HM2, (MATLAB or any software is fine) Due on March 22, 2024

Given a Data matrix with 58 rows and 2 columns that represents the Cartesian coordinates of 58 towns in West Germany:

1 Augsburg, 2 Bielefeld, 3 Bochum, 4 Bremen, 5 Darmstadt, 6 Essen, 7 Freiburg,

8 Hamburg, 9 Hannover, 10 Heilbronn, 10 Kaiserslautern, 132 Karlsruhe, 13 Kassel, 14 Kempten

15 Koblenz, 16 Koeln, 17 Landshut, 18 Lichtenfels, 19 Mainz, 20 Muenchen, 21 Muenster

22 Neuss, 23 Nuernburg, 24 Oldenburg, 25 Regensburg, 26 Rendsburg, 27 Stuttgart

28 Ulm, 29 Wuerzburg, 30 Aachen, 31 Ansbach, 32 Aschaffenburg, 33 Bamberg, 34 Bayreuth

35 Bonn, 36 Braunschweig, 37 Bremen, 38 Coburg, 39 Dortmund, 40 Duesseldorf

41 Duisburg, 42 Erlangen, 43 Frankfurt, 44 Fulda, 45 Fuerth, 46 Gelsen-Kirchen

47 Gummersburg, 48 Hagen, 49 Hersbruck, 50 Ingolstadt, 51 Kiel, 52 Mannheim

53 Marburg, 54 Offenburg, 55 Osnabrueck, 56 Reutlingen, 57 Saarbruecken, 58 Siegen

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Reference: Helmut Spaeth, ``Cluster Analysis Algorithms for Data Reduction and Classification of Objects, Ellis Horwood, 1980, page 80.

#

City coordinates (according to the numerical order listed above) **stored in the file Xdata.mat and** their affiliation (1=NW or 2=SE) **stored in the file idx.mat**

(1) 54.0 -65.0, (2) 0.0 71.0, (3) -31.0 53.0, (4) 8.0 111.0, (5) 1.0 -9.0, (6) -36.0 52.0, (7) -22.0 -76.0,

(8) 34.0 129.0, (9) 28.0 84.0, (10) 12.0 -38.0, (11) -21.0 -26.0, (12) -6.0 -41.0, (13) 21.0 45.0

(14) 38.0 -90.0, (15) -24.0 10.0, (16) -38.0 35.0, (17) 86.0 -57.0, (18) 58.0 -1.0, (19) -9.0 -3.0

(20) 70.0 -74.0, (21) -20.0 70.0, (22) -43.0 44.0, (23) 59.0 -26.0, (24) -5.0 114.0, (25) 83.0 -41.0

(26) 27.0 153.0, (27) 12.0 -49.0, (28) 30.0 -65.0, (29) 31.0 -12.0, (30) -57.0 28.0, (31) 44.0 -28.0

(32) 7.0 -7.0, (33) 54.0 -8.0, (34) 65.0 -8.0, (35) -35.0 25.0, (36) 46.0 79.0, (37) 5.0 118.0

(38) 56.0 4.0, (39) -21.0 54.0, (40) -40.0 45.0, (41) -43.0 51.0, (42) 57.0 -21.0, (43) 0.0 0.0

(44) 25.0 15.0, (45) 56.0 -25.0, (46) -34.0 56.0, (47) -24.0 36.0, (48) -25.0 49.0, (49) 64.0 -26.0

(50) 63.0 -48.0, (51) 37.0 155.0, (52) -5.0 -24.0, (53) 2.0 28.0, (54) -18.0 -58.0, (55) -10.0 82.0

(56) 12.0 -58.0, (57) -40.0 -28.0, (58) -16.0 28.0

The city coordinates can be plotted on a 2 dimensional plane in MATLAB by

```
%%%%%%%%%%%%%%%%%%%%
clear
close all
load Xdata
load idx
hold on
for i=1:length(Xdata)
   text(Xdata(i,1),Xdata(i,2),num2str(i))
end
axis([-60 100 -100 180])
figure
hold on
for i=1:length(Xdata)
   if idx(i) > 1.5
     plot(Xdata(i,1),Xdata(i,2),'bo')
   else plot(Xdata(i,1),Xdata(i,2),'r+')
   end
end
testdata=[0 22];
plot(testdata(1),testdata(2),'bd','linewidth',4)
%%%%%%%%%%%%%%%%%%%%
```

Cities 26, 51, 24,4 37,8,55,9,36,21,2,41,6,46,3,22,40,16,39,48,13,30,35,58,53,47, 15,58,53,13,36 are in the class north-west (NW) and the rests are in class south- east (SE) cities. City identification is in the data set idx.mat (load idx in MATLAB)

1) Determine the separating line in terms of the slope (m) and y-intercept (b).
2) Plot the separating line on top of cities on a two-dimensional plane.
3) The coordinate of the city Giessen is (0,22). Determine if Giessen is in the cluster NW or the cluster SE?