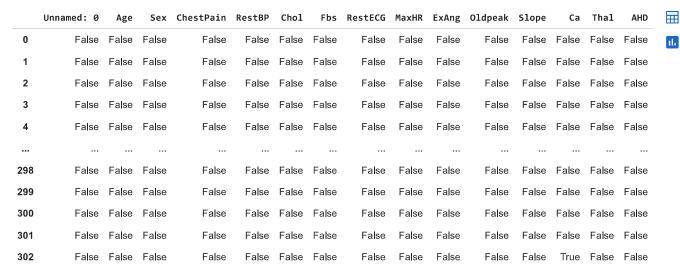
import pandas as pd

```
df=pd.read_csv("Heart.csv")
print(df.to_string())
                                       nontypical
     225
                   226
                          34
                                 0
                                                         118
                                                                210
                                                                        0
                                                                                   0
                                                                                         192
                                                                                                   0
                                                                                                            0.7
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
                          47
     226
                   227
                                 1
                                     asymptomatic
                                                         112
                                                                204
                                                                        0
                                                                                   0
                                                                                         143
                                                                                                   0
                                                                                                            0.1
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
                                                                                         172
     227
                   228
                          67
                                 0
                                       nonanginal
                                                         152
                                                                277
                                                                                                    0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                               No
     228
                   229
                          54
                                 1
                                                                        0
                                                                                         108
                                                                                                            0.0
                                                                                                                      2
                                     asymptomatic
                                                         110
                                                                206
                                                                                   2
                                                                                                   1
                                                                                                                          1.0
                                                                                                                                              Yes
                                                                                                                                    normal
     229
                   230
                          66
                                 1
                                     asymptomatic
                                                         112
                                                                212
                                                                        0
                                                                                   2
                                                                                         132
                                                                                                   1
                                                                                                            0.1
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                              Yes
     230
                                                                                                   0
                   231
                          52
                                 0
                                                                196
                                                                        0
                                                                                   2
                                                                                         169
                                                                                                            0.1
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                       nonanginal
                                                         136
                                                                                                                                               No
     231
                   232
                          55
                                 a
                                     asymptomatic
                                                         180
                                                                327
                                                                        a
                                                                                   1
                                                                                         117
                                                                                                   1
                                                                                                            3.4
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                              Yes
     232
                   233
                          49
                                 1
                                       nonanginal
                                                         118
                                                                149
                                                                        0
                                                                                   2
                                                                                         126
                                                                                                   0
                                                                                                            0.8
                                                                                                                      1
                                                                                                                          3.0
                                                                                                                                              Yes
                                                                                                                                    normal
                          74
     233
                                 0
                   234
                                       nontypical
                                                         120
                                                                269
                                                                        0
                                                                                   2
                                                                                         121
                                                                                                   1
                                                                                                            0.2
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                               No
     234
                   235
                          54
                                 a
                                       nonanginal
                                                         160
                                                                201
                                                                        0
                                                                                   0
                                                                                         163
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                               No
     235
                          54
                                                                        0
                                                                                                                      2
                   236
                                 1
                                     asymptomatic
                                                         122
                                                                286
                                                                                   2
                                                                                         116
                                                                                                   1
                                                                                                            3.2
                                                                                                                          2.0
                                                                                                                                              Yes
                                                                                                                                    normal
     236
                   237
                          56
                                 1
                                     asymptomatic
                                                         130
                                                                283
                                                                        1
                                                                                   2
                                                                                         103
                                                                                                   1
                                                                                                            1.6
                                                                                                                      3
                                                                                                                          0.0
                                                                                                                               reversable
                                                                                                                                              Yes
     237
                   238
                          46
                                     asymptomatic
                                                         120
                                                                        0
                                                                                         144
                                                                                                   0
                                                                                                            0.8
                                                                                                                          0.0
                                 1
                                                                249
                                                                                   2
                                                                                                                      1
                                                                                                                               reversable
                                                                                                                                              Yes
     238
                   239
                          49
                                 0
                                        nontypical
                                                         134
                                                                271
                                                                        0
                                                                                   0
                                                                                         162
                                                                                                   0
                                                                                                            0.0
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     239
                   240
                          42
                                 1
                                        nontypical
                                                         120
                                                                295
                                                                        0
                                                                                   0
                                                                                         162
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     240
                                                                                                   a
                   241
                          41
                                       nontypical
                                                         110
                                                                235
                                                                        0
                                                                                   0
                                                                                         153
                                                                                                            0.0
                                                                                                                          0.0
                                 1
                                                                                                                      1
                                                                                                                                    normal
                                                                                                                                               No
     241
                   242
                          41
                                 0
                                        nontypical
                                                         126
                                                                306
                                                                        0
                                                                                   0
                                                                                         163
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     242
                   243
                          49
                                  0
                                                         130
                                                                269
                                                                        0
                                                                                   0
                                                                                         163
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                               No
                                     asymptomatic
                                                                                                                                    normal
     243
                   244
                          61
                                 1
                                           typical
                                                         134
                                                                234
                                                                        0
                                                                                   0
                                                                                         145
                                                                                                   0
                                                                                                            2.6
                                                                                                                      2
                                                                                                                          2.0
                                                                                                                                    normal
                                                                                                                                              Yes
     244
                   245
                                       nonanginal
                                                         120
                                                                178
                                                                        1
                                                                                          96
                                                                                                    0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
                                                                                          71
                                                                                                   0
     245
                   246
                          67
                                                                        0
