k93lu2nfv

January 30, 2023

1 EDA

1.1 Importing Libraries

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

%matplotlib inline


import warnings
warnings.filterwarnings('ignore')

from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split, GridSearchCV,␣
 ↪RandomizedSearchCV
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from sklearn.preprocessing import LabelEncoder
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import (RandomForestClassifier, AdaBoostClassifier,␣
 ↪ExtraTreesClassifier, GradientBoostingClassifier)

from sklearn.pipeline import Pipeline
from sklearn.preprocessing import  StandardScaler
```

[3]:
```
from google.colab import files
files.upload()
```

```
<IPython.core.display.HTML object>
```

```
Saving heart_disease_uci.csv to heart_disease_uci.csv
```

[3]:
```
{'heart_disease_uci.csv': b'id,age,sex,dataset,cp,trestbps,chol,fbs,restecg,thal
ch,exang,oldpeak,slope,ca,thal,num\n1,63,Male,Cleveland,typical
angina,145,233,TRUE,lv hypertrophy,150,FALSE,2.3,downsloping,0,fixed
```

defect,0\n2,67,Male,Cleveland,asymptomatic,160,286,FALSE,lv hypertrophy,108,TRUE
,1.5,flat,3,normal,2\n3,67,Male,Cleveland,asymptomatic,120,229,FALSE,lv
hypertrophy,129,TRUE,2.6,flat,2,reversable defect,1\n4,37,Male,Cleveland,non-ang
inal,130,250,FALSE,normal,187,FALSE,3.5,downsloping,0,normal,0\n5,41,Female,Clev
eland,atypical angina,130,204,FALSE,lv
hypertrophy,172,FALSE,1.4,upsloping,0,normal,0\n6,56,Male,Cleveland,atypical ang
ina,120,236,FALSE,normal,178,FALSE,0.8,upsloping,0,normal,0\n7,62,Female,Clevela
nd,asymptomatic,140,268,FALSE,lv hypertrophy,160,FALSE,3.6,downsloping,2,normal,
3\n8,57,Female,Cleveland,asymptomatic,120,354,FALSE,normal,163,TRUE,0.6,upslopin
g,0,normal,0\n9,63,Male,Cleveland,asymptomatic,130,254,FALSE,lv
hypertrophy,147,FALSE,1.4,flat,1,reversable
defect,2\n10,53,Male,Cleveland,asymptomatic,140,203,TRUE,lv
hypertrophy,155,TRUE,3.1,downsloping,0,reversable defect,1\n11,57,Male,Cleveland
,asymptomatic,140,192,FALSE,normal,148,FALSE,0.4,flat,0,fixed
defect,0\n12,56,Female,Cleveland,atypical angina,140,294,FALSE,lv
hypertrophy,153,FALSE,1.3,flat,0,normal,0\n13,56,Male,Cleveland,non-
anginal,130,256,TRUE,lv hypertrophy,142,TRUE,0.6,flat,1,fixed
defect,2\n14,44,Male,Cleveland,atypical
angina,120,263,FALSE,normal,173,FALSE,0,upsloping,0,reversable
defect,0\n15,52,Male,Cleveland,non-
anginal,172,199,TRUE,normal,162,FALSE,0.5,upsloping,0,reversable
defect,0\n16,57,Male,Cleveland,non-anginal,150,168,FALSE,normal,174,FALSE,1.6,up
sloping,0,normal,0\n17,48,Male,Cleveland,atypical
angina,110,229,FALSE,normal,168,FALSE,1,downsloping,0,reversable defect,1\n18,54
,Male,Cleveland,asymptomatic,140,239,FALSE,normal,160,FALSE,1.2,upsloping,0,norm
al,0\n19,48,Female,Cleveland,non-anginal,130,275,FALSE,normal,139,FALSE,0.2,upsl
oping,0,normal,0\n20,49,Male,Cleveland,atypical angina,130,266,FALSE,normal,171,
FALSE,0.6,upsloping,0,normal,0\n21,64,Male,Cleveland,typical
angina,110,211,FALSE,lv
hypertrophy,144,TRUE,1.8,flat,0,normal,0\n22,58,Female,Cleveland,typical
angina,150,283,TRUE,lv
hypertrophy,162,FALSE,1,upsloping,0,normal,0\n23,58,Male,Cleveland,atypical
angina,120,284,FALSE,lv
hypertrophy,160,FALSE,1.8,flat,0,normal,1\n24,58,Male,Cleveland,non-
anginal,132,224,FALSE,lv hypertrophy,173,FALSE,3.2,upsloping,2,reversable
defect,3\n25,60,Male,Cleveland,asymptomatic,130,206,FALSE,lv
hypertrophy,132,TRUE,2.4,flat,2,reversable defect,4\n26,50,Female,Cleveland,non-
anginal,120,219,FALSE,normal,158,FALSE,1.6,flat,0,normal,0\n27,58,Female,Clevela
nd,non-anginal,120,340,FALSE,normal,172,FALSE,0,upsloping,0,normal,0\n28,66,Fema
le,Cleveland,typical angina,150,226,FALSE,normal,114,FALSE,2.6,downsloping,0,nor
mal,0\n29,43,Male,Cleveland,asymptomatic,150,247,FALSE,normal,171,FALSE,1.5,upsl
oping,0,normal,0\n30,40,Male,Cleveland,asymptomatic,110,167,FALSE,lv
hypertrophy,114,TRUE,2,flat,0,reversable
defect,3\n31,69,Female,Cleveland,typical angina,140,239,FALSE,normal,151,FALSE,1
.8,upsloping,2,normal,0\n32,60,Male,Cleveland,asymptomatic,117,230,TRUE,normal,1
60,TRUE,1.4,upsloping,2,reversable defect,2\n33,64,Male,Cleveland,non-anginal,14
0,335,FALSE,normal,158,FALSE,0,upsloping,0,normal,1\n34,59,Male,Cleveland,asympt

omatic,135,234,FALSE,normal,161,FALSE,0.5,flat,0,reversable
defect,0\n35,44,Male,Cleveland,non-anginal,130,233,FALSE,normal,179,TRUE,0.4,ups
loping,0,normal,0\n36,42,Male,Cleveland,asymptomatic,140,226,FALSE,normal,178,FA
LSE,0,upsloping,0,normal,0\n37,43,Male,Cleveland,asymptomatic,120,177,FALSE,lv
hypertrophy,120,TRUE,2.5,flat,0,reversable
defect,3\n38,57,Male,Cleveland,asymptomatic,150,276,FALSE,lv
hypertrophy,112,TRUE,0.6,flat,1,fixed defect,1\n39,55,Male,Cleveland,asymptomati
c,132,353,FALSE,normal,132,TRUE,1.2,flat,1,reversable
defect,3\n40,61,Male,Cleveland,non-anginal,150,243,TRUE,normal,137,TRUE,1,flat,0
,normal,0\n41,65,Female,Cleveland,asymptomatic,150,225,FALSE,lv
hypertrophy,114,FALSE,1,flat,3,reversable defect,4\n42,40,Male,Cleveland,typical
angina,140,199,FALSE,normal,178,TRUE,1.4,upsloping,0,reversable
defect,0\n43,71,Female,Cleveland,atypical angina,160,302,FALSE,normal,162,FALSE,
0.4,upsloping,2,normal,0\n44,59,Male,Cleveland,non-anginal,150,212,TRUE,normal,1
57,FALSE,1.6,upsloping,0,normal,0\n45,61,Female,Cleveland,asymptomatic,130,330,F
ALSE,lv hypertrophy,169,FALSE,0,upsloping,0,normal,1\n46,58,Male,Cleveland,non-
anginal,112,230,FALSE,lv hypertrophy,165,FALSE,2.5,flat,1,reversable
defect,4\n47,51,Male,Cleveland,non-anginal,110,175,FALSE,normal,123,FALSE,0.6,up
sloping,0,normal,0\n48,50,Male,Cleveland,asymptomatic,150,243,FALSE,lv
hypertrophy,128,FALSE,2.6,flat,0,reversable
defect,4\n49,65,Female,Cleveland,non-anginal,140,417,TRUE,lv
hypertrophy,157,FALSE,0.8,upsloping,1,normal,0\n50,53,Male,Cleveland,non-
anginal,130,197,TRUE,lv hypertrophy,152,FALSE,1.2,downsloping,0,normal,0\n51,41,
Female,Cleveland,atypical angina,105,198,FALSE,normal,168,FALSE,0,upsloping,1,no
rmal,0\n52,65,Male,Cleveland,asymptomatic,120,177,FALSE,normal,140,FALSE,0.4,ups
loping,0,reversable defect,0\n53,44,Male,Cleveland,asymptomatic,112,290,FALSE,lv
hypertrophy,153,FALSE,0,upsloping,1,normal,2\n54,44,Male,Cleveland,atypical
angina,130,219,FALSE,lv hypertrophy,188,FALSE,0,upsloping,0,normal,0\n55,60,Male
,Cleveland,asymptomatic,130,253,FALSE,normal,144,TRUE,1.4,upsloping,1,reversable
defect,1\n56,54,Male,Cleveland,asymptomatic,124,266,FALSE,lv
hypertrophy,109,TRUE,2.2,flat,1,reversable defect,1\n57,50,Male,Cleveland,non-
anginal,140,233,FALSE,normal,163,FALSE,0.6,flat,1,reversable
defect,1\n58,41,Male,Cleveland,asymptomatic,110,172,FALSE,lv
hypertrophy,158,FALSE,0,upsloping,0,reversable
defect,1\n59,54,Male,Cleveland,non-anginal,125,273,FALSE,lv
hypertrophy,152,FALSE,0.5,downsloping,1,normal,0\n60,51,Male,Cleveland,typical
angina,125,213,FALSE,lv hypertrophy,125,TRUE,1.4,upsloping,1,normal,0\n61,51,Fem
ale,Cleveland,asymptomatic,130,305,FALSE,normal,142,TRUE,1.2,flat,0,reversable
defect,2\n62,46,Female,Cleveland,non-anginal,142,177,FALSE,lv hypertrophy,160,TR
UE,1.4,downsloping,0,normal,0\n63,58,Male,Cleveland,asymptomatic,128,216,FALSE,l
v hypertrophy,131,TRUE,2.2,flat,3,reversable
defect,1\n64,54,Female,Cleveland,non-anginal,135,304,TRUE,normal,170,FALSE,0,ups
loping,0,normal,0\n65,54,Male,Cleveland,asymptomatic,120,188,FALSE,normal,113,FA
LSE,1.4,flat,1,reversable
defect,2\n66,60,Male,Cleveland,asymptomatic,145,282,FALSE,lv
hypertrophy,142,TRUE,2.8,flat,2,reversable defect,2\n67,60,Male,Cleveland,non-
anginal,140,185,FALSE,lv

hypertrophy,155,FALSE,3,flat,0,normal,1\n68,54,Male,Cleveland,non-
anginal,150,232,FALSE,lv hypertrophy,165,FALSE,1.6,upsloping,0,reversable
defect,0\n69,59,Male,Cleveland,asymptomatic,170,326,FALSE,lv
hypertrophy,140,TRUE,3.4,downsloping,0,reversable
defect,2\n70,46,Male,Cleveland,non-anginal,150,231,FALSE,normal,147,FALSE,3.6,fl
at,0,normal,1\n71,65,Female,Cleveland,non-anginal,155,269,FALSE,normal,148,FALSE
,0.8,upsloping,0,normal,0\n72,67,Male,Cleveland,asymptomatic,125,254,TRUE,normal
,163,FALSE,0.2,flat,2,reversable defect,3\n73,62,Male,Cleveland,asymptomatic,120
,267,FALSE,normal,99,TRUE,1.8,flat,2,reversable
defect,1\n74,65,Male,Cleveland,asymptomatic,110,248,FALSE,lv
hypertrophy,158,FALSE,0.6,upsloping,2,fixed
defect,1\n75,44,Male,Cleveland,asymptomatic,110,197,FALSE,lv
hypertrophy,177,FALSE,0,upsloping,1,normal,1\n76,65,Female,Cleveland,non-
anginal,160,360,FALSE,lv hypertrophy,151,FALSE,0.8,upsloping,0,normal,0\n77,60,M
ale,Cleveland,asymptomatic,125,258,FALSE,lv
hypertrophy,141,TRUE,2.8,flat,1,reversable defect,1\n78,51,Female,Cleveland,non-
anginal,140,308,FALSE,lv
hypertrophy,142,FALSE,1.5,upsloping,1,normal,0\n79,48,Male,Cleveland,atypical
angina,130,245,FALSE,lv hypertrophy,180,FALSE,0.2,flat,0,normal,0\n80,58,Male,Cl
eveland,asymptomatic,150,270,FALSE,lv
hypertrophy,111,TRUE,0.8,upsloping,0,reversable
defect,3\n81,45,Male,Cleveland,asymptomatic,104,208,FALSE,lv hypertrophy,148,TRU
E,3,flat,0,normal,0\n82,53,Female,Cleveland,asymptomatic,130,264,FALSE,lv
hypertrophy,143,FALSE,0.4,flat,0,normal,0\n83,39,Male,Cleveland,non-
anginal,140,321,FALSE,lv
hypertrophy,182,FALSE,0,upsloping,0,normal,0\n84,68,Male,Cleveland,non-
anginal,180,274,TRUE,lv hypertrophy,150,TRUE,1.6,flat,0,reversable
defect,3\n85,52,Male,Cleveland,atypical angina,120,325,FALSE,normal,172,FALSE,0.
2,upsloping,0,normal,0\n86,44,Male,Cleveland,non-anginal,140,235,FALSE,lv
hypertrophy,180,FALSE,0,upsloping,0,normal,0\n87,47,Male,Cleveland,non-
anginal,138,257,FALSE,lv
hypertrophy,156,FALSE,0,upsloping,0,normal,0\n88,53,Female,Cleveland,non-
anginal,128,216,FALSE,lv hypertrophy,115,FALSE,0,upsloping,0,,0\n89,53,Female,Cl
eveland,asymptomatic,138,234,FALSE,lv
hypertrophy,160,FALSE,0,upsloping,0,normal,0\n90,51,Female,Cleveland,non-
anginal,130,256,FALSE,lv hypertrophy,149,FALSE,0.5,upsloping,0,normal,0\n91,66,M
ale,Cleveland,asymptomatic,120,302,FALSE,lv hypertrophy,151,FALSE,0.4,flat,0,nor
mal,0\n92,62,Female,Cleveland,asymptomatic,160,164,FALSE,lv
hypertrophy,145,FALSE,6.2,downsloping,3,reversable
defect,3\n93,62,Male,Cleveland,non-
anginal,130,231,FALSE,normal,146,FALSE,1.8,flat,3,reversable
defect,0\n94,44,Female,Cleveland,non-anginal,108,141,FALSE,normal,175,FALSE,0.6,
flat,0,normal,0\n95,63,Female,Cleveland,non-anginal,135,252,FALSE,lv hypertrophy
,172,FALSE,0,upsloping,0,normal,0\n96,52,Male,Cleveland,asymptomatic,128,255,FAL
SE,normal,161,TRUE,0,upsloping,1,reversable
defect,1\n97,59,Male,Cleveland,asymptomatic,110,239,FALSE,lv
hypertrophy,142,TRUE,1.2,flat,1,reversable

defect,2\n98,60,Female,Cleveland,asymptomatic,150,258,FALSE,lv
hypertrophy,157,FALSE,2.6,flat,2,reversable
defect,3\n99,52,Male,Cleveland,atypical angina,134,201,FALSE,normal,158,FALSE,0.
8,upsloping,1,normal,0\n100,48,Male,Cleveland,asymptomatic,122,222,FALSE,lv hype
rtrophy,186,FALSE,0,upsloping,0,normal,0\n101,45,Male,Cleveland,asymptomatic,115
,260,FALSE,lv
hypertrophy,185,FALSE,0,upsloping,0,normal,0\n102,34,Male,Cleveland,typical
angina,118,182,FALSE,lv hypertrophy,174,FALSE,0,upsloping,0,normal,0\n103,57,Fem
ale,Cleveland,asymptomatic,128,303,FALSE,lv
hypertrophy,159,FALSE,0,upsloping,1,normal,0\n104,71,Female,Cleveland,non-
anginal,110,265,TRUE,lv
hypertrophy,130,FALSE,0,upsloping,1,normal,0\n105,49,Male,Cleveland,non-
anginal,120,188,FALSE,normal,139,FALSE,2,flat,3,reversable
defect,3\n106,54,Male,Cleveland,atypical
angina,108,309,FALSE,normal,156,FALSE,0,upsloping,0,reversable defect,0\n107,59,
Male,Cleveland,asymptomatic,140,177,FALSE,normal,162,TRUE,0,upsloping,1,reversab
le defect,2\n108,57,Male,Cleveland,non-anginal,128,229,FALSE,lv
hypertrophy,150,FALSE,0.4,flat,1,reversable defect,1\n109,61,Male,Cleveland,asym
ptomatic,120,260,FALSE,normal,140,TRUE,3.6,flat,1,reversable defect,2\n110,39,Ma
le,Cleveland,asymptomatic,118,219,FALSE,normal,140,FALSE,1.2,flat,0,reversable
defect,3\n111,61,Female,Cleveland,asymptomatic,145,307,FALSE,lv
hypertrophy,146,TRUE,1,flat,0,reversable
defect,1\n112,56,Male,Cleveland,asymptomatic,125,249,TRUE,lv
hypertrophy,144,TRUE,1.2,flat,1,normal,1\n113,52,Male,Cleveland,typical
angina,118,186,FALSE,lv hypertrophy,190,FALSE,0,flat,0,fixed
defect,0\n114,43,Female,Cleveland,asymptomatic,132,341,TRUE,lv
hypertrophy,136,TRUE,3,flat,0,reversable defect,2\n115,62,Female,Cleveland,non-
anginal,130,263,FALSE,normal,97,FALSE,1.2,flat,1,reversable
defect,2\n116,41,Male,Cleveland,atypical
angina,135,203,FALSE,normal,132,FALSE,0,flat,0,fixed
defect,0\n117,58,Male,Cleveland,non-anginal,140,211,TRUE,lv hypertrophy,165,FALS
E,0,upsloping,0,normal,0\n118,35,Female,Cleveland,asymptomatic,138,183,FALSE,nor
mal,182,FALSE,1.4,upsloping,0,normal,0\n119,63,Male,Cleveland,asymptomatic,130,3
30,TRUE,lv hypertrophy,132,TRUE,1.8,upsloping,3,reversable
defect,3\n120,65,Male,Cleveland,asymptomatic,135,254,FALSE,lv
hypertrophy,127,FALSE,2.8,flat,1,reversable
defect,2\n121,48,Male,Cleveland,asymptomatic,130,256,TRUE,lv
hypertrophy,150,TRUE,0,upsloping,2,reversable
defect,3\n122,63,Female,Cleveland,asymptomatic,150,407,FALSE,lv
hypertrophy,154,FALSE,4,flat,3,reversable defect,4\n123,51,Male,Cleveland,non-an
ginal,100,222,FALSE,normal,143,TRUE,1.2,flat,0,normal,0\n124,55,Male,Cleveland,a
symptomatic,140,217,FALSE,normal,111,TRUE,5.6,downsloping,0,reversable
defect,3\n125,65,Male,Cleveland,typical angina,138,282,TRUE,lv
hypertrophy,174,FALSE,1.4,flat,1,normal,1\n126,45,Female,Cleveland,atypical
angina,130,234,FALSE,lv hypertrophy,175,FALSE,0.6,flat,0,normal,0\n127,56,Female
,Cleveland,asymptomatic,200,288,TRUE,lv
hypertrophy,133,TRUE,4,downsloping,2,reversable defect,3\n128,54,Male,Cleveland,

asymptomatic,110,239,FALSE,normal,126,TRUE,2.8,flat,1,reversable
defect,3\n129,44,Male,Cleveland,atypical angina,120,220,FALSE,normal,170,FALSE,0
,upsloping,0,normal,0\n130,62,Female,Cleveland,asymptomatic,124,209,FALSE,normal
,163,FALSE,0,upsloping,0,normal,0\n131,54,Male,Cleveland,non-
anginal,120,258,FALSE,lv hypertrophy,147,FALSE,0.4,flat,0,reversable
defect,0\n132,51,Male,Cleveland,non-
anginal,94,227,FALSE,normal,154,TRUE,0,upsloping,1,reversable
defect,0\n133,29,Male,Cleveland,atypical angina,130,204,FALSE,lv hypertrophy,202
,FALSE,0,upsloping,0,normal,0\n134,51,Male,Cleveland,asymptomatic,140,261,FALSE,
lv hypertrophy,186,TRUE,0,upsloping,0,normal,0\n135,43,Female,Cleveland,non-angi
nal,122,213,FALSE,normal,165,FALSE,0.2,flat,0,normal,0\n136,55,Female,Cleveland,
atypical angina,135,250,FALSE,lv hypertrophy,161,FALSE,1.4,flat,0,normal,0\n137,
70,Male,Cleveland,asymptomatic,145,174,FALSE,normal,125,TRUE,2.6,downsloping,0,r
eversable defect,4\n138,62,Male,Cleveland,atypical angina,120,281,FALSE,lv
hypertrophy,103,FALSE,1.4,flat,1,reversable defect,3\n139,35,Male,Cleveland,asym
ptomatic,120,198,FALSE,normal,130,TRUE,1.6,flat,0,reversable
defect,1\n140,51,Male,Cleveland,non-anginal,125,245,TRUE,lv
hypertrophy,166,FALSE,2.4,flat,0,normal,0\n141,59,Male,Cleveland,atypical angina
,140,221,FALSE,normal,164,TRUE,0,upsloping,0,normal,0\n142,59,Male,Cleveland,typ
ical angina,170,288,FALSE,lv hypertrophy,159,FALSE,0.2,flat,0,reversable
defect,1\n143,52,Male,Cleveland,atypical angina,128,205,TRUE,normal,184,FALSE,0,
upsloping,0,normal,0\n144,64,Male,Cleveland,non-
anginal,125,309,FALSE,normal,131,TRUE,1.8,flat,0,reversable
defect,1\n145,58,Male,Cleveland,non-anginal,105,240,FALSE,lv
hypertrophy,154,TRUE,0.6,flat,0,reversable defect,0\n146,47,Male,Cleveland,non-a
nginal,108,243,FALSE,normal,152,FALSE,0,upsloping,0,normal,1\n147,57,Male,Clevel
and,asymptomatic,165,289,TRUE,lv hypertrophy,124,FALSE,1,flat,3,reversable
defect,4\n148,41,Male,Cleveland,non-anginal,112,250,FALSE,normal,179,FALSE,0,ups
loping,0,normal,0\n149,45,Male,Cleveland,atypical angina,128,308,FALSE,lv
hypertrophy,170,FALSE,0,upsloping,0,normal,0\n150,60,Female,Cleveland,non-angina
l,102,318,FALSE,normal,160,FALSE,0,upsloping,1,normal,0\n151,52,Male,Cleveland,t
ypical angina,152,298,TRUE,normal,178,FALSE,1.2,flat,0,reversable
defect,0\n152,42,Female,Cleveland,asymptomatic,102,265,FALSE,lv
hypertrophy,122,FALSE,0.6,flat,0,normal,0\n153,67,Female,Cleveland,non-
anginal,115,564,FALSE,lv hypertrophy,160,FALSE,1.6,flat,0,reversable
defect,0\n154,55,Male,Cleveland,asymptomatic,160,289,FALSE,lv
hypertrophy,145,TRUE,0.8,flat,1,reversable
defect,4\n155,64,Male,Cleveland,asymptomatic,120,246,FALSE,lv hypertrophy,96,TRU
E,2.2,downsloping,1,normal,3\n156,70,Male,Cleveland,asymptomatic,130,322,FALSE,l
v hypertrophy,109,FALSE,2.4,flat,3,normal,1\n157,51,Male,Cleveland,asymptomatic,
140,299,FALSE,normal,173,TRUE,1.6,upsloping,0,reversable
defect,1\n158,58,Male,Cleveland,asymptomatic,125,300,FALSE,lv
hypertrophy,171,FALSE,0,upsloping,2,reversable
defect,1\n159,60,Male,Cleveland,asymptomatic,140,293,FALSE,lv
hypertrophy,170,FALSE,1.2,flat,2,reversable defect,2\n160,68,Male,Cleveland,non-
anginal,118,277,FALSE,normal,151,FALSE,1,upsloping,1,reversable
defect,0\n161,46,Male,Cleveland,atypical

