**MACHINE LEARNING ASSIGNMENT 6**

**Preetham Kesireddy**

**ID: 700741299**

**Github Link:** [**https://github.com/700741299-Preetham/Machine-Learning/tree/main/Assignment%206**](https://github.com/700741299-Preetham/Machine-Learning/tree/main/Assignment%206)

**Video Link:** [**https://youtu.be/shhDtqMAxno**](https://youtu.be/shhDtqMAxno)

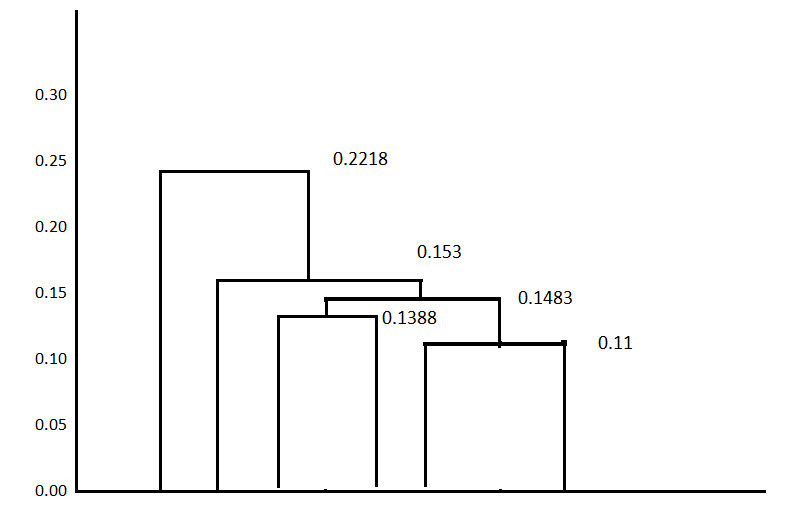
**Question 1**

Single Link Proximity:

* In **Single Linkage,**the distance between two clusters is the minimum distance between members of the two clusters

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **p1** | | **p2** | | **p3** | | **p4** | | **p5** | **p6** |
| **p1** | | 0 | | 0.2357 | | 0.2218 | | 0.3688 | | 0.3421 | 0.2347 |
| **p2** | | 0.2357 | | 0 | | 0.1483 | | 0.2042 | | 0.1388 | 0.254 |
| **p3** | | 0.2218 | | 0.1483 | | 0 | | 0.1513 | | 0.2843 | 0.11 |
| **p4** | | 0.3688 | | 0.2042 | | 0.1513 | | 0 | | 0.2932 | 0.2216 |
| **p5** | | 0.3421 | | 0.1388 | | 0.2843 | | 0.2932 | | 0 | 0.3921 |
| **p6** | | 0.2347 | | 0.254 | | 0.11 | | 0.2216 | | 0.3921 | 0 |
|  | |  | |  | |  | |  | |  |  |
| smallest distance is | | | | | | | | | | 0.11 |  |
| so p3 and p6 forms first cluster | | | | | | | | | | |
|  | **p1** | | **p2** | | **p36** | | **p4** | | **p5** | |
| **p1** | 0 | | 0.2357 | | 0.2218 | | 0.3688 | | 0.3421 | |
| **p2** | 0.2357 | | 0 | | 0.1483 | | 0.2042 | | 0.1388 | |
| **p36** | 0.2218 | | 0.1483 | | 0 | | 0.1513 | | 0.2843 | |
| **p4** | 0.3688 | | 0.2042 | | 0.1513 | | 0 | | 0.2932 | |
| **p5** | 0.3421 | | 0.1388 | | 0.2843 | | 0.2932 | | 0 | |
|  |  | |  | |  | |  | |  | |
| smallest distance is | | | | | | | | | 0.1388 | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| so p2 and p5 forms 2nd cluster | | | | | |
|  | **p1** | **p25** | **p36** | **p4** |  |
| **p1** | 0 | 0.2357 | 0.2218 | 0.3688 |  |
| **p25** | 0.2357 | 0 | 0.1483 | 0.2042 |  |
| **p36** | 0.2218 | 0.1483 | 0 | 0.1513 |  |
| **p4** | 0.3688 | 0.2042 | 0.1513 | 0 |  |
|  |  |  |  |  |  |
| smallest distance is | | | | | 0.1483 |
| so p25 and p36 forms 3rdcluster | | | | | |
|  |  |  |  |  |  |
|  | **p1** | **p(25)(36)** | **p4** |  |  |
| **p1** | 0 | 0.2218 | 0.3688 |  |  |
| **p(25)(36)** | 0.2218 | 0 | 0.1513 |  |  |
| **p4** | 0.3688 | 0.1513 | 0 |  |  |
|  |  |  |  |  |  |
| smallest distance is | | | | | 0.153 |
| so p(25)(36)and p4 forms 4thcluster | | | | | |
|  | **p1** | **p4(25)(36)** |  |  |  |
| **p1** | 0 | 0.2218 |  |  |  |
| **p4(25)(36)** | 0.2218 | 0 |  |  |  |

