                                                       0
                                                                                  2
                                                                                       129
                           67
                                  1
       3
                      4
                           37
                                  1
                                       nonanginal
                                                         130
                                                               250
                                                                       0
                                                                                  0
                                                                                       187
       4
                      5
                           41
                                  0
                                       nontypical
                                                         130
                                                               204
                                                                       0
                                                                                  2
                                                                                       172
                           •••
                                                               •••
       298
                    299
                           45
                                  1
                                           typical
                                                         110
                                                                264
                                                                       0
                                                                                  0
                                                                                       132
       299
                                                                193
                                                                                  0
                                                                                       141
                    300
                           68
                                  1
                                     asymptomatic
                                                         144
                                                                        1
       300
                    301
                           57
                                     asymptomatic
                                                         130
                                                                131
                                                                       0
                                                                                       115
```

```
301
                  302
                        57
                              0
                                   nontypical
                                                   130
                                                         236
                                                                0
                                                                         2
                                                                              174
      302
                  303
                                                         175
                                                                         0
                                                                              173
                        38
                                   nonanginal
                                                   138
                                                                0
                              1
           ExAng
                  Oldpeak
                           Slope
                                   Ca
                                              Thal
      0
               0
                      2.3
                               3
                                  0.0
                                            fixed
               1
                      1.5
                               2
      1
                                  3.0
                                            normal
      2
               1
                      2.6
                               2
                                  2.0 reversable
      3
               0
                      3.5
                               3
                                  0.0
                                            normal
      4
               0
                      1.4
                                  0.0
                               1
                                            normal
      . .
               0
                      1.2
                               2
                                  0.0 reversable
      298
      299
               0
                      3.4
                               2
                                  2.0 reversable
      300
               1
                      1.2
                               2 1.0 reversable
      301
               0
                      0.0
                               2 1.0
                                           normal
      302
                      0.0
                               1 NaN
               0
                                           normal
      [303 rows x 14 columns]
[29]: pip install scikit-learn
     Defaulting to user installation because normal site-packages is not writeable
     Requirement already satisfied: scikit-learn in
     /home/admin1/.local/lib/python3.10/site-packages (1.5.1)
     Requirement already satisfied: numpy>=1.19.5 in
     /home/admin1/.local/lib/python3.10/site-packages (from scikit-learn) (2.0.1)
     Requirement already satisfied: scipy>=1.6.0 in
     /home/admin1/.local/lib/python3.10/site-packages (from scikit-learn) (1.14.0)
     Requirement already satisfied: joblib>=1.2.0 in
     /home/admin1/.local/lib/python3.10/site-packages (from scikit-learn) (1.4.2)
     Requirement already satisfied: threadpoolctl>=3.1.0 in
     /home/admin1/.local/lib/python3.10/site-packages (from scikit-learn) (3.5.0)
     [notice] A new release of pip is
     available: 24.0 -> 24.2
     [notice] To update, run:
     python3 -m pip install --upgrade pip
     Note: you may need to restart the kernel to use updated packages.
[30]: from sklearn.model_selection import train_test_split
[31]: x = df.iloc[:,:-1]
      y = df.iloc[:,-1]
[32]: xtrain, xtest, ytrain, ytest = train_test_split(x,y, test_size=0.5)
[33]: xtrain.shape
```

```
rows , columns = xtrain.shape
      print(f"rows = {rows} and columns = {columns}")
     rows = 151 and columns = 13
[34]: ytrain.shape
      rows = ytrain.shape
      print(f"rows = {rows} ")
     rows = (151,)
[35]: xtest.shape
[35]: (152, 13)
[36]: ytest.shape
[36]: (152,)
[37]: rows
[37]: (151,)
[45]: #get the mean age of the patients.
      mean_age = df["Age"].mean()
      print(mean_age)
     54.43894389438944
[44]: #get only Age, Sex, ChestPain, RestBP, Chol from the dataset.
      test = df.iloc[ :, 1:6]
      print(test)
                       ChestPain RestBP Chol
          Age Sex
                                            233
     0
           63
                         typical
                                      145
                 1
     1
           67
                    asymptomatic
                                      160
                                            286
     2
                                            229
           67
                    asymptomatic
                                      120
     3
           37
                      nonanginal
                                      130
                                            250
     4
           41
                 0
                      nontypical
                                      130
                                            204
     298
           45
                         typical
                                      110
                                            264
                 1
     299
                 1 asymptomatic
                                      144
                                            193
           68
     300
           57
                 1
                    asymptomatic
                                      130
                                            131
           57
                      nontypical
                                      130
                                            236
     301
     302
           38
                      nonanginal
                                      138
                                            175
```

[303 rows x 5 columns]

[49]: #get the datatypes of each column print(df.dtypes)

Unnamed: 0 int64 Age int64 int64 Sex ChestPain object RestBP int64 Chol int64 Fbs int64 RestECG int64 MaxHR int64 ExAng int64 Oldpeak float64 Slope int64 Ca float64 Thal object dtype: object

300

[50]: zero_row = df[df.eq(0).any(axis = 1)]
print(zero_row)

1 1.2

	Unname	d: 0	Age	Sex	Ch	estPain	${\tt RestBP}$	Chol	Fbs	RestECG	${\tt MaxHR}$	\
0		1	63	1		typical	145	233	1	2	150	
1		2	67	1	asymp	tomatic	160	286	0	2	108	
2		3	67	1	asymp	tomatic	120	229	0	2	129	
3		4	37	1	non	anginal	130	250	0	0	187	
4		5	41	0		typical	130	204	0	2	172	
			•••		•••			•••	•••			
298		299	45	1		typical	110	264	0	0	132	
299		300	68	1		tomatic	144	193	1	0	141	
300		301	57	1	٠ -	tomatic	130	131	0	0	115	
301		302	57	0		typical	130	236	0	2	174	
302		303	38	1		anginal	138	175	0	0	173	
002		000	00	-	11011		100	110	Ŭ	ŭ	110	
	ExAng	Oldp	eak Slope		Ca	Т	hal					
0	0	_	2.3	3			xed					
1	1		1.5	2		nor						
2	1		2.6	2	2.0	reversa						
				_								
3	0		3.5	3		nor	mal					
4	0		1.4	1	0.0	nor	mal					
	•••	•••	•••	•••		•••						
298	0		1.2	2	0.0	reversa	ble					
299	0		3.4	2	2.0	reversa	ble					

2 1.0 reversable