```
angina,101,197,TRUE,normal,156,FALSE,0,upsloping,0,reversable
defect,0\n162,77,Male,Cleveland,asymptomatic,125,304,FALSE,lv
hypertrophy,162,TRUE,0,upsloping,3,normal,4\n163,54,Female,Cleveland,non-anginal
,110,214,FALSE,normal,158,FALSE,1.6,flat,0,normal,0\n164,58,Female,Cleveland,asy
mptomatic,100,248,FALSE,lv
hypertrophy,122,FALSE,1,flat,0,normal,0\n165,48,Male,Cleveland,non-anginal,124,2
55,TRUE,normal,175,FALSE,0,upsloping,2,normal,0\n166,57,Male,Cleveland,asymptoma
tic,132,207,FALSE,normal,168,TRUE,0,upsloping,0,reversable
defect,0\n167,52,Male,Cleveland,non-anginal,138,223,FALSE,normal,169,FALSE,0,ups
loping,,normal,0\n168,54,Female,Cleveland,atypical angina,132,288,TRUE,lv hypert
rophy,159,TRUE,0,upsloping,1,normal,0\n169,35,Male,Cleveland,asymptomatic,126,28
2,FALSE,lv hypertrophy,156,TRUE,0,upsloping,0,reversable
defect,1\n170,45,Female,Cleveland,atypical angina,112,160,FALSE,normal,138,FALSE
,0,flat,0,normal,0\n171,70,Male,Cleveland,non-
anginal,160,269,FALSE,normal,112,TRUE,2.9,flat,1,reversable
defect,3\n172,53,Male,Cleveland,asymptomatic,142,226,FALSE,lv
hypertrophy,111,TRUE,0,upsloping,0,reversable defect,0\n173,59,Female,Cleveland,
asymptomatic,174,249,FALSE,normal,143,TRUE,0,flat,0,normal,1\n174,62,Female,Clev
eland,asymptomatic,140,394,FALSE,lv hypertrophy,157,FALSE,1.2,flat,0,normal,0\n1
75,64,Male,Cleveland,asymptomatic,145,212,FALSE,lv
hypertrophy,132,FALSE,2,flat,2,fixed defect,4\n176,57,Male,Cleveland,asymptomati
c,152,274,FALSE,normal,88,TRUE,1.2,flat,1,reversable defect,1\n177,52,Male,Cleve
land,asymptomatic,108,233,TRUE,normal,147,FALSE,0.1,upsloping,3,reversable
defect,0\n178,56,Male,Cleveland,asymptomatic,132,184,FALSE,lv
hypertrophy,105,TRUE,2.1,flat,1,fixed defect,1\n179,43,Male,Cleveland,non-angina
l,130,315,FALSE,normal,162,FALSE,1.9,upsloping,1,normal,0\n180,53,Male,Cleveland
,non-anginal,130,246,TRUE,lv hypertrophy,173,FALSE,0,upsloping,3,normal,0\n181,4
8,Male,Cleveland,asymptomatic,124,274,FALSE,lv
hypertrophy,166,FALSE,0.5,flat,0,reversable
defect,3\n182,56,Female,Cleveland,asymptomatic,134,409,FALSE,lv
hypertrophy,150,TRUE,1.9,flat,2,reversable
defect,2\n183,42,Male,Cleveland,typical angina,148,244,FALSE,lv
hypertrophy,178,FALSE,0.8,upsloping,2,normal,0\n184,59,Male,Cleveland,typical
angina,178,270,FALSE,lv hypertrophy,145,FALSE,4.2,downsloping,0,reversable
defect,0\n185,60,Female,Cleveland,asymptomatic,158,305,FALSE,lv
hypertrophy,161,FALSE,0,upsloping,0,normal,1\n186,63,Female,Cleveland,atypical a
ngina,140,195,FALSE,normal,179,FALSE,0,upsloping,2,normal,0\n187,42,Male,Clevela
nd,non-anginal,120,240,TRUE,normal,194,FALSE,0.8,downsloping,0,reversable
defect,0\n188,66,Male,Cleveland,atypical
angina,160,246,FALSE,normal,120,TRUE,0,flat,3,fixed
defect,2\n189,54,Male,Cleveland,atypical angina,192,283,FALSE,lv
hypertrophy,195,FALSE,0,upsloping,1,reversable
defect,1\n190,69,Male,Cleveland,non-anginal,140,254,FALSE,lv
hypertrophy,146,FALSE,2,flat,3,reversable defect,2\n191,50,Male,Cleveland,non-an
ginal,129,196,FALSE,normal,163,FALSE,0,upsloping,0,normal,0\n192,51,Male,Clevela
nd,asymptomatic,140,298,FALSE,normal,122,TRUE,4.2,flat,3,reversable
defect,3\n193,43,Male,Cleveland,asymptomatic,132,247,TRUE,lv
```

hypertrophy,143,TRUE,0.1,flat,,reversable defect,1\n194,62,Female,Cleveland,asym
ptomatic,138,294,TRUE,normal,106,FALSE,1.9,flat,3,normal,2\n195,68,Female,Clevel
and,non-anginal,120,211,FALSE,lv hypertrophy,115,FALSE,1.5,flat,0,normal,0\n196,
67,Male,Cleveland,asymptomatic,100,299,FALSE,lv
hypertrophy,125,TRUE,0.9,flat,2,normal,3\n197,69,Male,Cleveland,typical
angina,160,234,TRUE,lv hypertrophy,131,FALSE,0.1,flat,1,normal,0\n198,45,Female,
Cleveland,asymptomatic,138,236,FALSE,lv
hypertrophy,152,TRUE,0.2,flat,0,normal,0\n199,50,Female,Cleveland,atypical angin
a,120,244,FALSE,normal,162,FALSE,1.1,upsloping,0,normal,0\n200,59,Male,Cleveland
,typical angina,160,273,FALSE,lv hypertrophy,125,FALSE,0,upsloping,0,normal,1\n2
01,50,Female,Cleveland,asymptomatic,110,254,FALSE,lv hypertrophy,159,FALSE,0,ups
loping,0,normal,0\n202,64,Female,Cleveland,asymptomatic,180,325,FALSE,normal,154
,TRUE,0,upsloping,0,normal,0\n203,57,Male,Cleveland,non-
anginal,150,126,TRUE,normal,173,FALSE,0.2,upsloping,1,reversable
defect,0\n204,64,Female,Cleveland,non-
anginal,140,313,FALSE,normal,133,FALSE,0.2,upsloping,0,reversable defect,0\n205,
43,Male,Cleveland,asymptomatic,110,211,FALSE,normal,161,FALSE,0,upsloping,0,reve
rsable defect,0\n206,45,Male,Cleveland,asymptomatic,142,309,FALSE,lv
hypertrophy,147,TRUE,0,flat,3,reversable
defect,3\n207,58,Male,Cleveland,asymptomatic,128,259,FALSE,lv
hypertrophy,130,TRUE,3,flat,2,reversable
defect,3\n208,50,Male,Cleveland,asymptomatic,144,200,FALSE,lv
hypertrophy,126,TRUE,0.9,flat,0,reversable
defect,3\n209,55,Male,Cleveland,atypical angina,130,262,FALSE,normal,155,FALSE,0
,upsloping,0,normal,0\n210,62,Female,Cleveland,asymptomatic,150,244,FALSE,normal
,154,TRUE,1.4,flat,0,normal,1\n211,37,Female,Cleveland,non-anginal,120,215,FALSE
,normal,170,FALSE,0,upsloping,0,normal,0\n212,38,Male,Cleveland,typical
angina,120,231,FALSE,normal,182,TRUE,3.8,flat,0,reversable
defect,4\n213,41,Male,Cleveland,non-anginal,130,214,FALSE,lv hypertrophy,168,FAL
SE,2,flat,0,normal,0\n214,66,Female,Cleveland,asymptomatic,178,228,TRUE,normal,1
65,TRUE,1,flat,2,reversable defect,3\n215,52,Male,Cleveland,asymptomatic,112,230
,FALSE,normal,160,FALSE,0,upsloping,1,normal,1\n216,56,Male,Cleveland,typical
angina,120,193,FALSE,lv hypertrophy,162,FALSE,1.9,flat,0,reversable
defect,0\n217,46,Female,Cleveland,atypical angina,105,204,FALSE,normal,172,FALSE
,0,upsloping,0,normal,0\n218,46,Female,Cleveland,asymptomatic,138,243,FALSE,lv h
ypertrophy,152,TRUE,0,flat,0,normal,0\n219,64,Female,Cleveland,asymptomatic,130,
303,FALSE,normal,122,FALSE,2,flat,2,normal,0\n220,59,Male,Cleveland,asymptomatic
,138,271,FALSE,lv
hypertrophy,182,FALSE,0,upsloping,0,normal,0\n221,41,Female,Cleveland,non-
anginal,112,268,FALSE,lv
hypertrophy,172,TRUE,0,upsloping,0,normal,0\n222,54,Female,Cleveland,non-
anginal,108,267,FALSE,lv
hypertrophy,167,FALSE,0,upsloping,0,normal,0\n223,39,Female,Cleveland,non-angina
l,94,199,FALSE,normal,179,FALSE,0,upsloping,0,normal,0\n224,53,Male,Cleveland,as
ymptomatic,123,282,FALSE,normal,95,TRUE,2,flat,2,reversable defect,3\n225,63,Fem
ale,Cleveland,asymptomatic,108,269,FALSE,normal,169,TRUE,1.8,flat,2,normal,1\n22
6,34,Female,Cleveland,atypical angina,118,210,FALSE,normal,192,FALSE,0.7,upslopi

ng,0,normal,0\n227,47,Male,Cleveland,asymptomatic,112,204,FALSE,normal,143,FALSE
,0.1,upsloping,0,normal,0\n228,67,Female,Cleveland,non-anginal,152,277,FALSE,nor
mal,172,FALSE,0,upsloping,1,normal,0\n229,54,Male,Cleveland,asymptomatic,110,206
,FALSE,lv hypertrophy,108,TRUE,0,flat,1,normal,3\n230,66,Male,Cleveland,asymptom
atic,112,212,FALSE,lv
hypertrophy,132,TRUE,0.1,upsloping,1,normal,2\n231,52,Female,Cleveland,non-
anginal,136,196,FALSE,lv hypertrophy,169,FALSE,0.1,flat,0,normal,0\n232,55,Femal
e,Cleveland,asymptomatic,180,327,FALSE,st-t
abnormality,117,TRUE,3.4,flat,0,normal,2\n233,49,Male,Cleveland,non-
anginal,118,149,FALSE,lv
hypertrophy,126,FALSE,0.8,upsloping,3,normal,1\n234,74,Female,Cleveland,atypical
angina,120,269,FALSE,lv
hypertrophy,121,TRUE,0.2,upsloping,1,normal,0\n235,54,Female,Cleveland,non-angin
al,160,201,FALSE,normal,163,FALSE,0,upsloping,1,normal,0\n236,54,Male,Cleveland,
asymptomatic,122,286,FALSE,lv hypertrophy,116,TRUE,3.2,flat,2,normal,3\n237,56,M
ale,Cleveland,asymptomatic,130,283,TRUE,lv
hypertrophy,103,TRUE,1.6,downsloping,0,reversable
defect,2\n238,46,Male,Cleveland,asymptomatic,120,249,FALSE,lv
hypertrophy,144,FALSE,0.8,upsloping,0,reversable
defect,1\n239,49,Female,Cleveland,atypical angina,134,271,FALSE,normal,162,FALSE
,0,flat,0,normal,0\n240,42,Male,Cleveland,atypical angina,120,295,FALSE,normal,1
62,FALSE,0,upsloping,0,normal,0\n241,41,Male,Cleveland,atypical angina,110,235,F
ALSE,normal,153,FALSE,0,upsloping,0,normal,0\n242,41,Female,Cleveland,atypical a
ngina,126,306,FALSE,normal,163,FALSE,0,upsloping,0,normal,0\n243,49,Female,Cleve
land,asymptomatic,130,269,FALSE,normal,163,FALSE,0,upsloping,0,normal,0\n244,61,
Male,Cleveland,typical angina,134,234,FALSE,normal,145,FALSE,2.6,flat,2,normal,2
\n245,60,Female,Cleveland,non-anginal,120,178,TRUE,normal,96,FALSE,0,upsloping,0
,normal,0\n246,67,Male,Cleveland,asymptomatic,120,237,FALSE,normal,71,FALSE,1,fl
at,0,normal,2\n247,58,Male,Cleveland,asymptomatic,100,234,FALSE,normal,156,FALSE
,0.1,upsloping,1,reversable
defect,2\n248,47,Male,Cleveland,asymptomatic,110,275,FALSE,lv hypertrophy,118,TR
UE,1,flat,1,normal,1\n249,52,Male,Cleveland,asymptomatic,125,212,FALSE,normal,16
8,FALSE,1,upsloping,2,reversable defect,3\n250,62,Male,Cleveland,atypical
angina,128,208,TRUE,lv hypertrophy,140,FALSE,0,upsloping,0,normal,0\n251,57,Male
,Cleveland,asymptomatic,110,201,FALSE,normal,126,TRUE,1.5,flat,0,fixed defect,0\
n252,58,Male,Cleveland,asymptomatic,146,218,FALSE,normal,105,FALSE,2,flat,1,reve
rsable defect,1\n253,64,Male,Cleveland,asymptomatic,128,263,FALSE,normal,105,TRU
E,0.2,flat,1,reversable defect,0\n254,51,Female,Cleveland,non-
anginal,120,295,FALSE,lv hypertrophy,157,FALSE,0.6,upsloping,0,normal,0\n255,43,
Male,Cleveland,asymptomatic,115,303,FALSE,normal,181,FALSE,1.2,flat,0,normal,0\n
256,42,Female,Cleveland,non-anginal,120,209,FALSE,normal,173,FALSE,0,flat,0,norm
al,0\n257,67,Female,Cleveland,asymptomatic,106,223,FALSE,normal,142,FALSE,0.3,up
sloping,2,normal,0\n258,76,Female,Cleveland,non-anginal,140,197,FALSE,st-t
abnormality,116,FALSE,1.1,flat,0,normal,0\n259,70,Male,Cleveland,atypical
angina,156,245,FALSE,lv
hypertrophy,143,FALSE,0,upsloping,0,normal,0\n260,57,Male,Cleveland,atypical
angina,124,261,FALSE,normal,141,FALSE,0.3,upsloping,0,reversable

defect,1\n261,44,Female,Cleveland,non-anginal,118,242,FALSE,normal,149,FALSE,0.3
,flat,1,normal,0\n262,58,Female,Cleveland,atypical angina,136,319,TRUE,lv
hypertrophy,152,FALSE,0,upsloping,2,normal,3\n263,60,Female,Cleveland,typical an
gina,150,240,FALSE,normal,171,FALSE,0.9,upsloping,0,normal,0\n264,44,Male,Clevel
and,non-anginal,120,226,FALSE,normal,169,FALSE,0,upsloping,0,normal,0\n265,61,Ma
le,Cleveland,asymptomatic,138,166,FALSE,lv hypertrophy,125,TRUE,3.6,flat,1,norma
l,4\n266,42,Male,Cleveland,asymptomatic,136,315,FALSE,normal,125,TRUE,1.8,flat,0
,fixed defect,2\n267,52,Male,Cleveland,asymptomatic,128,204,TRUE,normal,156,TRUE
,1,flat,0,,2\n268,59,Male,Cleveland,non-
anginal,126,218,TRUE,normal,134,FALSE,2.2,flat,1,fixed defect,2\n269,40,Male,Cle
veland,asymptomatic,152,223,FALSE,normal,181,FALSE,0,upsloping,0,reversable
defect,1\n270,42,Male,Cleveland,non-anginal,130,180,FALSE,normal,150,FALSE,0,ups
loping,0,normal,0\n271,61,Male,Cleveland,asymptomatic,140,207,FALSE,lv
hypertrophy,138,TRUE,1.9,upsloping,1,reversable
defect,1\n272,66,Male,Cleveland,asymptomatic,160,228,FALSE,lv
hypertrophy,138,FALSE,2.3,upsloping,0,fixed defect,0\n273,46,Male,Cleveland,asym
ptomatic,140,311,FALSE,normal,120,TRUE,1.8,flat,2,reversable defect,2\n274,71,Fe
male,Cleveland,asymptomatic,112,149,FALSE,normal,125,FALSE,1.6,flat,0,normal,0\n
275,59,Male,Cleveland,typical angina,134,204,FALSE,normal,162,FALSE,0.8,upslopin
g,2,normal,1\n276,64,Male,Cleveland,typical angina,170,227,FALSE,lv
hypertrophy,155,FALSE,0.6,flat,0,reversable
defect,0\n277,66,Female,Cleveland,non-anginal,146,278,FALSE,lv
hypertrophy,152,FALSE,0,flat,1,normal,0\n278,39,Female,Cleveland,non-anginal,138
,220,FALSE,normal,152,FALSE,0,flat,0,normal,0\n279,57,Male,Cleveland,atypical
angina,154,232,FALSE,lv hypertrophy,164,FALSE,0,upsloping,1,normal,1\n280,58,Fem
ale,Cleveland,asymptomatic,130,197,FALSE,normal,131,FALSE,0.6,flat,0,normal,0\n2
81,57,Male,Cleveland,asymptomatic,110,335,FALSE,normal,143,TRUE,3,flat,1,reversa
ble defect,2\n282,47,Male,Cleveland,non-anginal,130,253,FALSE,normal,179,FALSE,0
,upsloping,0,normal,0\n283,55,Female,Cleveland,asymptomatic,128,205,FALSE,st-t
abnormality,130,TRUE,2,flat,1,reversable
defect,3\n284,35,Male,Cleveland,atypical angina,122,192,FALSE,normal,174,FALSE,0
,upsloping,0,normal,0\n285,61,Male,Cleveland,asymptomatic,148,203,FALSE,normal,1
61,FALSE,0,upsloping,1,reversable
defect,2\n286,58,Male,Cleveland,asymptomatic,114,318,FALSE,st-t
abnormality,140,FALSE,4.4,downsloping,3,fixed
defect,4\n287,58,Female,Cleveland,asymptomatic,170,225,TRUE,lv
hypertrophy,146,TRUE,2.8,flat,2,fixed defect,2\n288,58,Male,Cleveland,atypical
angina,125,220,FALSE,normal,144,FALSE,0.4,flat,,reversable
defect,0\n289,56,Male,Cleveland,atypical angina,130,221,FALSE,lv
hypertrophy,163,FALSE,0,upsloping,0,reversable
defect,0\n290,56,Male,Cleveland,atypical angina,120,240,FALSE,normal,169,FALSE,0
,downsloping,0,normal,0\n291,67,Male,Cleveland,non-anginal,152,212,FALSE,lv
hypertrophy,150,FALSE,0.8,flat,0,reversable
defect,1\n292,55,Female,Cleveland,atypical angina,132,342,FALSE,normal,166,FALSE
,1.2,upsloping,0,normal,0\n293,44,Male,Cleveland,asymptomatic,120,169,FALSE,norm
al,144,TRUE,2.8,downsloping,0,fixed
defect,2\n294,63,Male,Cleveland,asymptomatic,140,187,FALSE,lv