                                                                                   0
                                                                                                                      2
                                                                                                                          0.0
                                 1
                                                         120
                                                                237
                                                                                                            1.0
                                                                                                                                              Yes
                                     asymptomatic
                                                                                                                                    normal
     246
                   247
                          58
                                 1
                                     asymptomatic
                                                         100
                                                                234
                                                                        0
                                                                                   0
                                                                                         156
                                                                                                   0
                                                                                                            0.1
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                reversable
                                                                                                                                              Yes
     247
                   248
                          47
                                                         110
                                                                275
                                                                        0
                                                                                         118
                                                                                                            1.0
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                              Yes
                                 1
                                     asymptomatic
                                                                                   2
                                                                                                   1
                                                                                                                                    normal
     248
                   249
                          52
                                 1
                                     asymptomatic
                                                         125
                                                                212
                                                                        0
                                                                                   0
                                                                                         168
                                                                                                   a
                                                                                                            1.0
                                                                                                                      1
                                                                                                                          2.0
                                                                                                                                reversable
                                                                                                                                              Yes
     249
                   250
                          62
                                 1
                                                         128
                                                                208
                                                                        1
                                                                                   2
                                                                                         140
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
                                       nontypical
     250
                   251
                          57
                                                                                         126
                                                                                                                      2
                                 1
                                     asymptomatic
                                                         110
                                                                201
                                                                        0
                                                                                   0
                                                                                                   1
                                                                                                            1.5
                                                                                                                          0.0
                                                                                                                                     fixed
                                                                                                                                               No
     251
                   252
                           58
                                 1
                                     asymptomatic
                                                         146
                                                                218
                                                                                         105
                                                                                                   0
                                                                                                            2.0
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                reversable
                                                                                                                                              Yes
     252
                          64
                                                         128
                                                                        0
                                                                                   0
                                                                                         105
                                                                                                            0.2
                                                                                                                      2
                   253
                                 1
                                     asymptomatic
                                                                263
                                                                                                   1
                                                                                                                          1.0
                                                                                                                                reversable
                                                                                                                                               No
     253
                   254
                          51
                                 0
                                       nonanginal
                                                         120
                                                                295
                                                                        0
                                                                                   2
                                                                                         157
                                                                                                   0
                                                                                                            0.6
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                               No
                                                                                                                                    normal
     254
                   255
                          43
                                 1
                                     asymptomatic
                                                         115
                                                                303
                                                                        0
                                                                                   a
                                                                                         181
                                                                                                   0
                                                                                                            1.2
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     255
                   256
                          42
                                 0
                                       nonanginal
                                                         120
                                                                209
                                                                        0
                                                                                   0
                                                                                         173
                                                                                                   0
                                                                                                            0.0
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
                   257
                          67
                                 0
                                                                                         142
                                                                                                   0
                                                                                                                          2.0
     256
                                     asymptomatic
                                                         106
                                                                223
                                                                        0
                                                                                   0
                                                                                                            0.3
                                                                                                                      1
                                                                                                                                    normal
                                                                                                                                               No
     257
                   258
                          76
                                 0
                                                         140
                                                                197
                                                                        0
                                                                                         116
                                                                                                   a
                                                                                                                      2
                                                                                                                          0.0
                                       nonanginal
                                                                                   1
                                                                                                            1.1
                                                                                                                                    normal
                                                                                                                                               No
     258
                   259
                          70
                                 1
                                        nontypical
                                                         156
                                                                245
                                                                        0
                                                                                   2
                                                                                         143
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     259
                   260
                          57
                                 1
                                       nontypical
                                                         124
                                                                261
                                                                        0
                                                                                   0
                                                                                         141
                                                                                                   0
                                                                                                            0.3
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                               reversable
                                                                                                                                              Yes
     260
                   261
                          44
                                 0
                                       nonanginal
                                                         118
                                                                242
                                                                        0
                                                                                   0
                                                                                         149
                                                                                                   0
                                                                                                            0.3
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                               No
     261
                   262
                           58
                                       nontypical
                                                         136
                                                                319
                                                                        1
                                                                                         152
                                                                                                    0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          2.0
                                                                                                                                    normal
                                                                                                                                              Yes
                          60
                                 a
                                                                                                   a
     262
                   263
                                           typical
                                                         150
                                                                240
                                                                        a
                                                                                   a
                                                                                         171
                                                                                                            0.9
                                                                                                                      1
                                                                                                                          9.9
                                                                                                                                    normal
                                                                                                                                               Nο
                                                                                                            0.0
     263
                   264
                          44
                                 1
                                                         120
                                                                226
                                                                                         169
                                                                                                   0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                               No
                                       nonanginal
                                                                        0
                                                                                   0
                                                                                                                                    normal
     264
                   265
                          61
