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1  # <linkageDistances name="Joyson" rollNo=8390 />
2
3  import math
4
5  l3=[]
6  l4=[]
7  l5=[]
8  l6=[]
9
10 def singleLinkage(x,y,m,n):
11     l5=[]
12     for i in range(m):
13         for j in range(n):
14             distance1 = math.sqrt(sum([(a-b)**2 for a,b in zip(x[i],
15                                     y[j])]))
16             l5.append(distance1)
17
18     distance = min(l5)
19     print("Single linkage distance between the two clusters is ",
20           distance)
21
22 def completeLinkage(x,y,m,n):
23     l5=[]
24     for i in range(m):
25         for j in range(n):
26             distance1 = math.sqrt(sum([(a-b)**2 for a,b in zip(x[i],
27                                     y[j])]))
28             l5.append(distance1)
29
30     distance = max(l5)
31     print("Complete linkage distance between the two clusters is ",
32           distance)
33
34 def avgLinkage(x,y,m,n):
35     sum1=0
36     sum2=0
37     for i in x:
38         for j in y:
39             sum1 += abs(i[0]-j[0])
40             sum2 += abs(i[1]-j[1])
41
42     sum = math.sqrt(sum1**2+sum2**2)
43     sum = sum/(m*n)
44     print("Average linkage distance between the two clusters is ",sum)
45
46 def centroidLinkage(x,y,m,n):
47     sum=0
48     sum1=0
49     sum2=0
50     sum3=0
51     sum4=0
52     for i in x:

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51         sum1+=i[0]
52         sum2+=i[1]
53     sum1=sum1/m
54     sum2=sum2/m
55
56     for j in y:
57         sum3+=j[0]
58         sum4+=j[1]
59     sum3=sum3/n
60     sum4=sum4/n
61     sum5 = abs(sum1-sum3)
62     sum6 = abs(sum2-sum4)
63     sum = math.sqrt(sum5**2+sum6**2)
64     print("Centroid linkage distance between the two clusters is ",
        sum)
65
66
67 while(1) :
68     print("roll no 8390, name = Joyson Gaurea\n1) Enter data
        clusters\n2) Calculate linkage distances\n3) Exit");
69     choice = int(input())
70     if choice == 1 :
71         print("Enter first cluster")
72         u=int(input("Enter number of data points\n"))
73         for g in range(u):
74             print("Enter data point")
75             l1 = [int (a) for a in input().strip().split(",")]
76             l3.append(l1)
77         print("Enter second cluster")
78         v=int(input("Enter number of data points\n"))
79         for g in range(v):
80             print("Enter data point")
81             l2 = [int (a) for a in input().strip().split(",")]
82             l4.append(l2)
83     elif choice == 2 :
84         m = len(l3)
85         n = len(l4)
86         print("Clusters are ",l3," ",l4)
87         singleLinkage(l3,l4,m,n)
88         completeLinkage(l3,l4,m,n)
89         avgLinkage(l3,l4,m,n)
90         centroidLinkage(l3,l4,m,n)
91     elif choice == 3 :
92         break
93     else : print("Invalid choice, enter again\n")
94
95
96
97
98 '''
99 Output1
100
101 λ python linkageDistances.py
102 rollno 8390, name = Joyson Gaurea

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```
103 1) Enter data clusters
104 2) Calculate linkage distances
105 3) Exit
106 1
107 Enter first cluster
108 Enter number of data points
109 2
110 Enter data point
111 1,0
112 Enter data point
113 2,0
114 Enter second cluster
115 Enter number of data points
116 3
117 Enter data point
118 3,0
119 Enter data point
120 4,0
121 Enter data point
122 5,0
123 roll no 8390, name = Joyson Gaurea
124 1) Enter data clusters
125 2) Calculate linkage distances
126 3) Exit
127 2
128 Clusters are [[1, 0], [2, 0]] [[3, 0], [4, 0], [5, 0]]
129 Single linkage distance between the two clusters is 1.0
130 Complete linkage distance between the two clusters is 4.0
131 Average linkage distance between the two clusters is 2.5
132 Centroid linkage distance between the two clusters is 2.5
133
134
135 Output2
136 λ python linkageDistances.py
137 roll no 8390, name = Joyson Gaurea
138 1) Enter data clusters
139 2) Calculate linkage distances
140 3) Exit
141 1
142 Enter first cluster
143 Enter number of data points
144 2
145 Enter data point
146 1,2
147 Enter data point
148 2,3
149 Enter second cluster
150 Enter number of data points
151 3
152 Enter data point
153 3,4
154 Enter data point
155 4,5
156 Enter data point
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157 5,6
158 roll no 8390, name = Joyson Gaurea
159 1) Enter data clusters
160 2) Calculate linkage distances
161 3) Exit
162 2
163 Clusters are [[1, 2], [2, 3]] [[3, 4], [4, 5], [5, 6]]
164 Single linkage distance between the two clusters is
    1.4142135623730951
165 Complete linkage distance between the two clusters is
    5.656854249492381
166 Average linkage distance between the two clusters is
    3.5355339059327378
167 Centroid linkage distance between the two clusters is
    3.5355339059327378
168 '''
```