```
hypertrophy,144,TRUE,4,upsloping,2,reversable defect,2\n295,63,Female,Cleveland,
asymptomatic,124,197,FALSE,normal,136,TRUE,0,flat,0,normal,1\n296,41,Male,Clevel
and,atypical angina,120,157,FALSE,normal,182,FALSE,0,upsloping,0,normal,0\n297,5
9,Male,Cleveland,asymptomatic,164,176,TRUE,lv
hypertrophy,90,FALSE,1,flat,2,fixed defect,3\n298,57,Female,Cleveland,asymptomat
ic,140,241,FALSE,normal,123,TRUE,0.2,flat,0,reversable
defect,1\n299,45,Male,Cleveland,typical
angina,110,264,FALSE,normal,132,FALSE,1.2,flat,0,reversable defect,1\n300,68,Mal
e,Cleveland,asymptomatic,144,193,TRUE,normal,141,FALSE,3.4,flat,2,reversable def
ect,2\n301,57,Male,Cleveland,asymptomatic,130,131,FALSE,normal,115,TRUE,1.2,flat
,1,reversable defect,3\n302,57,Female,Cleveland,atypical angina,130,236,FALSE,lv
hypertrophy,174,FALSE,0,flat,1,normal,1\n303,38,Male,Cleveland,non-anginal,138,1
75,FALSE,normal,173,FALSE,0,upsloping,,normal,0\n304,28,Male,Cleveland,atypical
angina,130,132,FALSE,lv
hypertrophy,185,FALSE,0,,,,0\n305,29,Male,Hungary,atypical
angina,120,243,FALSE,normal,160,FALSE,0,,,,0\n306,29,Male,Hungary,atypical
angina,140,,FALSE,normal,170,FALSE,0,,,,0\n307,30,Female,Hungary,typical
angina,170,237,FALSE,st-t abnormality,170,FALSE,0,,,fixed
defect,0\n308,31,Female,Hungary,atypical angina,100,219,FALSE,st-t
abnormality,150,FALSE,0,,,,0\n309,32,Female,Hungary,atypical
angina,105,198,FALSE,normal,165,FALSE,0,,,,0\n310,32,Male,Hungary,atypical
angina,110,225,FALSE,normal,184,FALSE,0,,,,0\n311,32,Male,Hungary,atypical
angina,125,254,FALSE,normal,155,FALSE,0,,,,0\n312,33,Male,Hungary,non-
anginal,120,298,FALSE,normal,185,FALSE,0,,,,0\n313,34,Female,Hungary,atypical
angina,130,161,FALSE,normal,190,FALSE,0,,,,0\n314,34,Male,Hungary,atypical
angina,150,214,FALSE,st-t
abnormality,168,FALSE,0,,,,0\n315,34,Male,Hungary,atypical
angina,98,220,FALSE,normal,150,FALSE,0,,,,0\n316,35,Female,Hungary,typical
angina,120,160,FALSE,st-t abnormality,185,FALSE,0,,,,0\n317,35,Female,Hungary,as
ymptomatic,140,167,FALSE,normal,150,FALSE,0,,,,0\n318,35,Male,Hungary,atypical
angina,120,308,FALSE,lv
hypertrophy,180,FALSE,0,,,,0\n319,35,Male,Hungary,atypical
angina,150,264,FALSE,normal,168,FALSE,0,,,,0\n320,36,Male,Hungary,atypical
angina,120,166,FALSE,normal,180,FALSE,0,,,,0\n321,36,Male,Hungary,non-anginal,11
2,340,FALSE,normal,184,FALSE,1,flat,,normal,0\n322,36,Male,Hungary,non-
anginal,130,209,FALSE,normal,178,FALSE,0,,,,0\n323,36,Male,Hungary,non-
anginal,150,160,FALSE,normal,172,FALSE,0,,,,0\n324,37,Female,Hungary,atypical
angina,120,260,FALSE,normal,130,FALSE,0,,,,0\n325,37,Female,Hungary,non-anginal,
130,211,FALSE,normal,142,FALSE,0,,,,0\n326,37,Female,Hungary,asymptomatic,130,17
3,FALSE,st-t abnormality,184,FALSE,0,,,,0\n327,37,Male,Hungary,atypical
angina,130,283,FALSE,st-t abnormality,98,FALSE,0,,,,0\n328,37,Male,Hungary,non-a
nginal,130,194,FALSE,normal,150,FALSE,0,,,,0\n329,37,Male,Hungary,asymptomatic,1
20,223,FALSE,normal,168,FALSE,0,,,normal,0\n330,37,Male,Hungary,asymptomatic,130
,315,FALSE,normal,158,FALSE,0,,,,0\n331,38,Female,Hungary,atypical
angina,120,275,,normal,129,FALSE,0,,,,0\n332,38,Male,Hungary,atypical
angina,140,297,FALSE,normal,150,FALSE,0,,,,0\n333,38,Male,Hungary,non-
anginal,145,292,FALSE,normal,130,FALSE,0,,,,0\n334,39,Female,Hungary,non-
```

anginal,110,182,FALSE,st-t
abnormality,180,FALSE,0,,,,0\n335,39,Male,Hungary,atypical
angina,120,,FALSE,st-t
abnormality,146,FALSE,2,upsloping,,,0\n336,39,Male,Hungary,atypical
angina,120,200,FALSE,normal,160,TRUE,1,flat,,,0\n337,39,Male,Hungary,atypical
angina,120,204,FALSE,normal,145,FALSE,0,,,,0\n338,39,Male,Hungary,atypical
angina,130,,FALSE,normal,120,FALSE,0,,,,0\n339,39,Male,Hungary,atypical
angina,190,241,FALSE,normal,106,FALSE,0,,,,0\n340,39,Male,Hungary,non-
anginal,120,339,FALSE,normal,170,FALSE,0,,,,0\n341,39,Male,Hungary,non-anginal,1
60,147,TRUE,normal,160,FALSE,0,,,,0\n342,39,Male,Hungary,asymptomatic,110,273,FA
LSE,normal,132,FALSE,0,,,,0\n343,39,Male,Hungary,asymptomatic,130,307,FALSE,norm
al,140,FALSE,0,,,,0\n344,40,Male,Hungary,atypical
angina,130,275,FALSE,normal,150,FALSE,0,,,,0\n345,40,Male,Hungary,atypical
angina,140,289,FALSE,normal,172,FALSE,0,,,,0\n346,40,Male,Hungary,non-
anginal,130,215,FALSE,normal,138,FALSE,0,,,,0\n347,40,Male,Hungary,non-
anginal,130,281,FALSE,normal,167,FALSE,0,,,,0\n348,40,Male,Hungary,non-
anginal,140,,FALSE,normal,188,FALSE,0,,,,0\n349,41,Female,Hungary,atypical
angina,110,250,FALSE,st-t
abnormality,142,FALSE,0,,,,0\n350,41,Female,Hungary,atypical
angina,125,184,FALSE,normal,180,FALSE,0,,,,0\n351,41,Female,Hungary,atypical
angina,130,245,FALSE,normal,150,FALSE,0,,,,0\n352,41,Male,Hungary,atypical
angina,120,291,FALSE,st-t
abnormality,160,FALSE,0,,,,0\n353,41,Male,Hungary,atypical
angina,120,295,FALSE,normal,170,FALSE,0,,,,0\n354,41,Male,Hungary,atypical angin
a,125,269,FALSE,normal,144,FALSE,0,,,,0\n355,41,Male,Hungary,asymptomatic,112,25
0,FALSE,normal,142,FALSE,0,,,,0\n356,42,Female,Hungary,non-
anginal,115,211,FALSE,st-t
abnormality,137,FALSE,0,,,,0\n357,42,Male,Hungary,atypical
angina,120,196,FALSE,normal,150,FALSE,0,,,,0\n358,42,Male,Hungary,atypical
angina,120,198,FALSE,normal,155,FALSE,0,,,,0\n359,42,Male,Hungary,atypical
angina,150,268,FALSE,normal,136,FALSE,0,,,,0\n360,42,Male,Hungary,non-
anginal,120,228,FALSE,normal,152,TRUE,1.5,flat,,,0\n361,42,Male,Hungary,non-angi
nal,160,147,FALSE,normal,146,FALSE,0,,,,0\n362,42,Male,Hungary,asymptomatic,140,
358,FALSE,normal,170,FALSE,0,,,,0\n363,43,Female,Hungary,typical
angina,100,223,FALSE,normal,142,FALSE,0,,,,0\n364,43,Female,Hungary,atypical
angina,120,201,FALSE,normal,165,FALSE,0,,,,0\n365,43,Female,Hungary,atypical
angina,120,215,FALSE,st-t
abnormality,175,FALSE,0,,,,0\n366,43,Female,Hungary,atypical
angina,120,249,FALSE,st-t
abnormality,176,FALSE,0,,,,0\n367,43,Female,Hungary,atypical
angina,120,266,FALSE,normal,118,FALSE,0,,,,0\n368,43,Female,Hungary,atypical
angina,150,186,FALSE,normal,154,FALSE,0,,,,0\n369,43,Female,Hungary,non-
anginal,150,,FALSE,normal,175,FALSE,0,,,normal,0\n370,43,Male,Hungary,atypical a
ngina,142,207,FALSE,normal,138,FALSE,0,,,,0\n371,44,Female,Hungary,asymptomatic,
120,218,FALSE,st-t abnormality,115,FALSE,0,,,,0\n372,44,Male,Hungary,atypical
angina,120,184,FALSE,normal,142,FALSE,1,flat,,,0\n373,44,Male,Hungary,atypical a
ngina,130,215,FALSE,normal,135,FALSE,0,,,,0\n374,44,Male,Hungary,asymptomatic,15

0,412,FALSE,normal,170,FALSE,0,,,,0\n375,45,Female,Hungary,atypical
angina,130,237,FALSE,normal,170,FALSE,0,,,,0\n376,45,Female,Hungary,atypical ang
ina,180,,FALSE,normal,180,FALSE,0,,,,0\n377,45,Female,Hungary,asymptomatic,132,2
97,FALSE,normal,144,FALSE,0,,,,0\n378,45,Male,Hungary,atypical
angina,140,224,TRUE,normal,122,FALSE,0,,,,0\n379,45,Male,Hungary,non-anginal,135
,,FALSE,normal,110,FALSE,0,,,,0\n380,45,Male,Hungary,asymptomatic,120,225,FALSE,
normal,140,FALSE,0,,,,0\n381,45,Male,Hungary,asymptomatic,140,224,FALSE,normal,1
44,FALSE,0,,,,0\n382,46,Female,Hungary,asymptomatic,130,238,FALSE,normal,90,FALS
E,0,,,,0\n383,46,Male,Hungary,atypical
angina,140,275,FALSE,normal,165,TRUE,0,,,,0\n384,46,Male,Hungary,non-
anginal,120,230,FALSE,normal,150,FALSE,0,,,,0\n385,46,Male,Hungary,non-anginal,1
50,163,,normal,116,FALSE,0,,,,0\n386,46,Male,Hungary,asymptomatic,110,238,FALSE,
st-t abnormality,140,TRUE,1,flat,,normal,0\n387,46,Male,Hungary,asymptomatic,110
,240,FALSE,st-t abnormality,140,FALSE,0,,,normal,0\n388,46,Male,Hungary,asymptom
atic,180,280,FALSE,st-t
abnormality,120,FALSE,0,,,,0\n389,47,Female,Hungary,atypical angina,140,257,FALS
E,normal,135,FALSE,1,upsloping,,,0\n390,47,Female,Hungary,non-
anginal,130,,FALSE,normal,145,FALSE,2,flat,,,0\n391,47,Male,Hungary,typical
angina,110,249,FALSE,normal,150,FALSE,0,,,,0\n392,47,Male,Hungary,atypical angin
a,160,263,FALSE,normal,174,FALSE,0,,,,0\n393,47,Male,Hungary,asymptomatic,140,27
6,TRUE,normal,125,TRUE,0,,,,0\n394,48,Female,Hungary,atypical
angina,,308,FALSE,st-t
abnormality,,,2,upsloping,,,0\n395,48,Female,Hungary,atypical
angina,120,,TRUE,st-t
abnormality,148,FALSE,0,,,,0\n396,48,Female,Hungary,atypical
angina,120,284,FALSE,normal,120,FALSE,0,,,,0\n397,48,Female,Hungary,non-anginal,
120,195,FALSE,normal,125,FALSE,0,,,,0\n398,48,Female,Hungary,asymptomatic,108,16
3,FALSE,normal,175,FALSE,2,upsloping,,,0\n399,48,Female,Hungary,asymptomatic,120
,254,FALSE,st-t abnormality,110,FALSE,0,,,,0\n400,48,Female,Hungary,asymptomatic
,150,227,FALSE,normal,130,TRUE,1,flat,,,0\n401,48,Male,Hungary,atypical
angina,100,,FALSE,normal,100,FALSE,0,,,,0\n402,48,Male,Hungary,atypical
angina,130,245,FALSE,normal,160,FALSE,0,,,,0\n403,48,Male,Hungary,atypical
angina,140,238,FALSE,normal,118,FALSE,0,,,,0\n404,48,Male,Hungary,non-
anginal,110,211,FALSE,normal,138,FALSE,0,,,fixed
defect,0\n405,49,Female,Hungary,atypical
angina,110,,FALSE,normal,160,FALSE,0,,,,0\n406,49,Female,Hungary,atypical
angina,110,,FALSE,normal,160,FALSE,0,,,,0\n407,49,Female,Hungary,atypical
angina,124,201,FALSE,normal,164,FALSE,0,,,,0\n408,49,Female,Hungary,non-
anginal,130,207,FALSE,st-t
abnormality,135,FALSE,0,,,,0\n409,49,Male,Hungary,atypical
angina,100,253,FALSE,normal,174,FALSE,0,,,,0\n410,49,Male,Hungary,non-anginal,14
0,187,FALSE,normal,172,FALSE,0,,,,0\n411,49,Male,Hungary,asymptomatic,120,297,,n
ormal,132,FALSE,1,flat,,,0\n412,49,Male,Hungary,asymptomatic,140,,FALSE,normal,1
30,FALSE,0,,,,0\n413,50,Female,Hungary,atypical angina,110,202,FALSE,normal,145,
FALSE,0,,,,0\n414,50,Female,Hungary,asymptomatic,120,328,FALSE,normal,110,TRUE,1
,flat,,,0\n415,50,Male,Hungary,atypical
angina,120,168,FALSE,normal,160,FALSE,0,,0,,0\n416,50,Male,Hungary,atypical

```
angina,140,216,FALSE,normal,170,FALSE,0,,,normal,0\n417,50,Male,Hungary,atypical
angina,170,209,FALSE,st-t abnormality,116,FALSE,0,,,,0\n418,50,Male,Hungary,asym
ptomatic,140,129,FALSE,normal,135,FALSE,0,,,,0\n419,50,Male,Hungary,asymptomatic
,150,215,FALSE,normal,140,TRUE,0,,,,0\n420,51,Female,Hungary,atypical
angina,160,194,FALSE,normal,170,FALSE,0,,,,0\n421,51,Female,Hungary,non-
anginal,110,190,FALSE,normal,120,FALSE,0,,,,0\n422,51,Female,Hungary,non-anginal
,130,220,FALSE,normal,160,TRUE,2,upsloping,,,0\n423,51,Female,Hungary,non-angina
l,150,200,FALSE,normal,120,FALSE,0.5,upsloping,,,0\n424,51,Male,Hungary,atypical
angina,125,188,FALSE,normal,145,FALSE,0,,,,0\n425,51,Male,Hungary,atypical angin
a,130,224,FALSE,normal,150,FALSE,0,,,,0\n426,51,Male,Hungary,asymptomatic,130,17
9,FALSE,normal,100,FALSE,0,,,reversable defect,0\n427,52,Female,Hungary,atypical
angina,120,210,FALSE,normal,148,FALSE,0,,,,0\n428,52,Female,Hungary,atypical
angina,140,,FALSE,normal,140,FALSE,0,,,,0\n429,52,Female,Hungary,non-anginal,125
,272,FALSE,normal,139,FALSE,0,,,,0\n430,52,Female,Hungary,asymptomatic,130,180,F
ALSE,normal,140,TRUE,1.5,flat,,,0\n431,52,Male,Hungary,atypical
angina,120,284,FALSE,normal,118,FALSE,0,,,,0\n432,52,Male,Hungary,atypical
angina,140,100,FALSE,normal,138,TRUE,0,,,,0\n433,52,Male,Hungary,atypical
angina,160,196,FALSE,normal,165,FALSE,0,,,,0\n434,52,Male,Hungary,non-
anginal,140,259,FALSE,st-t
abnormality,170,FALSE,0,,,,0\n435,53,Female,Hungary,atypical
angina,113,468,,normal,127,FALSE,0,,,,0\n436,53,Female,Hungary,atypical
angina,140,216,FALSE,normal,142,TRUE,2,flat,,,0\n437,53,Female,Hungary,non-
anginal,120,274,FALSE,normal,130,FALSE,0,,,,0\n438,53,Male,Hungary,atypical
angina,120,,FALSE,normal,132,FALSE,0,,,,0\n439,53,Male,Hungary,atypical
angina,140,320,FALSE,normal,162,FALSE,0,,,,0\n440,53,Male,Hungary,non-anginal,12
0,195,FALSE,normal,140,FALSE,0,,,,0\n441,53,Male,Hungary,asymptomatic,124,260,FA
LSE,st-t abnormality,112,TRUE,3,flat,,,0\n442,53,Male,Hungary,asymptomatic,130,1
82,FALSE,normal,148,FALSE,0,,,,0\n443,53,Male,Hungary,asymptomatic,140,243,FALSE
,normal,155,FALSE,0,,,,0\n444,54,Female,Hungary,atypical angina,120,221,FALSE,no
rmal,138,FALSE,1,upsloping,,,0\n445,54,Female,Hungary,atypical
angina,120,230,TRUE,normal,140,FALSE,0,,,,0\n446,54,Female,Hungary,atypical angi
na,120,273,FALSE,normal,150,FALSE,1.5,flat,,,0\n447,54,Female,Hungary,atypical
angina,130,253,FALSE,st-t
abnormality,155,FALSE,0,,,,0\n448,54,Female,Hungary,atypical
angina,140,309,,st-t
abnormality,140,FALSE,0,,,,0\n449,54,Female,Hungary,atypical
angina,150,230,FALSE,normal,130,FALSE,0,,,,0\n450,54,Female,Hungary,atypical
angina,160,312,FALSE,normal,130,FALSE,0,,,,0\n451,54,Male,Hungary,typical angina
,120,171,FALSE,normal,137,FALSE,2,upsloping,,,0\n452,54,Male,Hungary,atypical
angina,110,208,FALSE,normal,142,FALSE,0,,,,0\n453,54,Male,Hungary,atypical
angina,120,238,FALSE,normal,154,FALSE,0,,,,0\n454,54,Male,Hungary,atypical
angina,120,246,FALSE,normal,110,FALSE,0,,,,0\n455,54,Male,Hungary,atypical
angina,160,195,FALSE,st-t
abnormality,130,FALSE,1,upsloping,,,0\n456,54,Male,Hungary,atypical
angina,160,305,FALSE,normal,175,FALSE,0,,,,0\n457,54,Male,Hungary,non-
anginal,120,217,FALSE,normal,137,FALSE,0,,,,0\n458,54,Male,Hungary,non-anginal,1
50,,FALSE,normal,122,FALSE,0,,,,0\n459,54,Male,Hungary,asymptomatic,150,365,FALS
```