                                 1
                                                         138
                                                                        0
                                                                                   2
                                                                                         125
                                                                                                   1
                                                                                                            3.6
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                              Yes
                                     asymptomatic
                                                                166
     265
                   266
                          42
                                 1
                                     asymptomatic
                                                         136
                                                                315
                                                                        0
                                                                                   0
                                                                                         125
                                                                                                   1
                                                                                                            1.8
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                     fixed
                                                                                                                                              Yes
     266
                   267
                           52
                                 1
                                     asymptomatic
                                                         128
                                                                204
                                                                        1
                                                                                   0
                                                                                         156
                                                                                                   1
                                                                                                            1.0
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                        NaN
                                                                                                                                              Yes
     267
                          59
                                                                                         134
                                                                                                   0
                                                                                                            2.2
                                                                                                                                      fixed
                   268
                                 1
                                       nonanginal
                                                         126
                                                                218
                                                                        1
                                                                                   0
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                              Yes
     268
                   269
                          40
                                     asymptomatic
                                                         152
                                                                223
                                                                                         181
                                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                reversable
                                                                                                                                              Yes
     269
                   270
                          42
                                       nonanginal
                                                         130
                                                                        0
                                                                                   0
                                                                                         150
                                                                                                   0
                                                                                                            0.0
                                 1
                                                                180
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                               No
                                                                                                                                    normal
     270
                   271
                          61
                                 1
                                     asymptomatic
                                                         140
                                                                207
                                                                        0
                                                                                   2
                                                                                         138
                                                                                                   1
                                                                                                            1.9
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                reversable
                                                                                                                                              Yes
     271
                   272
                          66
                                 1
                                     asymptomatic
                                                         160
                                                                228
                                                                        0
                                                                                   2
                                                                                         138
                                                                                                   0
                                                                                                            2.3
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                     fixed
                                                                                                                                               No
     272
                   273
                          46
                                 1
                                     asymptomatic
                                                         140
                                                                311
                                                                        9
                                                                                   a
                                                                                         120
                                                                                                   1
                                                                                                            1.8
                                                                                                                      2
                                                                                                                          2.0
                                                                                                                                reversable
                                                                                                                                              Yes
     273
                   274
                          71
                                 0
                                                                                         125
                                                                                                   0
                                                                                                                      2
                                     asymptomatic
                                                         112
                                                                149
                                                                        0
                                                                                   0
                                                                                                            1.6
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     274
                   275
                          59
                                 1
                                           typical
                                                         134
                                                                204
                                                                        0
                                                                                   0
                                                                                         162
                                                                                                   0
                                                                                                            0.8
                                                                                                                      1
                                                                                                                          2.0
                                                                                                                                    normal
                                                                                                                                              Yes
     275
                   276
                          64
                                 1
                                           typical
                                                         170
                                                                227
                                                                        0
                                                                                   2
                                                                                         155
                                                                                                   0
                                                                                                            0.6
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                reversable
                                                                                                                                               No
                   277
                                 0
                                       nonanginal
                                                         146
                                                                                                   0
     276
                          66
                                                                278
                                                                        0
                                                                                   2
                                                                                         152
                                                                                                            0.0
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                               No
                                                                                                                                    normal
     277
                   278
                          39
                                 0
                                       nonanginal
                                                         138
                                                                220
                                                                        0
                                                                                   0
                                                                                         152
                                                                                                   0
                                                                                                            0.0
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     278
                   279
                           57
                                       nontypical
                                                         154
                                                                232
                                                                                         164
                                                                                                    0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          1.0
                                                                                                                                    normal
                                                                                                                                              Yes
                          58
                                 a
                                                                                                   а
     279
                   280
                                     asymptomatic
                                                         130
                                                                197
                                                                        a
                                                                                   а
                                                                                         131
                                                                                                            0.6
                                                                                                                      2
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               Nο
     280
                   281
                          57
                                                                335
                                                                                         143
                                                                                                   1
                                                                                                                      2
                                 1
                                     asymptomatic
                                                         110
                                                                        0
                                                                                   0
                                                                                                            3.0
                                                                                                                          1.0
                                                                                                                                   ersable
                                                                                                                                              Yes
                          47
                                                                                         179
                                                                                                   0
     281
                   282
                                 1
                                       nonanginal
                                                         130
                                                                253
                                                                        0
                                                                                   0
                                                                                                            0.0
                                                                                                                      1
                                                                                                                          0.0
                                                                                                                                    normal
                                                                                                                                               No
     282
                   283
                          55
                                     asymptomatic
                                                         128
                                                                205
                                                                        0
                                                                                         130
                                                                                                   1
                                                                                                            2.0
                                                                                                                      2
                                                                                                                          1.0
                                                                                                                                reversable
                                                                                                                                              Yes
```