```
301 0 0.0 2 1.0 normal
302 0 0.0 1 NaN normal
```

[299 rows x 14 columns]

```
[51]: zero_entries = df.eq(0)
print(zero_entries)
```

```
ChestPain RestBP
                                                   Chol
                                                                RestECG \
     Unnamed: 0
                   Age
                          Sex
                                                           Fbs
0
          False
                False
                       False
                                   False
                                           False
                                                  False
                                                        False
                                                                  False
          False False
                       False
                                   False
                                           False
1
                                                  False
                                                          True
                                                                  False
2
          False False
                       False
                                   False
                                           False
                                                  False
                                                          True
                                                                  False
          False False False
3
                                   False
                                           False
                                                  False
                                                          True
                                                                   True
4
          False False
                                           False
                                                  False
                                                          True
                         True
                                   False
                                                                  False
          False
                False
                                                  False
                                                          True
                                                                   True
298
                        False
                                   False
                                           False
299
          False False
                       False
                                   False
                                           False
                                                  False
                                                         False
                                                                   True
300
          False False False
                                   False
                                           False
                                                  False
                                                          True
                                                                   True
301
          False False
                         True
                                   False
                                           False
                                                  False
                                                          True
                                                                  False
302
          False False False
                                   False
                                           False
                                                  False
                                                          True
                                                                   True
     MaxHR
           ExAng Oldpeak Slope
                                      Ca
                                           Thal
0
    False
             True
                     False False
                                    True
                                         False
    False False
                     False False False
1
2
    False False
                     False False
                                   False
                                         False
3
    False
             True
                     False False
                                    True False
4
    False
             True
                     False False
                                    True
                                          False
. .
    False
                           False
                                          False
298
             True
                     False
                                    True
299
    False
             True
                     False
                           False
                                   False
                                          False
300
    False
           False
                     False
                           False False
                                         False
301
    False
             True
                      True
                           False
                                   False
                                          False
302
    False
                      True
                           False False
                                         False
             True
```

[303 rows x 14 columns]

```
[55]: y = df[df["ExAng"] == 0]
print(y)
```

	Unnamed:	0	Age	Sex	${\tt ChestPain}$	${\tt RestBP}$	Chol	Fbs	${\tt RestECG}$	${\tt MaxHR}$	\
0		1	63	1	typical	145	233	1	2	150	
3		4	37	1	nonanginal	130	250	0	0	187	
4		5	41	0	nontypical	130	204	0	2	172	
5		6	56	1	nontypical	120	236	0	0	178	
6		7	62	0	asymptomatic	140	268	0	2	160	
			•••				•••				
29	96 29	97	59	1	asymptomatic	164	176	1	2	90	
29	98 29	99	45	1	typical	110	264	0	0	132	

```
299
                             1 asymptomatic
                 300
                       68
                                                  144
                                                        193
                                                               1
                                                                        0
                                                                              141
     301
                 302
                       57
                             0
                                  nontypical
                                                  130
                                                        236
                                                               0
                                                                        2
                                                                             174
     302
                 303
                       38
                                  nonanginal
                                                  138
                                                        175
                                                               0
                                                                              173
                             1
          ExAng Oldpeak Slope
                                             Thal
                                  Ca
                     2.3
     0
              0
                              3 0.0
                                            fixed
     3
                     3.5
                              3 0.0
                                           normal
              0
     4
                     1.4
                              1 0.0
                                           normal
              0
     5
              0
                     0.8
                              1 0.0
                                           normal
     6
              0
                     3.6
                              3 2.0
                                           normal
                       ... ...
     296
                     1.0
                              2 2.0
                                            fixed
              0
     298
                     1.2
                              2 0.0 reversable
              0
                     3.4
                              2 2.0 reversable
     299
              0
     301
                     0.0
                              2 1.0
                                           normal
              0
                     0.0
     302
              0
                              1 NaN
                                           normal
     [204 rows x 14 columns]
[57]: #get the shape of the data
      df.shape
[57]: (303, 14)
[58]: #get the max value of age from the age column in the dataset.
      y = df["Age"].max()
      print(y)
     77
[61]: #covid patients problem
      TP = 45
      TN = 395
      FP = 55
      FN = 5
      Accuracy = (TP + TN) / (TP + TN + FN + FP)
      print(f"Accuracy is: {Accuracy}")
      Precision = TP / (TP + FP)
      print(f"Precision is: {Precision}")
      Recall = TP / (TP + FN)
      print(f"Recall is: {Recall}")
```

```
F1_score = 2 / ( (1/Precision) + ( 1/Recall))
print(f"f1-score is {F1_score}")

Accuracy is: 0.88
Precision is: 0.45
Recall is: 0.9
f1-score is 0.6

[]:
```