```
E,st-t abnormality,134,FALSE,1,upsloping,,,0\n460,55,Female,Hungary,atypical
angina,110,344,FALSE,st-t
abnormality,160,FALSE,0,,,,0\n461,55,Female,Hungary,atypical
angina,122,320,FALSE,normal,155,FALSE,0,,,,0\n462,55,Female,Hungary,atypical
angina,130,394,FALSE,lv
hypertrophy,150,FALSE,0,,,,0\n463,55,Male,Hungary,atypical
angina,120,256,TRUE,normal,137,FALSE,0,,,reversable
defect,0\n464,55,Male,Hungary,atypical
angina,140,196,FALSE,normal,150,FALSE,0,,,reversable
defect,0\n465,55,Male,Hungary,atypical
angina,145,326,FALSE,normal,155,FALSE,0,,,,0\n466,55,Male,Hungary,non-
anginal,110,277,FALSE,normal,160,FALSE,0,,,,0\n467,55,Male,Hungary,non-
anginal,120,220,FALSE,lv hypertrophy,134,FALSE,0,,,,0\n468,55,Male,Hungary,asymp
tomatic,120,270,FALSE,normal,140,FALSE,0,,,,0\n469,55,Male,Hungary,asymptomatic,
140,229,FALSE,normal,110,TRUE,0.5,flat,,,0\n470,56,Female,Hungary,non-
anginal,130,219,,st-t abnormality,164,FALSE,0,,,reversable
defect,0\n471,56,Male,Hungary,atypical
angina,130,184,FALSE,normal,100,FALSE,0,,,,0\n472,56,Male,Hungary,non-
anginal,130,,FALSE,normal,114,FALSE,0,,,,0\n473,56,Male,Hungary,non-
anginal,130,276,FALSE,normal,128,TRUE,1,upsloping,,fixed defect,0\n474,56,Male,H
ungary,asymptomatic,120,85,FALSE,normal,140,FALSE,0,,,,0\n475,57,Female,Hungary,
typical angina,130,308,FALSE,normal,98,FALSE,1,flat,,,0\n476,57,Female,Hungary,a
symptomatic,180,347,FALSE,st-t
abnormality,126,TRUE,0.8,flat,,,0\n477,57,Male,Hungary,atypical
angina,140,260,TRUE,normal,140,FALSE,0,,,fixed
defect,0\n478,58,Male,Hungary,atypical
angina,130,230,FALSE,normal,150,FALSE,0,,,,0\n479,58,Male,Hungary,atypical
angina,130,251,FALSE,normal,110,FALSE,0,,,,0\n480,58,Male,Hungary,non-anginal,14
0,179,FALSE,normal,160,FALSE,0,,,,0\n481,58,Male,Hungary,asymptomatic,135,222,FA
LSE,normal,100,FALSE,0,,,,0\n482,59,Female,Hungary,atypical
angina,130,188,FALSE,normal,124,FALSE,1,flat,,,0\n483,59,Male,Hungary,atypical
angina,140,287,FALSE,normal,150,FALSE,0,,,,0\n484,59,Male,Hungary,non-
anginal,130,318,FALSE,normal,120,TRUE,1,flat,,normal,0\n485,59,Male,Hungary,non-
anginal,180,213,FALSE,normal,100,FALSE,0,,,,0\n486,59,Male,Hungary,asymptomatic,
140,,FALSE,normal,140,FALSE,0,,0,,0\n487,60,Male,Hungary,non-
anginal,120,246,FALSE,lv hypertrophy,135,FALSE,0,,,,0\n488,61,Female,Hungary,asy
mptomatic,130,294,FALSE,st-t abnormality,120,TRUE,1,flat,,,0\n489,61,Male,Hungar
y,asymptomatic,125,292,FALSE,st-t
abnormality,115,TRUE,0,,,,0\n490,62,Female,Hungary,typical
angina,160,193,FALSE,normal,116,FALSE,0,,,,0\n491,62,Male,Hungary,atypical angin
a,140,271,FALSE,normal,152,FALSE,1,upsloping,,,0\n492,31,Male,Hungary,asymptomat
ic,120,270,FALSE,normal,153,TRUE,1.5,flat,,,1\n493,33,Female,Hungary,asymptomati
c,100,246,FALSE,normal,150,TRUE,1,flat,,,1\n494,34,Male,Hungary,typical
angina,140,156,FALSE,normal,180,FALSE,0,,,,1\n495,35,Male,Hungary,atypical
angina,110,257,FALSE,normal,140,FALSE,0,,,,1\n496,36,Male,Hungary,atypical angin
a,120,267,FALSE,normal,160,FALSE,3,flat,,,1\n497,37,Male,Hungary,asymptomatic,14
0,207,FALSE,normal,130,TRUE,1.5,flat,,,1\n498,38,Male,Hungary,asymptomatic,110,1
```

96,FALSE,normal,166,FALSE,0,,,,1\n499,38,Male,Hungary,asymptomatic,120,282,FALSE
,normal,170,FALSE,0,,,,1\n500,38,Male,Hungary,asymptomatic,92,117,FALSE,normal,1
34,TRUE,2.5,flat,,,1\n501,40,Male,Hungary,asymptomatic,120,466,,normal,152,TRUE,
1,flat,,fixed defect,1\n502,41,Male,Hungary,asymptomatic,110,289,FALSE,normal,17
0,FALSE,0,,,fixed defect,1\n503,41,Male,Hungary,asymptomatic,120,237,,normal,138
,TRUE,1,flat,,,1\n504,43,Male,Hungary,asymptomatic,150,247,FALSE,normal,130,TRUE
,2,flat,,,1\n505,46,Male,Hungary,asymptomatic,110,202,FALSE,normal,150,TRUE,0,,,
,1\n506,46,Male,Hungary,asymptomatic,118,186,FALSE,normal,124,FALSE,0,,,reversab
le defect,1\n507,46,Male,Hungary,asymptomatic,120,277,FALSE,normal,125,TRUE,1,fl
at,,,1\n508,47,Male,Hungary,non-anginal,140,193,FALSE,normal,145,TRUE,1,flat,,,1
\n509,47,Male,Hungary,asymptomatic,150,226,FALSE,normal,98,TRUE,1.5,flat,0,rever
sable defect,1\n510,48,Male,Hungary,asymptomatic,106,263,TRUE,normal,110,FALSE,0
,,,,1\n511,48,Male,Hungary,asymptomatic,120,260,FALSE,normal,115,FALSE,2,flat,,,
1\n512,48,Male,Hungary,asymptomatic,160,268,FALSE,normal,103,TRUE,1,flat,,,1\n51
3,49,Female,Hungary,non-
anginal,160,180,FALSE,normal,156,FALSE,1,flat,,,1\n514,49,Male,Hungary,non-angin
al,115,265,FALSE,normal,175,FALSE,0,,,,1\n515,49,Male,Hungary,asymptomatic,130,2
06,FALSE,normal,170,FALSE,0,,,,1\n516,50,Female,Hungary,non-
anginal,140,288,FALSE,normal,140,TRUE,0,,,reversable defect,1\n517,50,Male,Hunga
ry,asymptomatic,145,264,FALSE,normal,150,FALSE,0,,,,1\n518,51,Female,Hungary,asy
mptomatic,160,303,FALSE,normal,150,TRUE,1,flat,,,1\n519,52,Male,Hungary,asymptom
atic,130,225,FALSE,normal,120,TRUE,2,flat,,,1\n520,54,Male,Hungary,asymptomatic,
125,216,FALSE,normal,140,FALSE,0,,,,1\n521,54,Male,Hungary,asymptomatic,125,224,
FALSE,normal,122,FALSE,2,flat,,,1\n522,55,Male,Hungary,asymptomatic,140,201,FALS
E,normal,130,TRUE,3,flat,,,1\n523,57,Male,Hungary,atypical
angina,140,265,FALSE,st-t
abnormality,145,TRUE,1,flat,,,1\n524,58,Male,Hungary,non-
anginal,130,213,FALSE,st-t abnormality,140,FALSE,0,,,fixed
defect,1\n525,59,Female,Hungary,asymptomatic,130,338,TRUE,st-t abnormality,130,T
RUE,1.5,flat,,,1\n526,60,Male,Hungary,asymptomatic,100,248,FALSE,normal,125,FALS
E,1,flat,,,1\n527,63,Male,Hungary,asymptomatic,150,223,FALSE,normal,115,FALSE,0,
,,,1\n528,65,Male,Hungary,asymptomatic,140,306,TRUE,normal,87,TRUE,1.5,flat,,,1\
n529,32,Male,Hungary,asymptomatic,118,529,FALSE,normal,130,FALSE,0,,,,1\n530,38,
Male,Hungary,asymptomatic,110,,FALSE,normal,150,TRUE,1,flat,,,1\n531,39,Male,Hun
gary,asymptomatic,110,280,FALSE,normal,150,FALSE,0,,,fixed defect,1\n532,40,Fema
le,Hungary,asymptomatic,150,392,FALSE,normal,130,FALSE,2,flat,,fixed
defect,1\n533,43,Male,Hungary,typical angina,120,291,FALSE,st-t abnormality,155,
FALSE,0,,,,1\n534,45,Male,Hungary,asymptomatic,130,219,FALSE,st-t abnormality,13
0,TRUE,1,flat,,,1\n535,46,Male,Hungary,asymptomatic,120,231,FALSE,normal,115,TRU
E,0,,,,1\n536,46,Male,Hungary,asymptomatic,130,222,FALSE,normal,112,FALSE,0,,,,1
\n537,48,Male,Hungary,asymptomatic,122,275,TRUE,st-t abnormality,150,TRUE,2,down
sloping,,,1\n538,48,Male,Hungary,asymptomatic,160,193,FALSE,normal,102,TRUE,3,fl
at,,,1\n539,48,Male,Hungary,asymptomatic,160,329,FALSE,normal,92,TRUE,1.5,flat,,
,1\n540,48,Male,Hungary,asymptomatic,160,355,FALSE,normal,99,TRUE,2,flat,,,1\n54
1,50,Male,Hungary,asymptomatic,130,233,FALSE,normal,121,TRUE,2,flat,,reversable
defect,1\n542,52,Male,Hungary,asymptomatic,120,182,FALSE,normal,150,FALSE,0,,,,1
\n543,52,Male,Hungary,asymptomatic,170,,FALSE,normal,126,TRUE,1.5,flat,,,1\n544,

53,Male,Hungary,asymptomatic,120,246,FALSE,normal,116,TRUE,0,,,,1\n545,54,Male,H
ungary,non-anginal,120,237,FALSE,normal,150,TRUE,1.5,,,reversable defect,1\n546,
54,Male,Hungary,asymptomatic,130,242,FALSE,normal,91,TRUE,1,flat,,,1\n547,54,Mal
e,Hungary,asymptomatic,130,603,TRUE,normal,125,TRUE,1,flat,,,1\n548,54,Male,Hung
ary,asymptomatic,140,,FALSE,normal,118,TRUE,0,,,,1\n549,54,Male,Hungary,asymptom
atic,200,198,FALSE,normal,142,TRUE,2,flat,,,1\n550,55,Male,Hungary,asymptomatic,
140,268,FALSE,normal,128,TRUE,1.5,flat,,,1\n551,56,Male,Hungary,asymptomatic,150
,213,TRUE,normal,125,TRUE,1,flat,,,1\n552,57,Male,Hungary,asymptomatic,150,255,F
ALSE,normal,92,TRUE,3,flat,,,1\n553,58,Male,Hungary,non-
anginal,160,211,TRUE,st-t abnormality,92,FALSE,0,,,,1\n554,58,Male,Hungary,asymp
tomatic,130,263,FALSE,normal,140,TRUE,2,flat,,,1\n555,41,Male,Hungary,asymptomat
ic,130,172,FALSE,st-t abnormality,130,FALSE,2,flat,,,1\n556,43,Male,Hungary,asym
ptomatic,120,175,FALSE,normal,120,TRUE,1,flat,,reversable
defect,1\n557,44,Male,Hungary,atypical angina,150,288,FALSE,normal,150,TRUE,3,fl
at,,,1\n558,44,Male,Hungary,asymptomatic,130,290,FALSE,normal,100,TRUE,2,flat,,,
1\n559,46,Male,Hungary,typical
angina,140,272,TRUE,normal,175,FALSE,2,flat,,,1\n560,47,Female,Hungary,non-angin
al,135,248,TRUE,normal,170,FALSE,0,,,,1\n561,48,Female,Hungary,asymptomatic,138,
214,FALSE,normal,108,TRUE,1.5,flat,,,1\n562,49,Male,Hungary,asymptomatic,130,341
,FALSE,normal,120,TRUE,1,flat,,,1\n563,49,Male,Hungary,asymptomatic,140,234,FALS
E,normal,140,TRUE,1,flat,,,1\n564,51,Male,Hungary,non-anginal,135,160,FALSE,norm
al,150,FALSE,2,flat,,,1\n565,52,Male,Hungary,asymptomatic,112,342,FALSE,st-t abn
ormality,96,TRUE,1,flat,,,1\n566,52,Male,Hungary,asymptomatic,130,298,FALSE,norm
al,110,TRUE,1,flat,,,1\n567,52,Male,Hungary,asymptomatic,140,404,FALSE,normal,12
4,TRUE,2,flat,,,1\n568,52,Male,Hungary,asymptomatic,160,246,FALSE,st-t
abnormality,82,TRUE,4,flat,,,1\n569,53,Male,Hungary,non-anginal,145,518,FALSE,no
rmal,130,FALSE,0,,,,1\n570,53,Male,Hungary,asymptomatic,180,285,FALSE,st-t abnor
mality,120,TRUE,1.5,flat,,,1\n571,54,Male,Hungary,asymptomatic,140,216,FALSE,nor
mal,105,FALSE,1.5,flat,,,1\n572,55,Male,Hungary,typical
angina,140,295,FALSE,,136,FALSE,0,,,,1\n573,55,Male,Hungary,atypical angina,160,
292,TRUE,normal,143,TRUE,2,flat,,,1\n574,55,Male,Hungary,asymptomatic,145,248,FA
LSE,normal,96,TRUE,2,flat,,,1\n575,56,Female,Hungary,atypical angina,120,279,FAL
SE,normal,150,FALSE,1,flat,,,1\n576,56,Male,Hungary,asymptomatic,150,230,FALSE,s
t-t abnormality,124,TRUE,1.5,flat,,,1\n577,56,Male,Hungary,asymptomatic,170,388,
FALSE,st-t abnormality,122,TRUE,2,flat,,,1\n578,58,Male,Hungary,atypical
angina,136,164,FALSE,st-t abnormality,99,TRUE,2,flat,,,1\n579,59,Male,Hungary,as
ymptomatic,130,,FALSE,normal,125,FALSE,0,,,,1\n580,59,Male,Hungary,asymptomatic,
140,264,TRUE,lv hypertrophy,119,TRUE,0,,,,1\n581,65,Male,Hungary,asymptomatic,17
0,263,TRUE,normal,112,TRUE,2,flat,,,1\n582,66,Male,Hungary,asymptomatic,140,,FAL
SE,normal,94,TRUE,1,flat,,,1\n583,41,Male,Hungary,asymptomatic,120,336,FALSE,nor
mal,118,TRUE,3,flat,,,1\n584,43,Male,Hungary,asymptomatic,140,288,FALSE,normal,1
35,TRUE,2,flat,,,1\n585,44,Male,Hungary,asymptomatic,135,491,FALSE,normal,135,FA
LSE,0,,,,1\n586,47,Female,Hungary,asymptomatic,120,205,FALSE,normal,98,TRUE,2,fl
at,,fixed defect,1\n587,47,Male,Hungary,asymptomatic,160,291,FALSE,st-t abnormal
ity,158,TRUE,3,flat,,,1\n588,49,Male,Hungary,asymptomatic,128,212,FALSE,normal,9
6,TRUE,0,,,,1\n589,49,Male,Hungary,asymptomatic,150,222,FALSE,normal,122,FALSE,2
,flat,,,1\n590,50,Male,Hungary,asymptomatic,140,231,FALSE,st-t abnormality,140,T

RUE,5,flat,,,1\n591,50,Male,Hungary,asymptomatic,140,341,FALSE,st-t abnormality,
125,TRUE,2.5,flat,,,1\n592,52,Male,Hungary,asymptomatic,140,266,FALSE,normal,134
,TRUE,2,flat,,,1\n593,52,Male,Hungary,asymptomatic,160,331,FALSE,normal,94,TRUE,
2.5,,,,1\n594,54,Female,Hungary,non-anginal,130,294,FALSE,st-t abnormality,100,T
RUE,0,flat,,,1\n595,56,Male,Hungary,asymptomatic,155,342,TRUE,normal,150,TRUE,3,
flat,,,1\n596,58,Female,Hungary,atypical
angina,180,393,FALSE,normal,110,TRUE,1,flat,,reversable
defect,1\n597,65,Male,Hungary,asymptomatic,130,275,FALSE,st-t
abnormality,115,TRUE,1,flat,,,1\n598,32,Male,Switzerland,typical angina,95,0,,no
rmal,127,FALSE,0.7,upsloping,,,1\n599,34,Male,Switzerland,asymptomatic,115,0,,,1
54,FALSE,0.2,upsloping,,,1\n600,35,Male,Switzerland,asymptomatic,,0,,normal,130,
TRUE,,,,reversable defect,3\n601,36,Male,Switzerland,asymptomatic,110,0,,normal,
125,TRUE,1,flat,,fixed defect,1\n602,38,Female,Switzerland,asymptomatic,105,0,,n
ormal,166,FALSE,2.8,upsloping,,,2\n603,38,Female,Switzerland,asymptomatic,110,0,
FALSE,normal,156,FALSE,0,flat,,normal,1\n604,38,Male,Switzerland,non-
anginal,100,0,,normal,179,FALSE,-1.1,upsloping,,,0\n605,38,Male,Switzerland,non-
anginal,115,0,FALSE,normal,128,TRUE,0,flat,,reversable defect,1\n606,38,Male,Swi
tzerland,asymptomatic,135,0,,normal,150,FALSE,0,,,normal,2\n607,38,Male,Switzerl
and,asymptomatic,150,0,,normal,120,TRUE,,,,normal,1\n608,40,Male,Switzerland,asy
mptomatic,95,0,,st-t abnormality,144,FALSE,0,upsloping,,,2\n609,41,Male,Switzerl
and,asymptomatic,125,0,,normal,176,FALSE,1.6,upsloping,,,2\n610,42,Male,Switzerl
and,asymptomatic,105,0,,normal,128,TRUE,-1.5,downsloping,,,1\n611,42,Male,Switze
rland,asymptomatic,145,0,FALSE,normal,99,TRUE,0,flat,,,2\n612,43,Male,Switzerlan
d,asymptomatic,100,0,,normal,122,FALSE,1.5,downsloping,,,3\n613,43,Male,Switzerl
and,asymptomatic,115,0,FALSE,normal,145,TRUE,2,flat,,reversable
defect,4\n614,43,Male,Switzerland,asymptomatic,140,0,FALSE,st-t
abnormality,140,TRUE,0.5,upsloping,,reversable
defect,2\n615,45,Male,Switzerland,non-anginal,110,0,,normal,138,FALSE,-0.1,upslo
ping,,,0\n616,46,Male,Switzerland,asymptomatic,100,0,,st-t abnormality,133,FALSE
,-2.6,flat,,,1\n617,46,Male,Switzerland,asymptomatic,115,0,FALSE,normal,113,TRUE
,1.5,flat,,reversable defect,1\n618,47,Male,Switzerland,non-
anginal,110,0,,normal,120,TRUE,0,,,normal,1\n619,47,Male,Switzerland,non-anginal
,155,0,FALSE,normal,118,TRUE,1,flat,,normal,3\n620,47,Male,Switzerland,asymptoma
tic,110,0,,st-t abnormality,149,FALSE,2.1,upsloping,,,2\n621,47,Male,Switzerland
,asymptomatic,160,0,FALSE,normal,124,TRUE,0,flat,,reversable defect,1\n622,48,Ma
le,Switzerland,asymptomatic,115,0,,normal,128,FALSE,0,flat,,fixed defect,2\n623,
50,Female,Switzerland,asymptomatic,160,0,,normal,110,FALSE,0,,,normal,1\n624,50,
Male,Switzerland,asymptomatic,115,0,FALSE,normal,120,TRUE,0.5,flat,,fixed
defect,3\n625,50,Male,Switzerland,asymptomatic,120,0,FALSE,st-t
abnormality,156,TRUE,0,upsloping,,fixed defect,3\n626,50,Male,Switzerland,asympt
omatic,145,0,,normal,139,TRUE,0.7,flat,,,1\n627,51,Female,Switzerland,asymptomat
ic,120,0,,normal,127,TRUE,1.5,upsloping,,,2\n628,51,Male,Switzerland,asymptomati
c,110,0,,normal,92,FALSE,0,flat,,,4\n629,51,Male,Switzerland,asymptomatic,120,0,
TRUE,normal,104,FALSE,0,flat,,normal,3\n630,51,Male,Switzerland,asymptomatic,130
,0,,normal,170,FALSE,-0.7,upsloping,,,2\n631,51,Male,Switzerland,asymptomatic,13
0,0,,st-t abnormality,163,FALSE,0,,,reversable defect,1\n632,51,Male,Switzerland
,asymptomatic,140,0,FALSE,normal,60,FALSE,0,flat,,normal,2\n633,51,Male,Switzerl