#a) Find Missing Values and replace the missing values with suitable alternative. #d.isnull()



303 rows × 15 columns

df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 15 columns):

| Data | columns (to | tal 15 columns): | |
|-------|--------------|------------------|----------|
| # | Column | Non-Null Count | Dtype |
| | | | |
| 0 | Unnamed: 0 | 303 non-null | int64 |
| 1 | Age | 303 non-null | int64 |
| 2 | Sex | 303 non-null | int64 |
| 3 | ChestPain | 303 non-null | object |
| 4 | RestBP | 303 non-null | int64 |
| 5 | Chol | 303 non-null | int64 |
| 6 | Fbs | 303 non-null | int64 |
| 7 | RestECG | 303 non-null | int64 |
| 8 | MaxHR | 303 non-null | int64 |
| 9 | ExAng | 303 non-null | int64 |
| 10 | Oldpeak | 303 non-null | float64 |
| 11 | Slope | 303 non-null | int64 |
| 12 | Ca | 299 non-null | float64 |
| 13 | Thal | 301 non-null | object |
| 14 | AHD | 303 non-null | object |
| dtype | es: float64(| 2), int64(10), o | bject(3) |

memory usage: 35.6+ KB

df.head(5)

| | Unnamed: | 0 | Age | Sex | ChestPain | RestBP | Chol | Fbs | RestECG | MaxHR | ExAng | Oldpeak | Slope | Ca | Thal | AHD |
|---|----------|---|-----|-----|--------------|--------|------|-----|---------|-------|-------|----------------|-------|-----|------------|-----|
| 0 | | 1 | 63 | 1 | typical | 145 | 233 | 1 | 2 | 150 | 0 | 2.3 | 3 | 0.0 | fixed | No |
| 1 | | 2 | 67 | 1 | asymptomatic | 160 | 286 | 0 | 2 | 108 | 1 | 1.5 | 2 | 3.0 | normal | Yes |
| 2 | | 3 | 67 | 1 | asymptomatic | 120 | 229 | 0 | 2 | 129 | 1 | 2.6 | 2 | 2.0 | reversable | Yes |
| 3 | | 4 | 37 | 1 | nonanginal | 130 | 250 | 0 | 0 | 187 | 0 | 3.5 | 3 | 0.0 | normal | No |
| 4 | | 5 | 41 | 0 | nontypical | 130 | 204 | 0 | 2 | 172 | 0 | 1.4 | 1 | 0.0 | normal | No |

df.tail(5)

| | Unnamed: 0 | Age | Sex | ChestPain | RestBP | Chol | Fbs | RestECG | MaxHR | ExAng | Oldpeak | Slope | Ca | Thal | AHD |
|-----|------------|-----|-----|--------------|--------|------|-----|---------|-------|-------|----------------|-------|-----|------------|-----|
| 298 | 299 | 45 | 1 | typical | 110 | 264 | 0 | 0 | 132 | 0 | 1.2 | 2 | 0.0 | reversable | Yes |
| 299 | 300 | 68 | 1 | asymptomatic | 144 | 193 | 1 | 0 | 141 | 0 | 3.4 | 2 | 2.0 | reversable | Yes |
| 300 | 301 | 57 | 1 | asymptomatic | 130 | 131 | 0 | 0 | 115 | 1 | 1.2 | 2 | 1.0 | reversable | Yes |
| 301 | 302 | 57 | 0 | nontypical | 130 | 236 | 0 | 2 | 174 | 0 | 0.0 | 2 | 1.0 | normal | Yes |
| 302 | 303 | 38 | 1 | nonanginal | 138 | 175 | 0 | 0 | 173 | 0 | 0.0 | 1 | NaN | normal | No |

```
df1=df.isnull().sum()
```

print(df1)

Unnamed: 0 0 Age Sex 0 ChestPain 0 RestBP Chol 0 Fbs 0 RestECG 0 MaxHR 0 ExAng 0 Oldpeak 0 Slope 4 Ca Thal 2 AHD dtype: int64

df2=df.isnull().sum().sum()

print(df2)

6

df.tail(10)

| | Unnamed: 0 | Age | Sex | ChestPain | RestBP | Chol | Fbs | RestECG | MaxHR | ExAng | Oldpeak | Slope | Са | Thal | AHD |
|-----|------------|-----|-----|--------------|--------|------|-----|---------|-------|-------|----------------|-------|-----|------------|-----|
| 293 | 294 | 63 | 1 | asymptomatic | 140 | 187 | 0 | 2 | 144 | 1 | 4.0 | 1 | 2.0 | reversable | Yes |
| 294 | 295 | 63 | 0 | asymptomatic | 124 | 197 | 0 | 0 | 136 | 1 | 0.0 | 2 | 0.0 | normal | Yes |
| 295 | 296 | 41 | 1 | nontypical | 120 | 157 | 0 | 0 | 182 | 0 | 0.0 | 1 | 0.0 | normal | No |
| 296 | 297 | 59 | 1 | asymptomatic | 164 | 176 | 1 | 2 | 90 | 0 | 1.0 | 2 | 2.0 | fixed | Yes |
| 297 | 298 | 57 | 0 | asymptomatic | 140 | 241 | 0 | 0 | 123 | 1 | 0.2 | 2 | 0.0 | reversable | Yes |
| 298 | 299 | 45 | 1 | typical | 110 | 264 | 0 | 0 | 132 | 0 | 1.2 | 2 | 0.0 | reversable | Yes |
| 299 | 300 | 68 | 1 | asymptomatic | 144 | 193 | 1 | 0 | 141 | 0 | 3.4 | 2 | 2.0 | reversable | Yes |
| 300 | 301 | 57 | 1 | asymptomatic | 130 | 131 | 0 | 0 | 115 | 1 | 1.2 | 2 | 1.0 | reversable | Yes |
| 301 | 302 | 57 | 0 | nontypical | 130 | 236 | 0 | 2 | 174 | 0 | 0.0 | 2 | 1.0 | normal | Yes |
| 302 | 303 | 38 | 1 | nonanginal | 138 | 175 | 0 | 0 | 173 | 0 | 0.0 | 1 | NaN | normal | No |

df3=df.fillna(value=0)

print(df3)

| | Unnamed: 0 | Age | Sex | ChestPain | RestBP | Chol | Fbs | RestECG | 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 | 299 | 45 | 1 | typical | 110 | 264 | 0 | 0 | 132 | |
| 299 | 300 | 68 | 1 | asymptomatic | 144 | 193 | 1 | 0 | 141 | |
| 300 | 301 | 57 | 1 | asymptomatic | 130 | 131 | 0 | 0 | 115 | |
| 301 | 302 | 57 | 0 | nontypical | 130 | 236 | 0 | 2 | 174 | |
| 302 | 303 | 38 | 1 | nonanginal | 138 | 175 | 0 | 0 | 173 | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| AHD | Thal | Ca | Slope | 01dpeak | ExAng | |
|-----|------------|-----|-------|---------|-------|-----|
| No | fixed | 0.0 | 3 | 2.3 | 0 | 0 |
| Yes | normal | 3.0 | 2 | 1.5 | 1 | 1 |
| Yes | reversable | 2.0 | 2 | 2.6 | 1 | 2 |
| No | normal | 0.0 | 3 | 3.5 | 0 | 3 |
| No | normal | 0.0 | 1 | 1.4 | 0 | 4 |
| | | | | | | |
| Yes | reversable | 0.0 | 2 | 1.2 | 0 | 298 |

```
299 0 3.4 2 2.0 reversable Yes
300 1 1.2 2 1.0 reversable Yes
301 0 0.0 2 1.0 normal Yes
302 0 0.0 1 0.0 normal No
```

[303 rows x 15 columns]

df3=df.fillna(value=5)

print(df3)

```
Unnamed: 0 Age
                              ChestPain RestBP
                                                 Chol Fbs RestECG MaxHR \
                      Sex
0
              1
                  63
                       1
                               typical
                                            145
                                                  233
                                                        1
                                                                       150
                          asymptomatic
                                                                       108
1
              2
                  67
                        1
                                            160
                                                  286
2
             3
                  67
                          asymptomatic
                                            120
                                                  229
                                                        a
                                                                  2
                                                                       129
                        1
3
             4
                  37
                        1
                             nonanginal
                                            130
                                                  250
                                                         0
                                                                       187
4
             5
                  41
                        0
                            nontypical
                                            130
                                                  204
                                                        0
                                                                  2
                                                                       172
            299
298
                  45
                                typical
                                            110
                                                  264
                                                        0
                                                                  0
                                                                       132
                       1
299
            300
                          asymptomatic
                                            144
                                                  193
                                                                       141
                  68
                        1
                                                        1
                                                                  0
300
            301
                  57
                          asymptomatic
                                            130
                                                  131
                                                                       115
            302
                            nontypical
301
                  57
                        0
                                            130
                                                  236
                                                        0
                                                                       174
302
            303
                  38
                        1
                             nonanginal
                                            138
                                                  175
                                                                       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 | 1 | 2.6 | 2 | 2.0 | reversable | Yes |
| 3 | 0 | 3.5 | 3 | 0.0 | normal | No |
| 4 | 0 | 1.4 | 1 | 0.0 | normal | No |
| | | | | | | |
| 298 | 0 | 1.2 | 2 | 0.0 | reversable | Yes |
| 299 | 0 | 3.4 | 2 | 2.0 | reversable | Yes |
| 300 | 1 | 1.2 | 2 | 1.0 | reversable | Yes |
| 301 | 0 | 0.0 | 2 | 1.0 | normal | Yes |
| 302 | a | 9.9 | 1 | 5.0 | normal | No |

[303 rows x 15 columns]

df4=df.fillna(method='pad')

print(df3)

| | Unnamed: 0 | Age | Sex | ChestPain | RestBP | Chol | Fbs | RestECG | 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 | 299 | 45 | 1 | typical | 110 | 264 | 0 | 0 | 132 | |
| 299 | 300 | 68 | 1 | asymptomatic | 144 | 193 | 1 | 0 | 141 | |
| 300 | 301 | 57 | 1 | asymptomatic | 130 | 131 | 0 | 0 | 115 | |
| 301 | 302 | 57 | 0 | nontypical | 130 | 236 | 0 | 2 | 174 | |
| 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 |
| 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 | 1 | 0.0 | normal | No |
| | | | | | | |
| 298 | 0 | 1.2 | 2 | 0.0 | reversable | Yes |
| 299 | 0 | 3.4 | 2 | 2.0 | reversable | Yes |
| 300 | 1 | 1.2 | 2 | 1.0 | reversable | Yes |
| 301 | 0 | 0.0 | 2 | 1.0 | normal | Yes |
| 302 | 0 | 0.0 | 1 | 5.0 | normal | No |

[303 rows x 15 columns]

print(df4)

```
Unnamed: 0 Age
                    Sex
                           ChestPain
                                      RestBP
                                            Chol
                                                  Fbs RestECG MaxHR \
0
               63
                             typical
                                        145
                                             233
                                                   1
                                                            2
                                                                 150
            1
                     1
             2
                                                    0
                                                             2
                                                                 108
                67
                      1 asymptomatic
                                        160
                                              286
```