```
and,asymptomatic,95,0,,normal,126,FALSE,2.2,flat,,,2\n634,52,Male,Switzerland,as
ymptomatic,130,0,,normal,120,FALSE,0,flat,,reversable defect,2\n635,52,Male,Swit
zerland,asymptomatic,135,0,,normal,128,TRUE,2,flat,,reversable defect,2\n636,52,
Male,Switzerland,asymptomatic,165,0,,normal,122,TRUE,1,upsloping,,reversable def
ect,2\n637,52,Male,Switzerland,asymptomatic,95,0,,normal,82,TRUE,,,,,2\n638,53,M
ale,Switzerland,atypical angina,120,0,FALSE,normal,95,FALSE,0,flat,,normal,3\n63
9,53,Male,Switzerland,atypical angina,130,0,,st-t
abnormality,120,FALSE,0.7,downsloping,,,0\n640,53,Male,Switzerland,non-
anginal,105,0,FALSE,normal,115,FALSE,0,flat,,reversable
defect,1\n641,53,Male,Switzerland,non-anginal,160,0,,lv
hypertrophy,122,TRUE,0,,,reversable defect,1\n642,53,Male,Switzerland,asymptomat
ic,120,0,,normal,120,FALSE,0,flat,,reversable defect,1\n643,53,Male,Switzerland,
asymptomatic,125,0,,normal,120,FALSE,1.5,upsloping,,,4\n644,53,Male,Switzerland,
asymptomatic,130,0,FALSE,lv hypertrophy,135,TRUE,1,flat,,reversable defect,2\n64
5,53,Male,Switzerland,asymptomatic,80,0,,normal,141,TRUE,2,downsloping,,,0\n646,
54,Male,Switzerland,asymptomatic,120,0,FALSE,normal,155,FALSE,0,flat,,reversable
defect,2\n647,54,Male,Switzerland,asymptomatic,130,0,,normal,110,TRUE,3,flat,,re
versable defect,3\n648,54,Male,Switzerland,asymptomatic,180,0,,normal,150,FALSE,
1.5,flat,,reversable defect,1\n649,55,Male,Switzerland,atypical
angina,140,0,,st-t abnormality,150,FALSE,0.2,upsloping,,,0\n650,55,Male,Switzerl
and,asymptomatic,115,0,,normal,155,FALSE,0.1,flat,,,1\n651,55,Male,Switzerland,a
symptomatic,120,0,FALSE,st-t abnormality,92,FALSE,0.3,upsloping,,reversable defe
ct,4\n652,55,Male,Switzerland,asymptomatic,140,0,FALSE,normal,83,FALSE,0,flat,,r
eversable defect,2\n653,56,Male,Switzerland,non-
anginal,120,0,FALSE,normal,97,FALSE,0,flat,,reversable
defect,0\n654,56,Male,Switzerland,non-
anginal,125,0,,normal,98,FALSE,-2,flat,,reversable
defect,2\n655,56,Male,Switzerland,non-anginal,155,0,FALSE,st-t abnormality,99,FA
LSE,0,flat,,normal,2\n656,56,Male,Switzerland,asymptomatic,115,0,,st-t abnormali
ty,82,FALSE,-1,upsloping,,,1\n657,56,Male,Switzerland,asymptomatic,120,0,FALSE,s
t-t abnormality,100,TRUE,-1,downsloping,,reversable
defect,2\n658,56,Male,Switzerland,asymptomatic,120,0,FALSE,st-t abnormality,148,
FALSE,0,flat,,,2\n659,56,Male,Switzerland,asymptomatic,125,0,TRUE,normal,103,TRU
E,1,flat,,reversable defect,3\n660,56,Male,Switzerland,asymptomatic,140,0,,norma
l,121,TRUE,1.8,upsloping,,,1\n661,57,Male,Switzerland,non-anginal,105,0,,normal,
148,FALSE,0.3,flat,,,1\n662,57,Male,Switzerland,asymptomatic,110,0,,st-t abnorma
lity,131,TRUE,1.4,upsloping,1,,3\n663,57,Male,Switzerland,asymptomatic,140,0,FAL
SE,normal,120,TRUE,2,flat,,fixed
defect,2\n664,57,Male,Switzerland,asymptomatic,140,0,,normal,100,TRUE,0,,,fixed
defect,3\n665,57,Male,Switzerland,asymptomatic,160,0,,normal,98,TRUE,2,flat,,rev
ersable defect,2\n666,57,Male,Switzerland,asymptomatic,95,0,,normal,182,FALSE,0.
7,downsloping,,,1\n667,58,Male,Switzerland,asymptomatic,115,0,,normal,138,FALSE,
0.5,upsloping,,,1\n668,58,Male,Switzerland,asymptomatic,130,0,FALSE,st-t
abnormality,100,TRUE,1,flat,,fixed
defect,4\n669,58,Male,Switzerland,asymptomatic,170,0,,st-t
abnormality,105,TRUE,0,,,normal,1\n670,59,Male,Switzerland,non-anginal,125,0,,no
rmal,175,FALSE,2.6,flat,,,1\n671,59,Male,Switzerland,asymptomatic,110,0,,normal,
```

94,FALSE,0,,,fixed defect,3\n672,59,Male,Switzerland,asymptomatic,120,0,FALSE,no
rmal,115,FALSE,0,flat,,normal,2\n673,59,Male,Switzerland,asymptomatic,125,0,,nor
mal,119,TRUE,0.9,upsloping,,,1\n674,59,Male,Switzerland,asymptomatic,135,0,FALSE
,normal,115,TRUE,1,flat,,reversable defect,1\n675,60,Male,Switzerland,non-angina
l,115,0,,normal,143,FALSE,2.4,upsloping,,,1\n676,60,Male,Switzerland,asymptomati
c,125,0,,normal,110,FALSE,0.1,upsloping,2,,3\n677,60,Male,Switzerland,asymptomat
ic,130,0,,st-t abnormality,130,TRUE,1.1,downsloping,1,,1\n678,60,Male,Switzerlan
d,asymptomatic,135,0,FALSE,normal,63,TRUE,0.5,upsloping,,reversable
defect,3\n679,60,Male,Switzerland,asymptomatic,160,0,FALSE,st-t
abnormality,99,TRUE,0.5,flat,,reversable defect,3\n680,60,Male,Switzerland,asymp
tomatic,160,0,,normal,149,FALSE,0.4,flat,,,1\n681,61,Male,Switzerland,non-
anginal,200,0,,st-t abnormality,70,FALSE,0,,,normal,3\n682,61,Male,Switzerland,a
symptomatic,105,0,,normal,110,TRUE,1.5,upsloping,,,1\n683,61,Male,Switzerland,as
ymptomatic,110,0,,normal,113,FALSE,1.4,flat,,,1\n684,61,Male,Switzerland,asympto
matic,125,0,FALSE,normal,105,TRUE,0,downsloping,,reversable
defect,3\n685,61,Male,Switzerland,asymptomatic,130,0,FALSE,lv
hypertrophy,115,FALSE,0,flat,,reversable defect,3\n686,61,Male,Switzerland,asymp
tomatic,130,0,,normal,77,FALSE,2.5,flat,,,3\n687,61,Male,Switzerland,asymptomati
c,150,0,FALSE,normal,105,TRUE,0,flat,,reversable defect,1\n688,61,Male,Switzerla
nd,asymptomatic,150,0,FALSE,normal,117,TRUE,2,flat,,reversable
defect,2\n689,61,Male,Switzerland,asymptomatic,160,0,TRUE,st-t
abnormality,145,FALSE,1,flat,,reversable
defect,2\n690,62,Female,Switzerland,typical angina,140,0,,normal,143,FALSE,0,,,n
ormal,2\n691,62,Female,Switzerland,asymptomatic,120,0,,st-t
abnormality,123,TRUE,1.7,downsloping,,,1\n692,62,Male,Switzerland,typical
angina,120,0,,lv
hypertrophy,134,FALSE,-0.8,flat,2,,1\n693,62,Male,Switzerland,non-anginal,160,0,
FALSE,normal,72,TRUE,0,flat,,normal,3\n694,62,Male,Switzerland,asymptomatic,115,
0,,normal,128,TRUE,2.5,downsloping,,,2\n695,62,Male,Switzerland,asymptomatic,115
,0,,normal,72,TRUE,-0.5,flat,,normal,1\n696,62,Male,Switzerland,asymptomatic,150
,0,,st-t abnormality,78,FALSE,2,flat,,reversable defect,3\n697,63,Male,Switzerla
nd,asymptomatic,100,0,,normal,109,FALSE,-0.9,flat,,,1\n698,63,Male,Switzerland,a
symptomatic,140,0,,lv hypertrophy,149,FALSE,2,upsloping,,,2\n699,63,Male,Switzer
land,asymptomatic,150,0,FALSE,normal,86,TRUE,2,flat,,,3\n700,63,Male,Switzerland
,asymptomatic,150,0,,st-t abnormality,154,FALSE,3.7,upsloping,,,3\n701,63,Male,S
witzerland,asymptomatic,185,0,FALSE,normal,98,TRUE,0,upsloping,,reversable defec
t,1\n702,64,Female,Switzerland,asymptomatic,200,0,FALSE,normal,140,TRUE,1,flat,,
normal,3\n703,64,Female,Switzerland,asymptomatic,95,0,,normal,145,FALSE,1.1,down
sloping,,,1\n704,64,Male,Switzerland,asymptomatic,110,0,,normal,114,TRUE,1.3,dow
nsloping,,,1\n705,65,Male,Switzerland,asymptomatic,115,0,FALSE,normal,93,TRUE,0,
flat,,reversable defect,1\n706,65,Male,Switzerland,asymptomatic,145,0,,st-t
abnormality,67,FALSE,,,,fixed defect,3\n707,65,Male,Switzerland,asymptomatic,155
,0,,normal,154,FALSE,1,upsloping,,,0\n708,65,Male,Switzerland,asymptomatic,160,0
,TRUE,st-t abnormality,122,FALSE,,,,reversable defect,3\n709,66,Female,Switzerla
nd,asymptomatic,155,0,,normal,90,FALSE,0,,,reversable defect,1\n710,66,Male,Swit
zerland,asymptomatic,150,0,FALSE,normal,108,TRUE,2,flat,,reversable
defect,3\n711,67,Male,Switzerland,typical angina,145,0,FALSE,lv hypertrophy,125,

FALSE,0,flat,,normal,2\n712,68,Male,Switzerland,asymptomatic,135,0,FALSE,st-t
abnormality,120,TRUE,0,upsloping,,reversable defect,3\n713,68,Male,Switzerland,a
symptomatic,145,0,,normal,136,FALSE,1.8,upsloping,,,1\n714,69,Male,Switzerland,a
symptomatic,135,0,FALSE,normal,130,FALSE,0,flat,,fixed
defect,1\n715,69,Male,Switzerland,asymptomatic,,0,FALSE,st-t
abnormality,,,,,,reversable
defect,3\n716,70,Male,Switzerland,asymptomatic,115,0,FALSE,st-t
abnormality,92,TRUE,0,flat,,reversable defect,1\n717,70,Male,Switzerland,asympto
matic,140,0,TRUE,normal,157,TRUE,2,flat,,reversable
defect,3\n718,72,Male,Switzerland,non-anginal,160,0,,lv
hypertrophy,114,FALSE,1.6,flat,2,,0\n719,73,Female,Switzerland,non-
anginal,160,0,FALSE,st-t
abnormality,121,FALSE,0,upsloping,,normal,1\n720,74,Male,Switzerland,atypical
angina,145,0,,st-t abnormality,123,FALSE,1.3,upsloping,,,1\n721,63,Male,VA Long
Beach,asymptomatic,140,260,FALSE,st-t
abnormality,112,TRUE,3,flat,,,2\n722,44,Male,VA Long
Beach,asymptomatic,130,209,FALSE,st-t
abnormality,127,FALSE,0,,,,0\n723,60,Male,VA Long
Beach,asymptomatic,132,218,FALSE,st-t
abnormality,140,TRUE,1.5,downsloping,,,2\n724,55,Male,VA Long
Beach,asymptomatic,142,228,FALSE,st-t
abnormality,149,TRUE,2.5,upsloping,,,1\n725,66,Male,VA Long Beach,non-
anginal,110,213,TRUE,lv hypertrophy,99,TRUE,1.3,flat,,,0\n726,66,Male,VA Long
Beach,non-anginal,120,0,FALSE,st-t
abnormality,120,FALSE,-0.5,upsloping,,,0\n727,65,Male,VA Long
Beach,asymptomatic,150,236,TRUE,st-t abnormality,105,TRUE,0,,,,3\n728,60,Male,VA
Long Beach,non-anginal,180,0,FALSE,st-t
abnormality,140,TRUE,1.5,flat,,,0\n729,60,Male,VA Long Beach,non-
anginal,120,0,,normal,141,TRUE,2,upsloping,,,3\n730,60,Male,VA Long
Beach,atypical angina,160,267,TRUE,st-t
abnormality,157,FALSE,0.5,flat,,,1\n731,56,Male,VA Long Beach,atypical
angina,126,166,FALSE,st-t abnormality,140,FALSE,0,,,,0\n732,59,Male,VA Long
Beach,asymptomatic,140,0,FALSE,st-t
abnormality,117,TRUE,1,flat,,,1\n733,62,Male,VA Long Beach,asymptomatic,110,0,FA
LSE,normal,120,TRUE,0.5,flat,,normal,1\n734,63,Male,VA Long Beach,non-
anginal,,0,FALSE,lv hypertrophy,,,,,,,1\n735,57,Male,VA Long
Beach,asymptomatic,128,0,TRUE,st-t
abnormality,148,TRUE,1,flat,,,1\n736,62,Male,VA Long
Beach,asymptomatic,120,220,FALSE,st-t
abnormality,86,FALSE,0,,,,0\n737,63,Male,VA Long Beach,asymptomatic,170,177,FALS
E,normal,84,TRUE,2.5,downsloping,,,4\n738,46,Male,VA Long
Beach,asymptomatic,110,236,FALSE,normal,125,TRUE,2,flat,,,1\n739,63,Male,VA Long
Beach,asymptomatic,126,0,FALSE,st-t
abnormality,120,FALSE,1.5,downsloping,,,0\n740,60,Male,VA Long
Beach,asymptomatic,152,0,FALSE,st-t abnormality,118,TRUE,0,,,reversable
defect,0\n741,58,Male,VA Long
Beach,asymptomatic,116,0,FALSE,normal,124,FALSE,1,upsloping,,,2\n742,64,Male,VA

Long Beach,asymptomatic,120,0,TRUE,st-t
abnormality,106,FALSE,2,flat,,,1\n743,63,Male,VA Long Beach,non-
anginal,130,0,FALSE,st-t abnormality,111,TRUE,0,,,,3\n744,74,Male,VA Long
Beach,non-anginal,,0,FALSE,normal,,,,,,,0\n745,52,Male,VA Long Beach,non-
anginal,128,0,FALSE,st-t abnormality,180,FALSE,3,upsloping,,,2\n746,69,Male,VA
Long Beach,asymptomatic,130,0,TRUE,st-t abnormality,129,FALSE,1,flat,,fixed
defect,2\n747,51,Male,VA Long Beach,asymptomatic,,0,TRUE,st-t
abnormality,,,,,,,2\n748,60,Male,VA Long Beach,asymptomatic,130,186,TRUE,st-t
abnormality,140,TRUE,0.5,flat,,,1\n749,56,Male,VA Long
Beach,asymptomatic,120,100,FALSE,normal,120,TRUE,1.5,flat,0,reversable
defect,1\n750,55,Male,VA Long Beach,non-anginal,,228,FALSE,st-t
abnormality,,,,,,,3\n751,54,Male,VA Long Beach,asymptomatic,,0,FALSE,st-t
abnormality,,,,,,,3\n752,77,Male,VA Long Beach,asymptomatic,124,171,FALSE,st-t
abnormality,110,TRUE,2,upsloping,,,3\n753,63,Male,VA Long
Beach,asymptomatic,160,230,TRUE,normal,105,TRUE,1,flat,,,3\n754,55,Male,VA Long
Beach,non-anginal,0,0,FALSE,normal,155,FALSE,1.5,flat,,,3\n755,52,Male,VA Long
Beach,non-anginal,122,0,FALSE,normal,110,TRUE,2,downsloping,,,2\n756,64,Male,VA
Long Beach,asymptomatic,144,0,FALSE,st-t
abnormality,122,TRUE,1,flat,,,3\n757,60,Male,VA Long
Beach,asymptomatic,,281,FALSE,st-t abnormality,,,,,,,2\n758,60,Male,VA Long
Beach,asymptomatic,120,0,FALSE,normal,133,TRUE,2,upsloping,,reversable
defect,0\n759,58,Male,VA Long
Beach,asymptomatic,,203,TRUE,normal,,,,,,,1\n760,59,Male,VA Long
Beach,asymptomatic,154,0,FALSE,st-t
abnormality,131,TRUE,1.5,,0,,0\n761,61,Male,VA Long Beach,non-
anginal,120,0,FALSE,normal,80,TRUE,0,flat,,,3\n762,40,Male,VA Long
Beach,asymptomatic,125,0,TRUE,normal,165,FALSE,0,,,reversable
defect,1\n763,61,Male,VA Long Beach,asymptomatic,,0,TRUE,st-t
abnormality,86,FALSE,1.5,flat,,reversable defect,3\n764,41,Male,VA Long
Beach,asymptomatic,104,0,FALSE,st-t abnormality,111,FALSE,0,,,,0\n765,57,Male,VA
Long Beach,asymptomatic,,277,TRUE,st-t abnormality,,,,,,,4\n766,63,Male,VA Long
Beach,asymptomatic,136,0,FALSE,normal,84,TRUE,0,,,reversable
defect,2\n767,59,Male,VA Long Beach,asymptomatic,122,233,FALSE,normal,117,TRUE,1
.3,downsloping,,,1\n768,51,Male,VA Long
Beach,asymptomatic,128,0,FALSE,normal,107,FALSE,0,,,,0\n769,59,Male,VA Long
Beach,non-anginal,,0,FALSE,normal,128,TRUE,2,downsloping,,,2\n770,42,Male,VA
Long Beach,non-anginal,134,240,,normal,160,FALSE,0,,,,0\n771,55,Male,VA Long
Beach,non-anginal,120,0,FALSE,st-t abnormality,125,TRUE,2.5,flat,,reversable
defect,1\n772,63,Female,VA Long Beach,atypical
angina,,0,FALSE,normal,,,,,,,0\n773,62,Male,VA Long
Beach,asymptomatic,152,153,FALSE,st-t
abnormality,97,TRUE,1.6,upsloping,,reversable defect,2\n774,56,Male,VA Long
Beach,atypical angina,124,224,TRUE,normal,161,FALSE,2,flat,,,0\n775,53,Male,VA
Long Beach,asymptomatic,126,0,FALSE,normal,106,FALSE,0,,,,1\n776,68,Male,VA Long
Beach,asymptomatic,138,0,FALSE,normal,130,TRUE,3,flat,,,2\n777,53,Male,VA Long
Beach,asymptomatic,154,0,,st-t abnormality,140,TRUE,1.5,flat,,,2\n778,60,Male,VA
Long Beach,non-anginal,,316,TRUE,st-t abnormality,,,,,,,3\n779,62,Male,VA Long

Beach,atypical angina,,0,FALSE,normal,,,,,,,0\n780,59,Male,VA Long
Beach,asymptomatic,178,0,TRUE,lv hypertrophy,120,TRUE,0,,,reversable
defect,1\n781,51,Male,VA Long Beach,asymptomatic,,218,TRUE,lv
hypertrophy,,,,,,,0\n782,61,Male,VA Long
Beach,asymptomatic,110,0,,normal,108,TRUE,2,downsloping,,,2\n783,57,Male,VA Long
Beach,asymptomatic,130,311,,st-t abnormality,148,TRUE,2,flat,,,1\n784,56,Male,VA
Long Beach,non-anginal,170,0,FALSE,lv
hypertrophy,123,TRUE,2.5,,,,4\n785,58,Male,VA Long Beach,atypical
angina,126,0,TRUE,normal,110,TRUE,2,flat,,,2\n786,69,Male,VA Long Beach,non-
anginal,140,0,,st-t abnormality,118,FALSE,2.5,downsloping,,,2\n787,67,Male,VA
Long Beach,typical
angina,142,270,TRUE,normal,125,FALSE,2.5,upsloping,,,3\n788,58,Male,VA Long
Beach,asymptomatic,120,0,FALSE,lv
hypertrophy,106,TRUE,1.5,downsloping,,reversable defect,1\n789,65,Male,VA Long
Beach,asymptomatic,,0,FALSE,normal,,,,,,,1\n790,63,Male,VA Long Beach,atypical
angina,,217,TRUE,st-t abnormality,,,,,,,1\n791,55,Male,VA Long Beach,atypical
angina,110,214,TRUE,st-t abnormality,180,FALSE,,,,,0\n792,57,Male,VA Long
Beach,asymptomatic,140,214,FALSE,st-t abnormality,144,TRUE,2,flat,,fixed
defect,2\n793,65,Male,VA Long Beach,typical
angina,,252,FALSE,normal,,,,,,,0\n794,54,Male,VA Long
Beach,asymptomatic,136,220,FALSE,normal,140,TRUE,3,flat,,,3\n795,72,Male,VA Long
Beach,non-anginal,120,214,FALSE,normal,102,TRUE,1,flat,,,3\n796,75,Male,VA Long
Beach,asymptomatic,170,203,TRUE,st-t abnormality,108,FALSE,0,,,reversable
defect,1\n797,49,Male,VA Long Beach,typical angina,130,0,FALSE,st-t
abnormality,145,FALSE,3,flat,,,2\n798,51,Male,VA Long Beach,non-
anginal,,339,FALSE,normal,,,,,,,3\n799,60,Male,VA Long
Beach,asymptomatic,142,216,FALSE,normal,110,TRUE,2.5,flat,,,2\n800,64,Female,VA
Long Beach,asymptomatic,142,276,FALSE,normal,140,TRUE,1,flat,,reversable
defect,1\n801,58,Male,VA Long Beach,asymptomatic,132,458,TRUE,normal,69,FALSE,1,
downsloping,,,0\n802,61,Male,VA Long Beach,asymptomatic,146,241,FALSE,normal,148
,TRUE,3,downsloping,,,2\n803,67,Male,VA Long
Beach,asymptomatic,160,384,TRUE,st-t
abnormality,130,TRUE,0,flat,,,2\n804,62,Male,VA Long
Beach,asymptomatic,135,297,FALSE,normal,130,TRUE,1,flat,,,2\n805,65,Male,VA Long
Beach,asymptomatic,136,248,FALSE,normal,140,TRUE,4,downsloping,,,4\n806,63,Male,
VA Long
Beach,asymptomatic,130,308,FALSE,normal,138,TRUE,2,flat,,,2\n807,69,Male,VA Long
Beach,asymptomatic,140,208,FALSE,st-t
abnormality,140,TRUE,2,,,,3\n808,51,Male,VA Long
Beach,asymptomatic,,227,TRUE,st-t abnormality,,,,,,,0\n809,62,Male,VA Long Beach
,asymptomatic,158,210,TRUE,normal,112,TRUE,3,downsloping,,,1\n810,55,Male,VA
Long Beach,non-anginal,,245,TRUE,st-t abnormality,,,,,,,1\n811,75,Male,VA Long
Beach,asymptomatic,136,225,FALSE,normal,112,TRUE,3,flat,,,3\n812,40,Male,VA Long
Beach,non-anginal,106,240,FALSE,normal,80,TRUE,0,,,reversable
defect,0\n813,67,Male,VA Long Beach,asymptomatic,120,0,TRUE,normal,150,FALSE,1.5
,downsloping,,,3\n814,58,Male,VA Long
Beach,asymptomatic,110,198,FALSE,normal,110,FALSE,0,,,,1\n815,60,Male,VA Long

Beach,asymptomatic,,195,FALSE,normal,,,,,,,0\n816,63,Male,VA Long
Beach,asymptomatic,160,267,TRUE,st-t abnormality,88,TRUE,2,,,,3\n817,35,Male,VA
Long Beach,non-anginal,,161,FALSE,st-t abnormality,,,,,,,0\n818,62,Male,VA Long
Beach,typical angina,112,258,FALSE,st-t
abnormality,150,TRUE,,,,,1\n819,43,Male,VA Long Beach,asymptomatic,122,0,FALSE,n
ormal,120,FALSE,0.5,upsloping,,,1\n820,63,Male,VA Long Beach,non-
anginal,130,0,TRUE,st-t abnormality,160,FALSE,3,flat,,,0\n821,68,Male,VA Long
Beach,non-anginal,150,195,TRUE,normal,132,FALSE,0,,,fixed
defect,1\n822,65,Male,VA Long
Beach,asymptomatic,150,235,FALSE,normal,120,TRUE,1.5,flat,,,3\n823,48,Male,VA
Long Beach,non-anginal,102,0,,st-t
abnormality,110,TRUE,1,downsloping,,,1\n824,63,Male,VA Long
Beach,asymptomatic,96,305,FALSE,st-t
abnormality,121,TRUE,1,upsloping,,,1\n825,64,Male,VA Long
Beach,asymptomatic,130,223,FALSE,st-t
abnormality,128,FALSE,0.5,flat,,,0\n826,61,Male,VA Long
Beach,asymptomatic,120,282,FALSE,st-t abnormality,135,TRUE,4,downsloping,,fixed
defect,3\n827,50,Male,VA Long Beach,asymptomatic,144,349,FALSE,lv
hypertrophy,120,TRUE,1,upsloping,,reversable defect,1\n828,59,Male,VA Long
Beach,asymptomatic,124,,FALSE,normal,117,TRUE,1,flat,,,1\n829,55,Male,VA Long
Beach,asymptomatic,150,160,FALSE,st-t
abnormality,150,FALSE,0,,,,0\n830,45,Male,VA Long Beach,non-
anginal,,236,FALSE,normal,,,,,,,0\n831,65,Male,VA Long
Beach,asymptomatic,,312,FALSE,lv hypertrophy,,,,,,,3\n832,61,Male,VA Long
Beach,atypical angina,,283,FALSE,normal,,,,,,,0\n833,49,Male,VA Long Beach,non-
anginal,,142,FALSE,normal,,,,,,,3\n834,72,Male,VA Long
Beach,asymptomatic,,211,FALSE,normal,,,,,,,1\n835,50,Male,VA Long
Beach,asymptomatic,,218,FALSE,normal,,,,,,,1\n836,64,Male,VA Long
Beach,asymptomatic,,306,TRUE,st-t abnormality,,,,,,,3\n837,55,Male,VA Long
Beach,asymptomatic,116,186,TRUE,st-t
abnormality,102,FALSE,0,,,,2\n838,63,Male,VA Long
Beach,asymptomatic,110,252,FALSE,st-t
abnormality,140,TRUE,2,flat,,,2\n839,59,Male,VA Long Beach,asymptomatic,125,222,
FALSE,normal,135,TRUE,2.5,downsloping,,,3\n840,56,Male,VA Long
Beach,asymptomatic,,0,FALSE,lv hypertrophy,,,,,,,1\n841,62,Male,VA Long
Beach,non-anginal,,0,TRUE,st-t abnormality,,,,,,,2\n842,74,Male,VA Long
Beach,asymptomatic,150,258,TRUE,st-t
abnormality,130,TRUE,4,downsloping,,,3\n843,54,Male,VA Long
Beach,asymptomatic,130,202,TRUE,normal,112,TRUE,2,flat,,,1\n844,57,Male,VA Long
Beach,asymptomatic,110,197,FALSE,lv hypertrophy,100,FALSE,0,,,,0\n845,62,Male,VA
Long Beach,non-anginal,,204,FALSE,st-t abnormality,,,,,,,1\n846,76,Male,VA Long
Beach,non-anginal,104,,FALSE,lv
hypertrophy,120,FALSE,3.5,downsloping,,,4\n847,54,Female,VA Long
Beach,asymptomatic,138,274,FALSE,normal,105,TRUE,1.5,flat,,,1\n848,70,Male,VA
Long Beach,asymptomatic,170,192,FALSE,st-t
abnormality,129,TRUE,3,downsloping,,,2\n849,61,Female,VA Long Beach,atypical
angina,140,298,TRUE,normal,120,TRUE,0,,,reversable defect,0\n850,48,Male,VA Long

Beach,asymptomatic,,272,FALSE,st-t abnormality,,,,,,,0\n851,48,Male,VA Long
Beach,non-anginal,132,220,TRUE,st-t abnormality,162,FALSE,0,,,fixed
defect,1\n852,61,Male,VA Long Beach,typical angina,142,200,TRUE,st-t
abnormality,100,FALSE,1.5,downsloping,,,3\n853,66,Male,VA Long Beach,asymptomati
c,112,261,FALSE,normal,140,FALSE,1.5,upsloping,,,1\n854,68,Male,VA Long
Beach,typical angina,,181,TRUE,st-t abnormality,,,,,,,0\n855,55,Male,VA Long
Beach,asymptomatic,172,260,FALSE,normal,73,FALSE,2,,,,3\n856,62,Male,VA Long
Beach,non-anginal,120,220,FALSE,lv hypertrophy,86,FALSE,0,,,,0\n857,71,Male,VA
Long Beach,non-anginal,,221,FALSE,normal,,,,,,,3\n858,74,Male,VA Long
Beach,typical angina,,216,TRUE,normal,,,,,,,3\n859,53,Male,VA Long Beach,non-
anginal,155,175,TRUE,st-t abnormality,160,FALSE,,,,fixed
defect,0\n860,58,Male,VA Long Beach,non-anginal,150,219,FALSE,st-t
abnormality,118,TRUE,0,,,,2\n861,75,Male,VA Long
Beach,asymptomatic,160,310,TRUE,normal,112,TRUE,2,downsloping,,reversable
defect,0\n862,56,Male,VA Long Beach,non-anginal,,208,TRUE,st-t
abnormality,,,,,,,4\n863,58,Male,VA Long Beach,non-anginal,,232,FALSE,st-t
abnormality,,,,,,,2\n864,64,Male,VA Long Beach,asymptomatic,134,273,FALSE,normal
,102,TRUE,4,downsloping,,,4\n865,54,Male,VA Long Beach,non-
anginal,,203,FALSE,st-t abnormality,,,,,,,0\n866,54,Male,VA Long Beach,atypical
angina,,182,FALSE,st-t abnormality,,,,,,,0\n867,59,Male,VA Long
Beach,asymptomatic,140,274,FALSE,normal,154,TRUE,2,flat,,,0\n868,55,Male,VA Long
Beach,asymptomatic,,204,TRUE,st-t abnormality,,,,,,,1\n869,57,Male,VA Long
Beach,asymptomatic,144,270,TRUE,st-t
abnormality,160,TRUE,2,flat,,,3\n870,61,Male,VA Long
Beach,asymptomatic,,292,FALSE,st-t abnormality,,,,,,,3\n871,41,Male,VA Long
Beach,asymptomatic,150,171,FALSE,normal,128,TRUE,1.5,flat,,,0\n872,71,Male,VA
Long Beach,asymptomatic,130,221,FALSE,st-t
abnormality,115,TRUE,0,,,,3\n873,38,Male,VA Long Beach,asymptomatic,110,289,FALS
E,normal,105,TRUE,1.5,downsloping,,,1\n874,55,Male,VA Long
Beach,asymptomatic,158,217,FALSE,normal,110,TRUE,2.5,flat,,,1\n875,56,Male,VA
Long Beach,asymptomatic,128,223,FALSE,st-t
abnormality,119,TRUE,2,downsloping,,,2\n876,69,Male,VA Long
Beach,asymptomatic,,,TRUE,normal,,,,,,,2\n877,64,Male,VA Long
Beach,asymptomatic,150,193,FALSE,st-t
abnormality,135,TRUE,0.5,flat,,,2\n878,72,Male,VA Long
Beach,asymptomatic,160,,TRUE,lv hypertrophy,130,FALSE,1.5,,,,2\n879,69,Male,VA
Long Beach,asymptomatic,,210,TRUE,st-t abnormality,,,,,,,2\n880,56,Male,VA Long
Beach,asymptomatic,,282,TRUE,normal,,,,,,,1\n881,62,Male,VA Long
Beach,asymptomatic,,170,FALSE,st-t abnormality,120,TRUE,3,,,,4\n882,67,Male,VA
Long Beach,asymptomatic,,369,FALSE,normal,,,,,,,3\n883,57,Male,VA Long
Beach,asymptomatic,156,173,FALSE,lv
hypertrophy,119,TRUE,3,downsloping,,,3\n884,69,Male,VA Long
Beach,asymptomatic,,289,TRUE,st-t abnormality,,,,,,,3\n885,51,Male,VA Long
Beach,asymptomatic,,,TRUE,lv hypertrophy,,,,,,reversable
defect,1\n886,48,Male,VA Long
Beach,asymptomatic,140,,FALSE,normal,159,TRUE,1.5,upsloping,,,3\n887,69,Male,VA
Long Beach,asymptomatic,122,216,TRUE,lv hypertrophy,84,TRUE,0,,,reversable