```
2
                    3
                        67
                              1 asymptomatic
                                                    120
                                                          229
                                                                 0
                                                                           2
                                                                                129
                                                                                187
     3
                   4
                        37
                              1
                                   nonanginal
                                                    130
                                                          250
                                                                 0
                                                                           0
     4
                   5
                        41
                                    nontypical
                                                    130
                                                          204
                                                                 0
                                                                           2
                                                                                172
     298
                  299
                        45
                              1
                                       typical
                                                    110
                                                          264
                                                                 0
                                                                           0
                                                                                132
                                 asymptomatic
     299
                  300
                        68
                              1
                                                    144
                                                          193
                                                                 1
                                                                           0
                                                                                141
     300
                  301
                        57
                              1
                                 asymptomatic
                                                    130
                                                          131
                                                                 0
                                                                           0
                                                                                115
     301
                  302
                        57
                              0
                                   nontypical
                                                    130
                                                          236
                                                                 0
                                                                           2
                                                                                174
                                                                                173
     302
                  303
                        38
                              1
                                    nonanginal
                                                    138
                                                          175
                                                                 0
          ExAng
                 Oldpeak Slope
                                   Ca
                                              Thal
                                                     AHD
    0
                      2.3
                               3
                                  0.0
                                             fixed
                                                     No
    1
                      1.5
                                  3.0
                                            normal
                                                     Yes
    2
              1
                      2.6
                               2
                                  2.0
                                       reversable
                                                     Yes
     3
                               3
                                  0.0
                                            normal
    4
              0
                      1.4
                               1
                                  0.0
                                            normal
                                                     No
                                       reversable
     298
              0
                      1.2
                               2
                                  0.0
                                                     Yes
     299
              0
                      3.4
                               2
                                  2.0
                                       reversable
                                                     Yes
     300
                      1.2
                               2 1.0
                                       reversable
                                                     Yes
     301
              0
                      0.0
                               2 1.0
                                            normal
                                                     Yes
     302
              0
                               1 1.0
                                            normal
     [303 rows x 15 columns]
df5=df.fillna(method='bfill')
print(df5)
          Unnamed: 0
                       Age
                            Sex
                                     ChestPain RestBP
                                                         Chol
                                                               Fbs RestECG
                                                                              MaxHR \
     0
                        63
                                       typical
                                                    145
                                                          233
                                                                                150
                              1
                                                                 1
                                                                           2
                    1
    1
                    2
                        67
                              1
                                 asymptomatic
                                                    160
                                                          286
                                                                 a
                                                                           2
                                                                                108
     2
                    3
                        67
                                                    120
                                                          229
                                                                                129
                              1
                                 asymptomatic
                   4
                        37
                                                          250
                                                                                187
     3
                              1
                                   nonanginal
                                                    130
                                                                 0
                                                                           0
     4
                    5
                        41
                              0
                                    nontypical
                                                    130
                                                          204
                                                                 0
                                                                           2
                                                                                172
     298
                  299
                        45
                              1
                                       typical
                                                    110
                                                          264
                                                                 0
                                                                           0
                                                                                132
     299
                  300
                        68
                              1
                                 asymptomatic
                                                    144
                                                          193
                                                                                141
                                 asymptomatic
     300
                  301
                        57
                              1
                                                    130
                                                          131
                                                                 0
                                                                           0
                                                                                115
     301
                  302
                        57
                              0
                                    nontypical
                                                    130
                                                          236
                                                                 0
                                                                                174
    302
                                   nonanginal
                                                                                173
                  303
                        38
                              1
                                                    138
                                                          175
                                                                 0
                 Oldpeak Slope
                                              Thal
                                                     AHD
          ExAng
                                   Ca
    0
              0
                      2.3
                               3
                                  0.0
                                             fixed
                                                     No
    1
                                  3.0
                                            normal
    2
                      2.6
                               2
                                  2.0
                                       reversable
              1
                                                     Yes
     3
              0
                      3.5
                               3
                                  0.0
                                            normal
                                                     No
     4
              0
                               1
                                  0.0
                      1.4
                                            normal
                                                     No
                                  0.0
     298
              0
                      1.2
                               2
                                       reversable
                                                     Yes
     299
              0
                      3.4
                               2 2.0
                                       reversable
                                                     Yes
     300
                               2 1.0
                                       reversable
     301
              0
                               2 1.0
                      0.0
                                            normal
                                                     Yes
     302
              0
                      0.0
                               1
                                  NaN
                                            normal
                                                     No
     [303 rows x 15 columns]
df6=df.fillna(value=df['Ca'].mean())
print(df6)
                                                                   RestECG
          Unnamed: 0
                            Sex
                                     ChestPain RestBP
                                                         Cho1
                                                                              MaxHR \
                                                               Fbs
                       Age
     0
                                       typical
                                                    145
                                                          233
                                                                                150
                                                          286
                                                                                108
    1
                    2
                        67
                                 asymptomatic
                                                    160
                                                                 0
                                                                           2
                              1
    2
                    3
                        67
                              1
                                 asymptomatic
                                                    120
                                                          229
                                                                 0
                                                                           2
                                                                                129
     3
                   4
                        37
                              1
                                   nonanginal
                                                    130
                                                          250
                                                                 0
                                                                                187
     4
                   5
                        41
                              0
                                    nontypical
                                                    130
                                                          204
                                                                 0
                                                                           2
                                                                                172
                                                    . . .
                                                          . . .
     298
                  299
                        45
                              1
                                      typical
                                                    110
                                                          264
                                                                 0
                                                                           0
                                                                                132
     299
                  300
                        68
                                 asymptomatic
                                                    144
                                                          193
                                                                 1
                                                                           0
                                                                                141
     300
                  301
                        57
                                 asymptomatic
                                                    130
                                                          131
                                                                                115
                                                                 0
                                                                           0
                              1
     301
                  302
                        57
                              0
                                    nontypical
                                                    130
                                                          236
                                                                 0
                                                                           2
                                                                                174
     302
                                    nonanginal
                                                    138
                                                                                173
          ExAng
                 Oldpeak Slope
                                                    Thal
                                                          AHD
     0
                      2.3
                               3
                                  0.000000
              0
                                                   fixed
                                                          No
     1
              1
                      1.5
                               2 3.000000
                                                 normal Yes
```