```
defect,2\n888,69,Male,VA Long Beach,non-anginal,,271,FALSE,lv
hypertrophy,,,,,,,0\n889,64,Male,VA Long Beach,asymptomatic,,244,TRUE,st-t
abnormality,,,,,,,2\n890,57,Male,VA Long Beach,atypical angina,180,285,TRUE,st-t
abnormality,120,FALSE,0.8,,,,1\n891,53,Male,VA Long
Beach,asymptomatic,124,243,FALSE,normal,122,TRUE,2,flat,,reversable
defect,1\n892,37,Male,VA Long Beach,non-anginal,118,240,FALSE,lv
hypertrophy,165,FALSE,1,flat,,normal,0\n893,67,Male,VA Long
Beach,asymptomatic,140,219,FALSE,st-t abnormality,122,TRUE,2,flat,,reversable
defect,3\n894,74,Male,VA Long Beach,non-
anginal,140,237,TRUE,normal,94,FALSE,0,,,,1\n895,63,Male,VA Long Beach,atypical
angina,,165,FALSE,st-t abnormality,,,,,,,0\n896,58,Male,VA Long
Beach,asymptomatic,100,213,FALSE,st-t
abnormality,110,FALSE,0,,,,0\n897,61,Male,VA Long
Beach,asymptomatic,190,287,TRUE,lv
hypertrophy,150,TRUE,2,downsloping,,,4\n898,64,Male,VA Long
Beach,asymptomatic,130,258,TRUE,lv hypertrophy,130,FALSE,0,,,fixed
defect,2\n899,58,Male,VA Long Beach,asymptomatic,160,256,TRUE,lv
hypertrophy,113,TRUE,1,upsloping,,,3\n900,60,Male,VA Long
Beach,asymptomatic,130,186,TRUE,lv
hypertrophy,140,TRUE,0.5,flat,,,1\n901,57,Male,VA Long
Beach,asymptomatic,122,264,FALSE,lv hypertrophy,100,FALSE,0,,,,1\n902,55,Male,VA
Long Beach,non-anginal,,,FALSE,st-t abnormality,,,,,,,0\n903,55,Male,VA Long
Beach,asymptomatic,120,226,FALSE,lv
hypertrophy,127,TRUE,1.7,downsloping,,reversable defect,1\n904,56,Male,VA Long
Beach,asymptomatic,130,203,TRUE,normal,98,FALSE,1.5,flat,,reversable
defect,1\n905,57,Male,VA Long Beach,asymptomatic,130,207,FALSE,st-t
abnormality,96,TRUE,1,flat,,,0\n906,61,Male,VA Long Beach,non-
anginal,,284,FALSE,normal,,,,,,,1\n907,61,Male,VA Long Beach,non-
anginal,120,337,FALSE,normal,98,TRUE,0,,,,3\n908,58,Male,VA Long Beach,non-
anginal,150,219,FALSE,st-t abnormality,118,TRUE,0,,,,2\n909,74,Male,VA Long Beac
h,asymptomatic,155,310,FALSE,normal,112,TRUE,1.5,downsloping,,,2\n910,68,Male,VA
Long Beach,non-
anginal,134,254,TRUE,normal,151,TRUE,0,,,normal,0\n911,51,Female,VA Long
Beach,asymptomatic,114,258,TRUE,lv
hypertrophy,96,FALSE,1,upsloping,,,0\n912,62,Male,VA Long
Beach,asymptomatic,160,254,TRUE,st-t
abnormality,108,TRUE,3,flat,,,4\n913,53,Male,VA Long
Beach,asymptomatic,144,300,TRUE,st-t
abnormality,128,TRUE,1.5,flat,,,3\n914,62,Male,VA Long
Beach,asymptomatic,158,170,FALSE,st-t
abnormality,138,TRUE,0,,,,1\n915,46,Male,VA Long
Beach,asymptomatic,134,310,FALSE,normal,126,FALSE,0,,,normal,2\n916,54,Female,VA
Long Beach,asymptomatic,127,333,TRUE,st-t
abnormality,154,FALSE,0,,,,1\n917,62,Male,VA Long Beach,typical
angina,,139,FALSE,st-t abnormality,,,,,,,0\n918,55,Male,VA Long
Beach,asymptomatic,122,223,TRUE,st-t abnormality,100,FALSE,0,,,fixed
defect,2\n919,58,Male,VA Long Beach,asymptomatic,,385,TRUE,lv
```