```
2
                    2.6
                             2 2.000000 reversable
             1
                                                      Yes
    3
             0
                    3.5
                             3 0.000000
                                              normal
                                                       No
             0
                    1.4
                             1 0.000000
                                              normal
                                                       No
    298
             0
                    1.2
                             2 0.000000
                                         reversable
    299
             0
                    3.4
                             2 2.000000
                                         reversable
                                                      Yes
     300
             1
                    1.2
                             2 1.000000 reversable Yes
     301
             0
                    0.0
                             2 1.000000
                                              normal
                                                      Yes
     302
             0
                    0.0
                             1 0.672241
                                              normal
                                                       No
     [303 rows x 15 columns]
df7=df.fillna(value=df['Ca'].min())
print(df7)
         Unnamed: 0 Age
                                  ChestPain RestBP
                          Sex
                                                     Chol
                                                           Fbs RestECG MaxHR \
    0
                  1
                                    typical
                                                145
                                                      233
                                                             1
                                                                           150
    1
                  2
                      67
                                                160
                                                      286
                                                                           108
                            1
                               asymptomatic
                                                             0
                                                                      2
    2
                  3
                      67
                            1
                               asymptomatic
                                                120
                                                      229
                                                                           129
                                                                           187
                                 nonanginal
     4
                  5
                     41
                            0
                                 nontypical
                                                130
                                                      204
                                                             0
                                                                           172
                                                                      2
    298
                299
                     45
                                    typical
                                                110
                                                      264
                                                                           132
    299
                300
                      68
                            1
                               asymptomatic
                                                144
                                                      193
                                                             1
                                                                           141
                301
     300
                      57
                            1
                               asymptomatic
                                                130
                                                      131
                                                                           115
    301
                302
                      57
                            0
                                 nontypical
                                                130
                                                      236
                                                             0
                                                                      2
                                                                           174
    302
                                                                           173
                                 nonanginal
                                                138
          ExAng
               Oldpeak Slope
                                Ca
                                           Thal
                                                 AHD
    0
                    2.3
                                0.0
                                          fixed
                            3
                                                  No
    1
             1
                    1.5
                             2 3.0
                                         normal
                                                 Yes
    2
                             2 2.0 reversable
                    2.6
                                                 Yes
    3
                    3.5
                             3 0.0
                                         normal
                                                  No
    4
             0
                             1 0.0
    298
             0
                    1.2
                             2 0.0 reversable
                                                 Yes
     299
                    3.4
                             2 2.0 reversable
     300
             1
                    1.2
                             2 1.0 reversable
                                                 Yes
     301
             0
                    0.0
                             2 1.0
                                         normal
    302
             0
                    0.0
                             1 0.0
                                         normal
                                                 No
     [303 rows x 15 columns]
df8=df.fillna(value=df['Ca'].max())
print(df8)
         Unnamed: 0
                    Age
                                  ChestPain RestBP
                                                     Chol Fbs RestECG MaxHR \
                          Sex
    0
                  1
                      63
                            1
                                    typical
                                                145
                                                      233
                                                             1
                                                                           150
    1
                  2
                      67
                                                160
                                                      286
                                                                           108
                               asymptomatic
    2
                  3
                      67
                               asymptomatic
                                                120
                                                      229
                                                                           129
                            1
    3
                  4
                     37
                                 nonanginal
                                                130
                                                      250
                                                                           187
                  5
                      41
                            0
                                 nontypical
                                                130
                                                      204
                                                             0
                                                                      2
                                                                           172
                299
                                    typical
     298
                                                110
                                                      264
                                                                           132
                                                144
    299
                300
                      68
                               asymptomatic
                                                      193
                                                                           141
                            1
                                                             1
    300
                301
                      57
                            1
                               asymptomatic
                                                130
                                                      131
                                                                           115
    301
                302
                      57
                                                                           174
                            0
                                                130
                                                      236
                                 nontypical
    302
                303
                      38
                                 nonanginal
                                                138
                                                      175
                                                                           173
                                           Thal AHD
          ExAng Oldpeak Slope
                                Ca
    0
                    2.3
                                0.0
                                          fixed
    1
                    1.5
                             2 3.0
                                         normal
                                                 Yes
             1
    2
                    2.6
                             2
                                2.0 reversable
                                                 Yes
    3
                    3.5
                             3 0.0
                                                  No
                                        normal
     4
             0
                    1.4
                             1 0.0
                                         normal
                                                  No
                    . . .
    298
             0
                    1.2
                            2 0.0 reversable
                                                 Yes
     299
             0
                    3.4
                             2 2.0 reversable
     300
                    1.2
                             2 1.0 reversable
                                                 Yes
             1
     301
             0
                    0.0
                             2 1.0
                                         normal
                                                 Yes
                             1 3.0
                                         normal
     [303 rows x 15 columns]
```

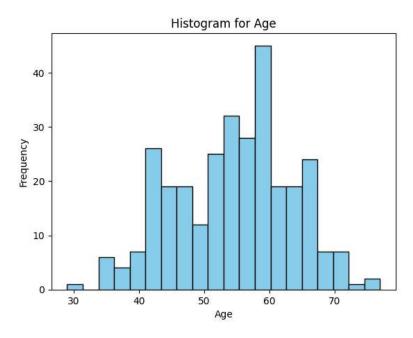
https://colab.research.google.com/drive/10Z7ik1itkBFJj9n8mkFFw ATiL9An-LQ#scrollTo=SK8hLeVEbTx-&printMode=true

```
#e) Find data type of each column.
df.dtypes
                      int64
     Unnamed: 0
     Age
                      int64
     Sex
                      int64
     ChestPain
                    object
     RestBP
                      int64
     Chol
                      int64
     Fbs
                      int64
     RestECG
                      int64
     MaxHR
                      int64
     ExAng
                      int64
                   float64
     01dpeak
     Slope
                      int64
     Ca
                    float64
     Thal
                    object
                     object
     dtype: object
df9=df.fillna(value=df['Age'].min())
print(df9)
                                                                             MaxHR \
          Unnamed: 0
                      Age
                            Sex
                                    ChestPain RestBP
                                                        Chol
                                                              Fbs RestECG
     0
                   1
                       63
                              1
                                      typical
                                                   145
                                                         233
                                                                1
                                                                          2
                                                                               150
                   2
                                                                               108
     1
                       67
                              1
                                 asymptomatic
                                                   160
                                                         286
                                                                0
                                                                          2
     2
                   3
                       67
                              1
                                 asymptomatic
                                                   120
                                                         229
                                                                0
                                                                          2
                                                                               129
                   4
                       37
                                   nonanginal
                                                         250
                                                                               187
     3
                                                   130
     4
                   5
                              0
                                   {\tt nontypical}
                                                   130
                                                         204
                                                                0
                       41
                                                                          2
                                                                               172
     298
                 299
                                      typical
                                                                               132
                       45
                                                   110
                                                         264
                                                                0
                                                                         0
                              1
     299
                 300
                       68
                              1
                                 asymptomatic
                                                   144
                                                         193
                                                                1
                                                                          0
                                                                               141
                 301
                                 asymptomatic
     300
                       57
                              1
                                                   130
                                                         131
                                                                0
                                                                          0
                                                                               115
     301
                 302
                       57
                              0
                                   nontypical
                                                   130
                                                         236
                                                                               174
                                                                0
                                                                          2
     302
                 303
                                   nonanginal
                                                   138
                                                                               173
                 Oldpeak Slope
                                              Thal AHD
          ExAng
                                    Ca
     0
              0
                      2.3
                               3
                                   0.0
                                             fixed
                                                      No
     1
              1
                      1.5
                               2
                                   3.0
                                             normal
                                                     Yes
     2
                      2.6
                               2
                                   2.0
                                        reversable
                                                     Yes
              1
     3
              0
                      3.5
                               3
                                   0.0
                                             normal
                                                      No
     4
              0
                      1.4
                               1
                                   0.0
                                             normal
     298
              0
                      1.2
                               2
                                   0.0
                                        reversable
                                                     Yes
                      3.4
                                   2.0
                                        reversable
                                                     Yes
     300
                               2
              1
                      1.2
                                   1.0
                                        reversable
                                                     Yes
     301
              0
                      0.0
                               2
                                   1.0
                                             normal
                               1 29.0
     302
                      0.0
                                             normal
                                                      No
     [303 rows x 15 columns]
#g) Find Mean age of patients considering above dataset.
print(df['Age'].mean())
     54.43894389438944
#h) Find shape of data.
df10=df.shape
print(df10)
     (303, 15)
#f) Finding out Zero's.
zeros_count = (df == 0).sum()
print(zeros_count)
     Unnamed: 0
                      0
     Age
                      0
                     97
     Sex
     ChestPain
                      0
     RestBP
```

```
Chol
                0
Fbs
              258
RestECG
              151
MaxHR
                0
              204
ExAng
Oldpeak
               99
Slope
                0
              176
Ca
Thal
                0
AHD
                0
dtype: int64
```

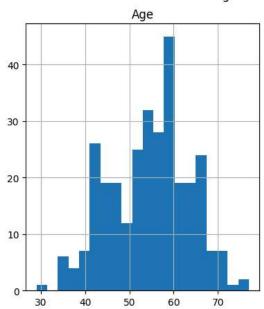
#d) Draw histogram for any two suitable attributes (E.g.age and Chol attributes for above dataset) import matplotlib.pyplot as plt

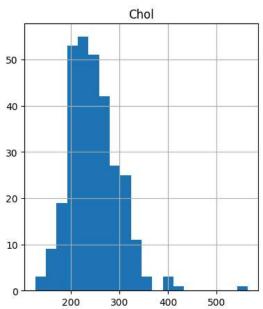
```
selected_column = 'Age'
plt.hist(df[selected_column], bins=20, color='skyblue', edgecolor='black')
plt.title(f'Histogram for {selected_column}')
plt.xlabel(selected_column)
plt.ylabel('Frequency')
plt.show()
```



```
selected_columns = ['Age', 'Chol']
df[selected_columns].hist(bins=20, figsize=(10, 5))
plt.suptitle('Histogram for Selected Columns')
plt.show()
```

Histogram for Selected Columns





```
#c) Prepare boxplot analysis for each numerical attribute. Find outliers (if any) in each attribute in the dataset.
#seaborn is used here
# Assuming 'df' is your DataFrame
# Convert non-numeric values to NaN
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
df = df.apply(pd.to_numeric, errors='coerce')
plt.figure(figsize=(15, 10))
sns.boxplot(data=df)
plt.title("Boxplot Analysis for Numerical Attributes")
plt.xticks(rotation=45)
plt.show()
# Outlier detection and handling
Q1 = df.quantile(0.25)
Q3 = df.quantile(0.75)
IQR = Q3 - Q1
outliers = ((df < (Q1 - 1.5 * IQR)) | (df > (Q3 + 1.5 * IQR))).sum()
print("Outliers:")
print(outliers)
```

Boxplot Analysis for Numerical Attributes