```
hypertrophy,,,,,,,0\n920,62,Male,VA Long Beach,atypical angina,120,254,FALSE,lv
hypertrophy,93,TRUE,0,,,,1\n'}
```

1.2 Reading Dataset

[4]:
```
hd = pd.read_csv('/content/heart_disease_uci.csv')
hd.head()
```

[4]:

	id	age	sex	dataset	cp	trestbps	chol	fbs	restecg	thalch	exang	oldpeak	slope	ca	thal	num
0	1	63	Male	Cleveland	typical angina	145.0	233.0	True	lv hypertrophy	150.0	False	2.3	downsloping	0.0	fixed defect	0
1	2	67	Male	Cleveland	asymptomatic	160.0	286.0	False	lv hypertrophy	108.0	True	1.5	flat	3.0	normal	2
2	3	67	Male	Cleveland	asymptomatic	120.0	229.0	False	lv hypertrophy	129.0	True	2.6	flat	2.0	reversable defect	1
3	4	37	Male	Cleveland	non-anginal	130.0	250.0	False	normal	187.0	False	3.5	downsloping	0.0	normal	0
4	5	41	Female	Cleveland	atypical angina	130.0	204.0	False	lv hypertrophy	172.0	False	1.4	upsloping	0.0	normal	0

1.3 Columns Info

- id : (Unique id for each patient)
- age : (Age of the patient in years)
- origin : (place of study)
- sex : (Male/Female)
- cp : chest pain type ([typical angina, atypical angina, non-anginal, asymptomatic])
- trestbps : resting blood pressure (resting blood pressure (in mm Hg on admission to the hospital))
- chol : (serum cholesterol in mg/dl)
- fbs : (if fasting blood sugar $>$ 120 mg/dl)
- restecg : (resting electrocardiographic results)
- – Values: [normal, stt abnormality, lv hypertrophy]
- thalach: maximum heart rate achieved
- exang: exercise-induced angina (True/ False)
- oldpeak: ST depression induced by exercise relative to rest
- slope: the slope of the peak exercise ST segment
- ca: number of major vessels (0-3) colored by fluoroscopy

- thal: [normal; fixed defect; reversible defect]
- num: the predicted attribute

[5]:
```
hd.shape
```

[5]:
```
(920, 16)
```

[6]:
```
hd.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 920 entries, 0 to 919
Data columns (total 16 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   id        920 non-null    int64
 1   age       920 non-null    int64
 2   sex       920 non-null    object
 3   dataset   920 non-null    object
 4   cp        920 non-null    object
 5   trestbps  861 non-null    float64
 6   chol      890 non-null    float64
 7   fbs       830 non-null    object
 8   restecg   918 non-null    object
 9   thalch    865 non-null    float64
 10  exang     865 non-null    object
 11  oldpeak   858 non-null    float64
 12  slope     611 non-null    object
 13  ca        309 non-null    float64
 14  thal      434 non-null    object
 15  num       920 non-null    int64
dtypes: float64(5), int64(3), object(8)
memory usage: 115.1+ KB
```

Droping Column 'dataset' as it is not required for visualization. 'id' and 'dataset' column is not important to us as 'id' is a unique value and 'dataset' column contains the place where applicant has studied. 'ca' column has more than 60% of Nan values if we fill that it could mislead us, so it's better that we drop that column.

[7]:
```
hd = hd.drop(['id','dataset','ca'],axis=1)
```

Renaming Columns Renaming some columns for our better understanding.

[8]:
```
hd.rename(columns = {'cp':'Chest_Pain_Type', 'trestbps':
 ↪'Resting_Blood_Pressure','chol':'serum_cholesterol','fbs':
 ↪'Fasting_Blood_Sugar','restecg':'Resting_Electrocardiographic','thalch':
 ↪'Maximum_Heart_Rate','exang':'Exercise_Induced_Angina','oldpeak':
 ↪'ST_Depression_Induced','thal':'Heart_Condition'}, inplace = True)
```

1.4 Columns After Renaming

- id : (Unique id for each patient)
- age : (Age of the patient in years)
- origin : (place of study)
- sex : (Male/Female)
- Chest_Pain_Type : chest pain type ([typical angina, atypical angina, non-anginal, asymptomatic])
- Resting_Blood_Pressure : resting blood pressure (resting blood pressure (in mm Hg on admission to the hospital))
- serum_cholesterol : (serum cholesterol in mg/dl)
- Fasting_Bood_Sugar : (if fasting blood sugar > 120 mg/dl)
- Resting_Electrocardiographic : (resting electrocardiographic results)
- – Values: [normal, stt abnormality, lv hypertrophy]
- Maximum_Heart_Rate: maximum heart rate achieved
- Exercise_Induced_Angina: exercise-induced angina (True/ False)
- ST_Depression_Induced: ST depression induced by exercise relative to rest
- slope: the slope of the peak exercise ST segment
- Heart_Condition: [normal; fixed defect; reversible defect]
- num: the predicted attribute

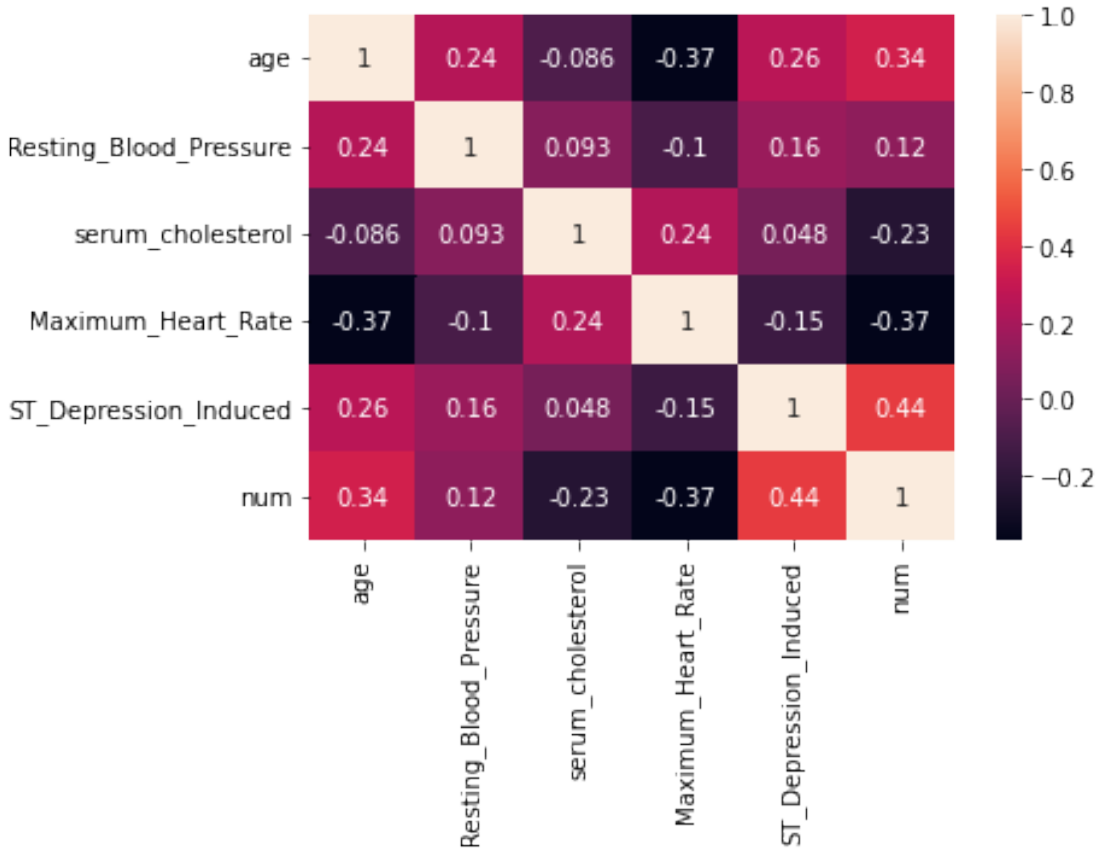
[9]:
```
hd.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 920 entries, 0 to 919
Data columns (total 13 columns):
 #   Column                      Non-Null Count  Dtype
---  ------                      --------------  -----
 0   age                         920 non-null    int64
 1   sex                         920 non-null    object
 2   Chest_Pain_Type             920 non-null    object
 3   Resting_Blood_Pressure      861 non-null    float64
 4   serum_cholesterol           890 non-null    float64
 5   Fasting_Blood_Sugar         830 non-null    object
 6   Resting_Electrocardiographic  918 non-null    object
 7   Maximum_Heart_Rate          865 non-null    float64
 8   Exercise_Induced_Angina     865 non-null    object
 9   ST_Depression_Induced       858 non-null    float64
 10  slope                       611 non-null    object
 11  Heart_Condition             434 non-null    object
 12  num                         920 non-null    int64
dtypes: float64(4), int64(2), object(7)
memory usage: 93.6+ KB
```

It shows that there are null values in the dataset. Columns 'Vessels_Colored' and 'Heart_Condition' have more than 50% null values.

[10]:
```
sns.heatmap(hd.corr(),annot=True)
```

[10]: <matplotlib.axes._subplots.AxesSubplot at 0x7f70a281c670>



1.5 Cleaning Dataset

Now we need to remove Null values from the Dataset.

Columns 'Resting_Blood_Pressure','serum_cholesterol','Fasting_Blood_Sugar','Resting_Electrocardiographic','
and 'Heart_Condition' has Nan values.

Column = 'Resting_Blood_Pressure'

[11]:
```
hd['Resting_Blood_Pressure'].unique()
```

[11]:
```
array([145., 160., 120., 130., 140., 172., 150., 110., 132., 117., 135.,
       112., 105., 124., 125., 142., 128., 170., 155., 104., 180., 138.,
       108., 134., 122., 115., 118., 100., 200.,  94., 165., 102., 152.,
       101., 126., 174., 148., 178., 158., 192., 129., 144., 123., 136.,
       146., 106., 156., 154., 114., 164.,  98., 190.,  nan, 113.,  92.,
        95.,  80., 185., 116.,   0.,  96., 127.])
```

[12]:
```
drop_row = hd[hd['Resting_Blood_Pressure']==0].index
hd.drop(drop_row, inplace=True)
```

[13]:
```
hd['Resting_Blood_Pressure'].isnull().value_counts()
```

[13]:
```
False    860
True      59
Name: Resting_Blood_Pressure, dtype: int64
```

There are 59 Nan values, Now we will fill these by mean of the 'Resting_Blood_Pressure' column by grouping them with age.

[14]:
```
mean_value1 = hd.groupby('age')['Resting_Blood_Pressure'].mean()
```

[15]:
```
for i,j in zip(mean_value1.index,mean_value1):
    hd.loc[hd['age']==i,'Resting_Blood_Pressure']= hd.
 ↪loc[hd['age']==i,'Resting_Blood_Pressure'].fillna(j)
```

[16]:
```
hd['Resting_Blood_Pressure'].isnull().sum()
```

[16]:
```
0
```

We have filled the Nan valus with mean of grouping 'Resting_Blood_Pressure' with 'age' column. It is clean now with no Nan values. And we will do similar process for 'serum_cholesterol'.

Column = 'serum_cholesterol'

[17]:
```
hd['serum_cholesterol'].unique()
```

[17]:
```
array([233., 286., 229., 250., 204., 236., 268., 354., 254., 203., 192.,
       294., 256., 263., 199., 168., 239., 275., 266., 211., 283., 284.,
       224., 206., 219., 340., 226., 247., 167., 230., 335., 234., 177.,
       276., 353., 243., 225., 302., 212., 330., 175., 417., 197., 198.,
       290., 253., 172., 273., 213., 305., 216., 304., 188., 282., 185.,
       232., 326., 231., 269., 267., 248., 360., 258., 308., 245., 270.,
       208., 264., 321., 274., 325., 235., 257., 164., 141., 252., 255.,
       201., 222., 260., 182., 303., 265., 309., 307., 249., 186., 341.,
       183., 407., 217., 288., 220., 209., 227., 261., 174., 281., 221.,
       205., 240., 289., 318., 298., 564., 246., 322., 299., 300., 293.,
       277., 214., 207., 223., 160., 394., 184., 315., 409., 244., 195.,
       196., 126., 313., 259., 200., 262., 215., 228., 193., 271., 210.,
       327., 149., 295., 306., 178., 237., 218., 242., 319., 166., 180.,
       311., 278., 342., 169., 187., 157., 176., 241., 131., 132.,  nan,
       161., 173., 194., 297., 292., 339., 147., 291., 358., 412., 238.,
       163., 280., 202., 328., 129., 190., 179., 272., 100., 468., 320.,
       312., 171., 365., 344.,  85., 347., 251., 287., 156., 117., 466.,
       338., 529., 392., 329., 355., 603., 404., 518., 285., 279., 388.,
       336., 491., 331., 393.,   0., 153., 316., 458., 384., 349., 142.,
```

```
       181., 310., 170., 369., 165., 337., 333., 139., 385.])
```

[18]:
```
hd['serum_cholesterol'].isnull().sum()
```

[18]:
```
30
```

[19]:
```
mean_value2 = hd.groupby('age')['serum_cholesterol'].mean()
```

[20]:
```
for i,j in zip(mean_value2.index,mean_value2.values):
    hd.loc[hd['age']==i,'serum_cholesterol']= hd.
 ↪loc[hd['age']==i,'serum_cholesterol'].fillna(j)
```

[21]:
```
for i,j in zip(mean_value2.index,mean_value2.values):
    hd.loc[(hd['age']==i)& (hd['serum_cholesterol']==0.0),'serum_cholesterol']=j
```

[22]:
```
hd['serum_cholesterol'].isnull().sum()
```

[22]:
```
0
```

Column = 'Fasting_Bood_Sugar'

[23]:
```
hd['Fasting_Blood_Sugar'].isnull().sum()
```

[23]:
```
90
```

[24]:
```
hd['Fasting_Blood_Sugar'].unique()
```

[24]:
```
array([True, False, nan], dtype=object)
```

Here we can see that data is not even as male count is way more than females, so we can't fill the Nan values on the basis of mode and as this values are categorical so mean is not possible. So we have drop these values and as there are 90 Nan values it will not affect our visualization.

[25]:
```
hd.groupby('Fasting_Blood_Sugar')['sex'].value_counts()
```

[25]:
```
Fasting_Blood_Sugar  sex
False                Male      527
                     Female    164
True                 Male      119
                     Female     19
Name: sex, dtype: int64
```

Column = 'Resting_Electrocardiographic'

[26]:
```
hd['Resting_Electrocardiographic'].unique()
```

[26]:
```
array(['lv hypertrophy', 'normal', 'st-t abnormality', nan], dtype=object)
```

Column = 'Maximum_Heart_Rate'

[27]:
```
hd['Maximum_Heart_Rate'].unique()
```

[27]:
```
array([150., 108., 129., 187., 172., 178., 160., 163., 147., 155., 148.,
       153., 142., 173., 162., 174., 168., 139., 171., 144., 132., 158.,
       114., 151., 161., 179., 120., 112., 137., 157., 169., 165., 123.,
       128., 152., 140., 188., 109., 125., 131., 170., 113.,  99., 177.,
       141., 180., 111., 143., 182., 156., 115., 149., 145., 146., 175.,
       186., 185., 159., 130., 190., 136.,  97., 127., 154., 133., 126.,
       202., 103., 166., 164., 184., 124., 122.,  96., 138.,  88., 105.,
       194., 195., 106., 167.,  95., 192., 117., 121., 116.,  71., 118.,
       181., 134.,  90.,  98., 176., 135., 110.,  nan, 100.,  87., 102.,
        92.,  91.,  82., 119.,  94., 104.,  60.,  83.,  63.,  70.,  77.,
        72.,  78.,  86.,  93.,  67.,  84.,  80., 107.,  69.,  73.])
```

There are 55 Nan values. We are going fill these with mean of these values of that age.

[28]:
```
mean_value3 = hd.groupby('age')['Maximum_Heart_Rate'].mean()
```

[29]:
```
for i,j in zip(mean_value3.index,mean_value3):
    hd.loc[hd['age']==i,'Maximum_Heart_Rate']= hd.
 ↪loc[hd['age']==i,'Maximum_Heart_Rate'].fillna(j)
```

[30]:
```
hd['Maximum_Heart_Rate'].isnull().sum()
```

[30]:
```
0
```

Column = 'Exercise_Induced_Angina'

[ ]:
```
# hd['Exercise_Induced_Angina'].unique()
```

Column = 'ST_Depression_Induced'

[31]:
```
hd['ST_Depression_Induced'].unique()
```

[31]:
```
array([ 2.3,  1.5,  2.6,  3.5,  1.4,  0.8,  3.6,  0.6,  3.1,  0.4,  1.3,
        0. ,  0.5,  1.6,  1. ,  1.2,  0.2,  1.8,  3.2,  2.4,  2. ,  2.5,
        2.2,  2.8,  3. ,  3.4,  6.2,  4. ,  5.6,  2.9,  0.1,  2.1,  1.9,
        4.2,  0.9,  1.1,  3.8,  0.7,  0.3,  4.4,  5. ,  nan, -1.1, -1.5,
       -0.1, -2.6, -0.7, -2. , -1. ,  1.7, -0.8, -0.5, -0.9,  3.7])
```

[32]:
```
hd['ST_Depression_Induced'].isnull().sum()
```

[32]:
```
62
```

[33]:
```
mean_value4 = hd.groupby('age')['ST_Depression_Induced'].mean()
```

[34]:
```
for i,j in zip(mean_value4.index,mean_value4):
```

```
    hd.loc[hd['age']==i,'ST_Depression_Induced']= hd.
↪loc[hd['age']==i,'ST_Depression_Induced'].fillna(j)
```

[35]:
```
hd['ST_Depression_Induced'].isnull().sum()
```

[35]:
```
0
```

Column = 'slope'

[36]:
```
hd['slope'].unique()
```

[36]:
```
array(['downsloping', 'flat', 'upsloping', nan], dtype=object)
```

[37]:
```
hd['slope'].isnull().sum()
```

[37]:
```
309
```

[38]:
```
mode_value = hd.groupby('ST_Depression_Induced')['slope'].agg(pd.Series.mode)
mode_value
```

[38]:
```
ST_Depression_Induced
-2.6                          flat
-2.0                          flat
-1.5                   downsloping
-1.1                     upsloping
-1.0    [downsloping, upsloping]
                     …
 4.2           [downsloping, flat]
 4.4                   downsloping
 5.0                          flat
 5.6                   downsloping
 6.2                   downsloping
Name: slope, Length: 76, dtype: object
```

In some columns we can't fill values with mean or mode of that variable because at last it's a human body and every body is different from one another and these variables depend on many other aspects also, so its better to drop these rows instead of filling them.

[39]:
```
hd = hd.dropna()
```

[40]:
```
hd.shape
```

[40]:
```
(372, 13)
```

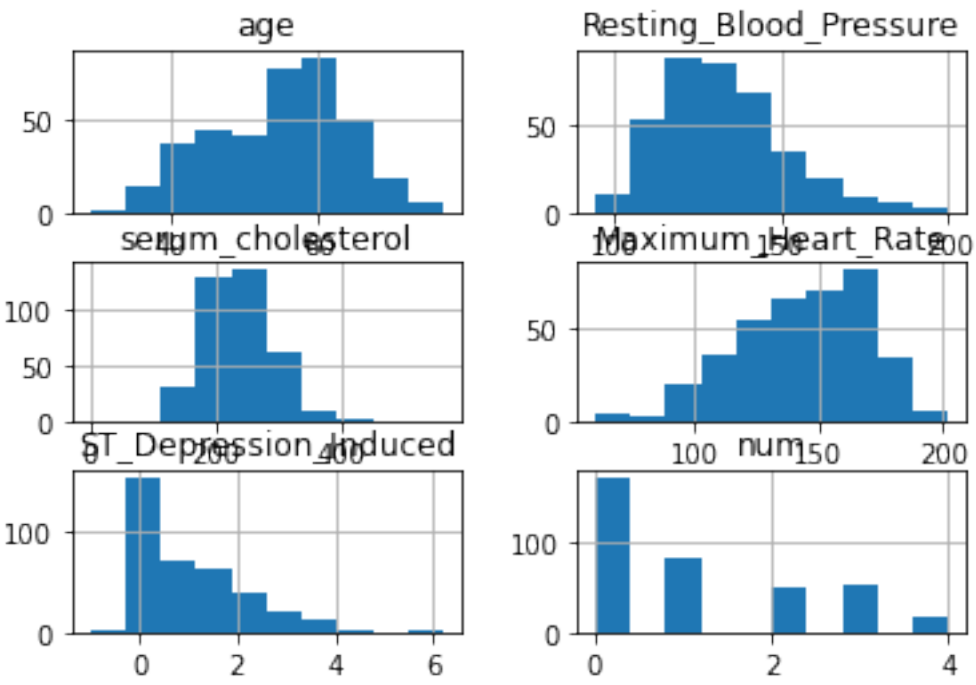
2 Data Visualization

[41]:
```
hd.head()
```

[41]:
```
   age     sex  Chest_Pain_Type  Resting_Blood_Pressure  serum_cholesterol  \
0   63    Male   typical angina                  145.0              233.0
1   67    Male     asymptomatic                  160.0              286.0
2   67    Male     asymptomatic                  120.0              229.0
3   37    Male      non-anginal                  130.0              250.0
4   41  Female  atypical angina                  130.0              204.0

  Fasting_Blood_Sugar Resting_Electrocardiographic  Maximum_Heart_Rate  \
0                True               lv hypertrophy               150.0
1               False               lv hypertrophy               108.0
2               False               lv hypertrophy               129.0
3               False                       normal               187.0
4               False               lv hypertrophy               172.0

  Exercise_Induced_Angina  ST_Depression_Induced        slope  \
0                   False                    2.3  downsloping
1                    True                    1.5         flat
2                    True                    2.6         flat
3                   False                    3.5  downsloping
4                   False                    1.4    upsloping

     Heart_Condition  num
0       fixed defect    0
1             normal    2
2  reversable defect    1
3             normal    0
4             normal    0
```

[42]:
```
hd.hist()
```

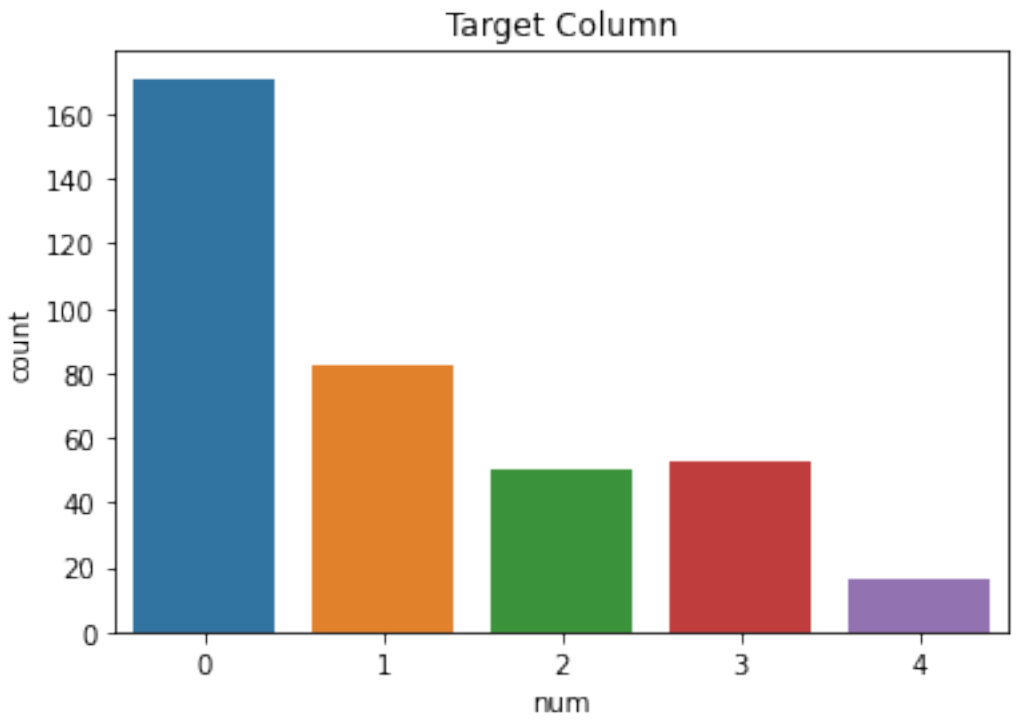
[42]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f709f9d50d0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f709f985520>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f709f92f940>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f709f95ad30>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f709f911190>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f709f8ba4c0>]],
      dtype=object)
```



2.0.1 Target Column

[43]:
```
sns.countplot(x='num',data = hd)
plt.title('Target Column')
```

[43]:
```
Text(0.5, 1.0, 'Target Column')
```

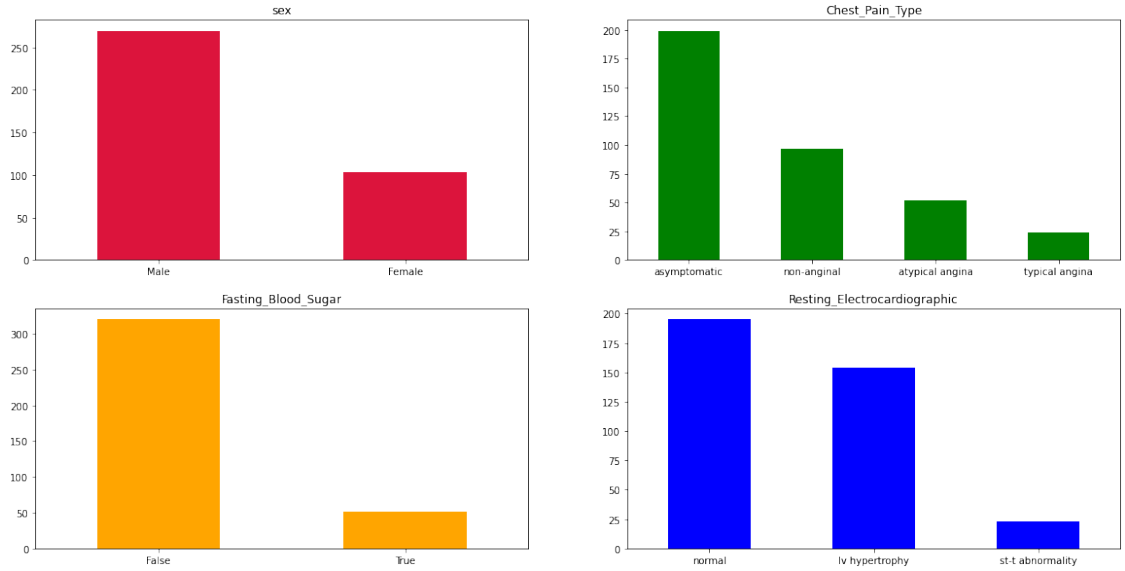


2.0.2 Independent Variable (Categorical)

[44]:
```
plt.figure(1)
plt.figure(figsize=(20,10))

# Column (sex)
plt.subplot(221)
hd['sex'].value_counts().plot(kind='bar',color='crimson',rot=0)
plt.title('sex')

# Column (Chest_Pain_Type)
plt.subplot(222)
hd['Chest_Pain_Type'].value_counts().plot(kind='bar',color='green',rot=0)
plt.title('Chest_Pain_Type')

# Column (Fasting_Blood_Sugar)
plt.subplot(223)
hd['Fasting_Blood_Sugar'].value_counts().plot(kind='bar',color='orange',rot=0)
plt.title('Fasting_Blood_Sugar')

# Column (Resting_Electrocardiographic)
plt.subplot(224)
```

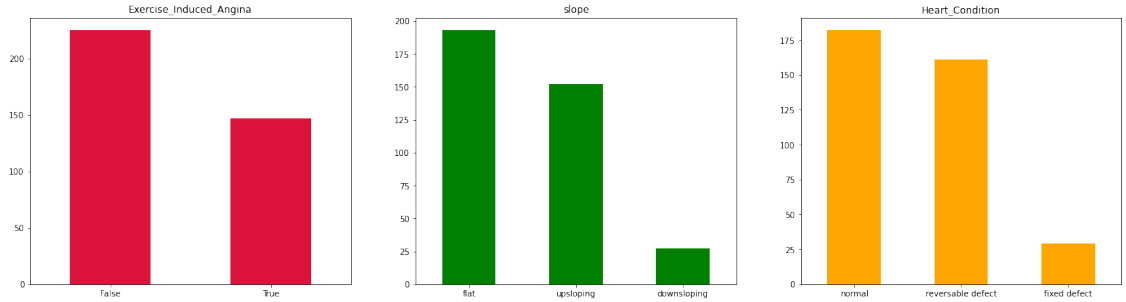
```
hd['Resting_Electrocardiographic'].value_counts().
  ↪plot(kind='bar',color='blue',rot=0)
plt.title('Resting_Electrocardiographic')

plt.show()
```

```
<Figure size 432x288 with 0 Axes>
```



[45]:
```
plt.figure(1)
plt.figure(figsize=(24,6))

# Column (Exercise_Induced_Angina)
plt.subplot(131)
hd['Exercise_Induced_Angina'].value_counts().
  ↪plot(kind='bar',color='crimson',rot=0)
plt.title('Exercise_Induced_Angina')

# Column (slope)
plt.subplot(132)
hd['slope'].value_counts().plot(kind='bar',color='green',rot=0)
plt.title('slope')

# Column (Heart_Condition)
plt.subplot(133)
hd['Heart_Condition'].value_counts().plot(kind='bar',color='orange',rot=0)
plt.title('Heart_Condition')

plt.show()
```

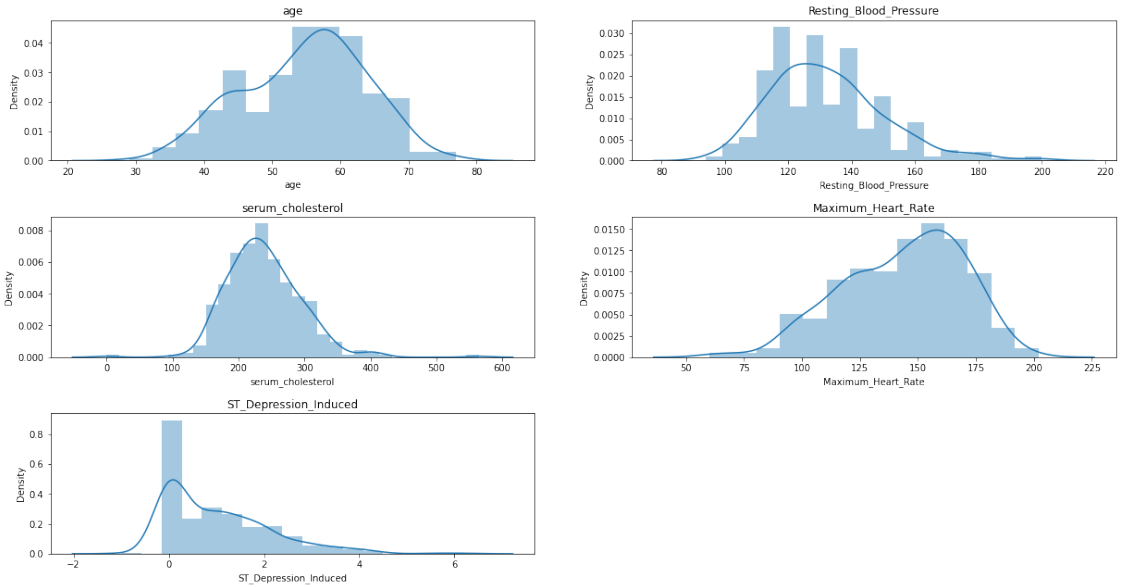
<Figure size 432x288 with 0 Axes>



2.0.3 Independent Variable (Continous)

[46]:
```
plt.figure(1)
plt.figure(figsize=(20,10))
plt.subplots_adjust(left=0.1,bottom=0.1,right=0.9,top=0.9,wspace=0.2,hspace=0.4)

# Column (age)
plt.subplot(321)
sns.distplot(hd['age'])
plt.title('age')

# Column (Resting_Blood_Pressure)
plt.subplot(322)
sns.distplot(hd['Resting_Blood_Pressure'])
plt.title('Resting_Blood_Pressure')

# Column (serum_cholesterol)
plt.subplot(323)
sns.distplot(hd['serum_cholesterol'])
plt.title('serum_cholesterol')

# Column (Maximum_Heart_Rate)
plt.subplot(324)
sns.distplot(hd['Maximum_Heart_Rate'])
plt.title('Maximum_Heart_Rate')

# Column (Maximum_Heart_Rate)
plt.subplot(325)
sns.distplot(hd['ST_Depression_Induced'])
plt.title('ST_Depression_Induced')

plt.show()
```

<Figure size 432x288 with 0 Axes>

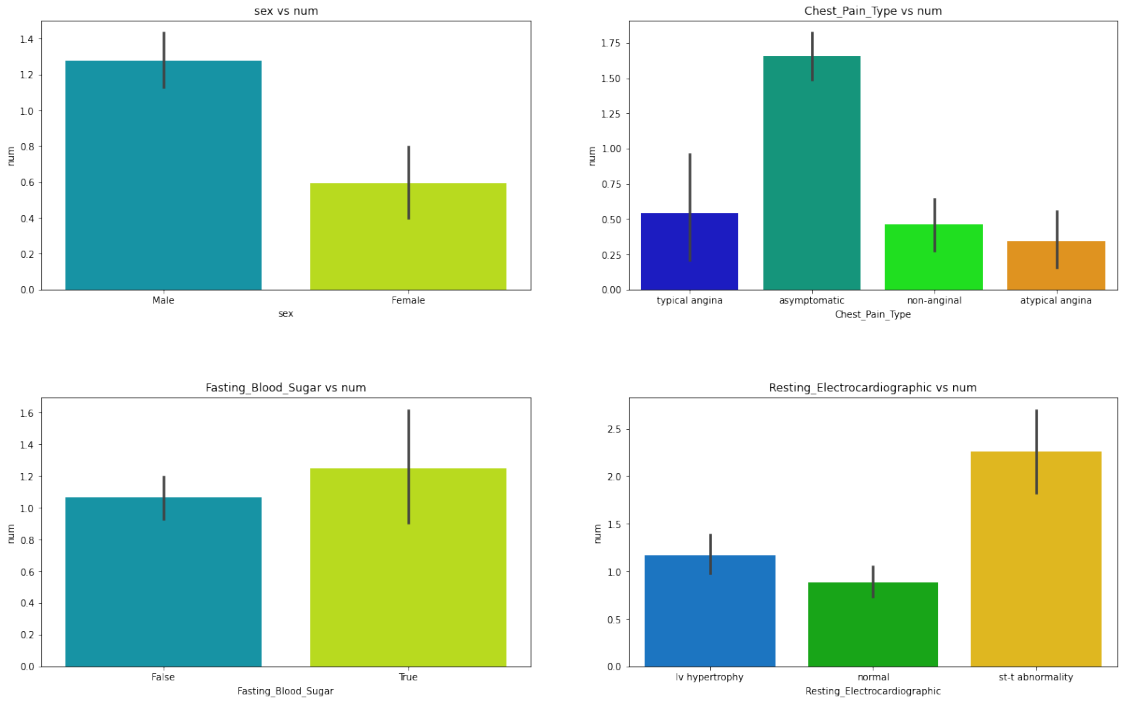


2.0.4 Target Variable vs Independent Variable (Categorical)

[47]:
```
plt.figure(1)
plt.figure(figsize = (20, 12))
plt.subplots_adjust(left=0.1,bottom=0.1,right=0.9,top=0.9,wspace=0.2,hspace=0.4)

# Column (num vs sex)
plt.subplot(221)
sns.barplot(x = hd['sex'], y = hd['num'], palette = "nipy_spectral")
plt.title('sex vs num')

# Column (num vs Chest_Pain_Type)
plt.subplot(222)
sns.barplot(x = hd['Chest_Pain_Type'], y = hd['num'], palette = "nipy_spectral")
plt.title('Chest_Pain_Type vs num')

# Column (num vs Fasting_Blood_Sugar)
plt.subplot(223)
sns.barplot(x = hd['Fasting_Blood_Sugar'], y = hd['num'], palette =␣
 ↪"nipy_spectral")
plt.title('Fasting_Blood_Sugar vs num')

# Column (num vs Resting_Electrocardiographic)
plt.subplot(224)
sns.barplot(x = hd['Resting_Electrocardiographic'], y = hd['num'], palette =␣
 ↪"nipy_spectral")
plt.title('Resting_Electrocardiographic vs num')
```

```
plt.show()
```

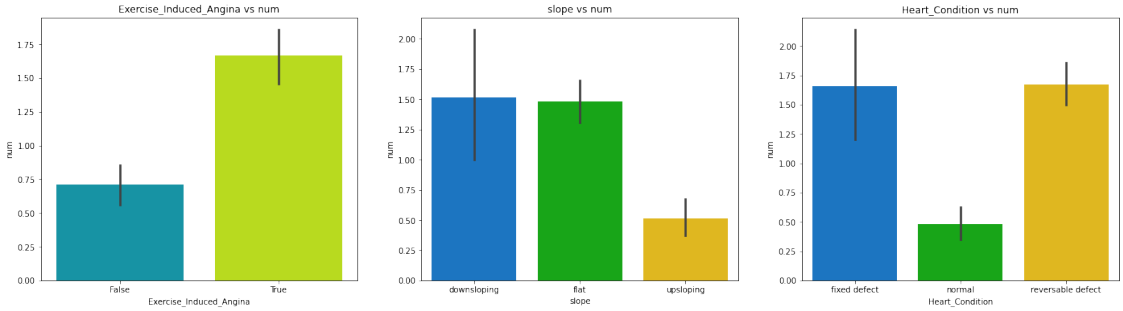
```
<Figure size 432x288 with 0 Axes>
```



[48]:
```
plt.figure(1)
plt.figure(figsize = (24, 6))

# Column (num vs Exercise_Induced_Angina)
plt.subplot(131)
sns.barplot(x = hd['Exercise_Induced_Angina'], y = hd['num'], palette =␣
 ↪"nipy_spectral")
plt.title('Exercise_Induced_Angina vs num')

# Column (num vs slope)
plt.subplot(132)
sns.barplot(x = hd['slope'], y = hd['num'], palette = "nipy_spectral")
plt.title('slope vs num')

# Column (num vs Heart_Condition)
plt.subplot(133)
sns.barplot(x = hd['Heart_Condition'], y = hd['num'], palette = "nipy_spectral")
plt.title('Heart_Condition vs num')
```

```
plt.show()
```

```
<Figure size 432x288 with 0 Axes>
```



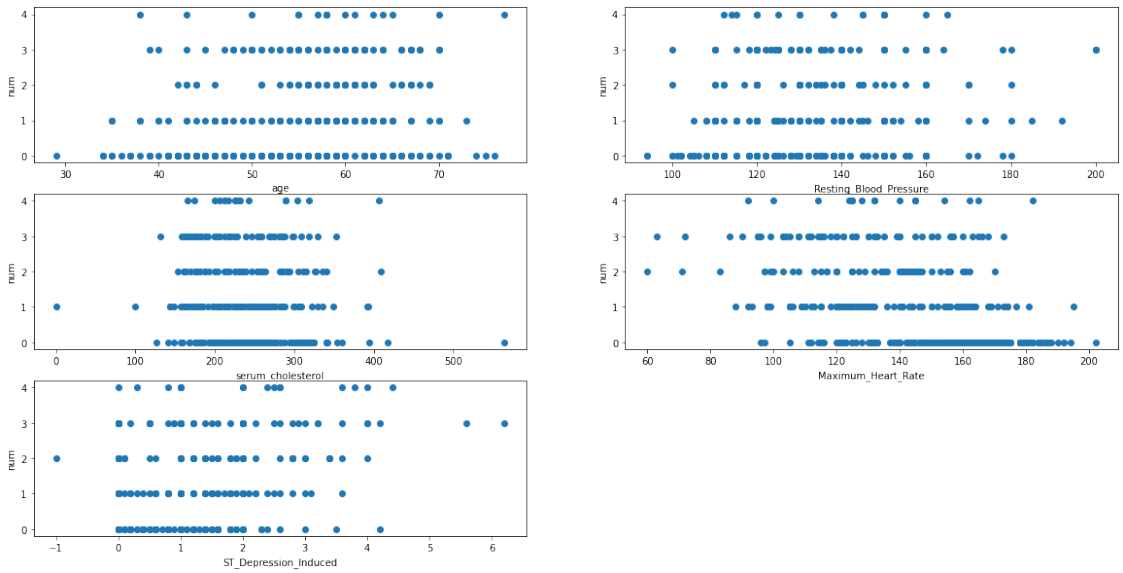
2.0.5 Target Variable vs Independent Variable (Continous)

[49]:
```
plt.figure(1)
plt.figure(figsize = (20, 10))

# Column (age vs num)
plt.subplot(321)
plt.ticklabel_format(style = 'plain')
plt.scatter(hd['age'], hd['num'])
plt.xlabel('age')
plt.ylabel('num')

# Column (Resting_Blood_Pressure vs num)
plt.subplot(322)
plt.ticklabel_format(style = 'plain')
plt.scatter(hd['Resting_Blood_Pressure'], hd['num'])
plt.xlabel('Resting_Blood_Pressure')
plt.ylabel('num')

# Column (serum_cholesterol vs num)
plt.subplot(323)
plt.ticklabel_format(style = 'plain')
plt.scatter(hd['serum_cholesterol'], hd['num'])
plt.xlabel('serum_cholesterol')
plt.ylabel('num')

# Column (Maximum_Heart_Rate vs num)
plt.subplot(324)
plt.ticklabel_format(style = 'plain')
plt.scatter(hd['Maximum_Heart_Rate'], hd['num'])
plt.xlabel('Maximum_Heart_Rate')
```

```
plt.ylabel('num')

# Column (ST_Depression_Induced vs num)
plt.subplot(325)
plt.ticklabel_format(style = 'plain')
plt.scatter(hd['ST_Depression_Induced'], hd['num'])
plt.xlabel('ST_Depression_Induced')
plt.ylabel('num')
```

[49]:
```
Text(0, 0.5, 'num')
```

```
<Figure size 432x288 with 0 Axes>
```



3 ML Models

[50]:
```
def replace_fun(column):
    l = hd[column].unique()
    for i,j in enumerate(l):
        hd[column] = hd[column].replace(j,i)

    return hd[column]
```

[51]:
```
replace_fun('sex')
replace_fun('Chest_Pain_Type')
replace_fun('Fasting_Blood_Sugar')
replace_fun('Resting_Electrocardiographic')
replace_fun('Exercise_Induced_Angina')
```

```
replace_fun('slope')
replace_fun('Heart_Condition')
hd.head()
```

[51]:

	age	sex	Chest_Pain_Type	Resting_Blood_Pressure	serum_cholesterol	Fasting_Blood_Sugar	Resting_Electrocardiographic	Maximum_Heart_Rate	Exercise_Induced_Angina	ST_Depression_Induced	slope	Heart_Condition	num
0	63	0	0	145.0	233.0	1	0	150.0	0	2.3	0	0	0
1	67	0	1	160.0	286.0	1	0	108.0	1	1.5	1	1	2
2	67	0	1	120.0	229.0	1	0	129.0	1	2.6	1	2	1
3	37	0	2	130.0	250.0	1	1	187.0	0	3.5	0	1	0
4	41	1	3	130.0	204.0	1	0	172.0	0	1.4	2	1	0

[52]:
```
X = hd.drop('num', axis=1)
Y = hd['num']
```

[53]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X,Y)
```

3.0.1 KNN Model

[54]:
```
gs_knn = {'n_neighbors':[5,21,31],'weights':['uniform','distance'],'p':
 ↪[1,2],'leaf_size':[10,15,40]}
```

[56]:
```
knn = GridSearchCV(KNeighborsClassifier(), param_grid=gs_knn, cv=15)
knn.fit(X_train,Y_train)
```

[56]:
```
GridSearchCV(cv=15, estimator=KNeighborsClassifier(),
             param_grid={'leaf_size': [10, 15, 40], 'n_neighbors': [5, 21, 31],
                         'p': [1, 2], 'weights': ['uniform', 'distance']})
```

[57]:
```
knn.best_score_, knn.best_estimator_
```

[57]:
```
(0.5046783625730994,
 KNeighborsClassifier(leaf_size=10, n_neighbors=21, p=1, weights='distance'))
```

[58]:
```
knn.score(X_train, Y_train),knn.score(X_test, Y_test)
```

[58]:
```
(1.0, 0.5053763440860215)
```

3.0.2 SVM Model

We can use Label Encoding but i have just tried by making a function above, so will continue with that.

[ ]:
```
# X_1 = X1.copy()
# for col in X1.columns:
#     lb = LabelEncoder()
#     X_1[col] = lb.fit_transform(X1[col].values)

# X_1.head()
```

[59]:
```
svm = SVC(kernel = 'poly', C =1500)
svm.fit(X_train, Y_train)
```

[59]:
```
SVC(C=1500, kernel='poly')
```

[60]:
```
svm.score(X_train,Y_train), svm.score(X_test, Y_test)
```

[60]:
```
(0.6415770609318996, 0.5161290322580645)
```

3.0.3 Naive Bayes Model

[61]:
```
nb = GaussianNB()
nb.fit(X_train,Y_train)
```

[61]:
```
GaussianNB()
```

[62]:
```
nb.score(X_train, Y_train), nb.score(X_test, Y_test)
```

[62]:
```
(0.5663082437275986, 0.4838709677419355)
```

3.0.4 Decision Tree with Grid Search CV

[63]:
```
dt = DecisionTreeClassifier()
dt.fit(X_train, Y_train)
```

[63]:
```
DecisionTreeClassifier()
```

[64]:
```
param_grid = {"max_depth": [5, 8, None],
              "max_features": [5, 8, 12],
              "min_samples_split": [4, 7, 10],
              "criterion": ["gini", "entropy"]}
```

[65]:
```
gs = GridSearchCV(dt, param_grid=param_grid, cv=20)
gs.fit(X, Y)
```

[65]:
```
GridSearchCV(cv=20, estimator=DecisionTreeClassifier(),
             param_grid={'criterion': ['gini', 'entropy'],
                         'max_depth': [5, 8, None], 'max_features': [5, 8, 12],
                         'min_samples_split': [4, 7, 10]})
```

[66]:
```
gs.score(X_train, Y_train), gs.score(X_test, Y_test)
```

[66]:
```
(0.6379928315412187, 0.5913978494623656)
```

3.0.5 Random Forest

[67]:
```
rfc = RandomForestClassifier()
rfc.fit(X_train, Y_train)
```

[67]:
```
RandomForestClassifier()
```

[68]:
```
rfc.score(X_train, Y_train),rfc.score(X_test, Y_test)
```

[68]:
```
(1.0, 0.4838709677419355)
```

[69]:
```
rfc.feature_importances_
```

[69]:
```
array([0.11766391, 0.02921877, 0.06966261, 0.12636389, 0.13877517,
       0.        , 0.04814355, 0.18848835, 0.04584362, 0.11553022,
       0.04465302, 0.07565688])
```

[70]:
```
feature_importance = pd.DataFrame({'importance': rfc.feature_importances_},␣
↪index= X.columns).sort_values('importance')
feature_importance
```

[70]:

	importance
Fasting_Blood_Sugar	0.000000
sex	0.029219
slope	0.044653
Exercise_Induced_Angina	0.045844
Resting_Electrocardiographic	0.048144
Chest_Pain_Type	0.069663
Heart_Condition	0.075657
ST_Depression_Induced	0.115530
age	0.117664
Resting_Blood_Pressure	0.126364
serum_cholesterol	0.138775
Maximum_Heart_Rate	0.188488

[71]:
```
feature_importance[feature_importance.importance > 0.06]
```

[71]:

	importance
Chest_Pain_Type	0.069663
Heart_Condition	0.075657
ST_Depression_Induced	0.115530
age	0.117664
Resting_Blood_Pressure	0.126364
serum_cholesterol	0.138775
Maximum_Heart_Rate	0.188488

3.0.6 AdaBoost

[72]:
```
ada = AdaBoostClassifier()
ada.fit(X, Y)
```

[72]:
```
AdaBoostClassifier()
```

[73]:
```
ada.score(X_train, Y_train),ada.score(X_test, Y_test)
```

[73]:
```
(0.5698924731182796, 0.5591397849462365)
```

[ ]:
```

```