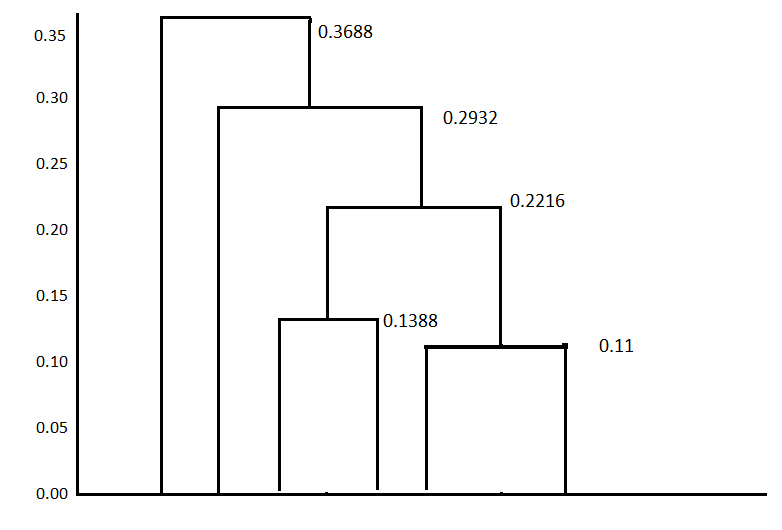


**1 4 2 5 3 6**

Complete Link Proximity:

* In **Complete Linkage,**the distance between two clusters is the maximum distance between members of the two clusters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **p1** | **p2** | **p3** | **p4** | **p5** | **p6** |
| **p1** | 0 | 0.2357 | 0.2218 | 0.3688 | 0.3421 | 0.2347 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **p2** | 0.2357 | 0 | 0.1483 | 0.2042 | 0.1388 | 0.254 |
| **p3** | 0.2218 | 0.1483 | 0 | 0.1513 | 0.2843 | 0.11 |
| **p4** | 0.3688 | 0.2042 | 0.1513 | 0 | 0.2932 | 0.2216 |
| **p5** | 0.3421 | 0.1388 | 0.2843 | 0.2932 | 0 | 0.3921 |
| **p6** | 0.2347 | 0.254 | 0.11 | 0.2216 | 0.3921 | 0 |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.11 |  |
| so p3 and p6 forms first cluster | | | | | |  |
|  | **p1** | **p2** | **p36** | **p4** | **p5** |  |
| **p1** | 0 | 0.2357 | 0.2347 | 0.3688 | 0.3421 |  |
| **p2** | 0.2357 | 0 | 0.254 | 0.2042 | 0.1388 |  |
| **p36** | 0.2347 | 0.254 | 0 | 0.2216 | 0.3921 |  |
| **p4** | 0.3688 | 0.2042 | 0.2216 | 0 | 0.2932 |  |
| **p5** | 0.3421 | 0.1388 | 0.3921 | 0.2932 | 0 |  |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.1388 |  |
| so p2 and p5 forms 2nd cluster | | | | | |  |
|  | **p1** | **p25** | **p36** | **p4** |  |  |
| **p1** | 0 | 0.3421 | 0.2347 | 0.3688 |  |  |
| **p25** | 0.3421 | 0 | 0.3921 | 0.2932 |  |  |
| **p36** | 0.2347 | 0.3921 | 0 | 0.2216 |  |  |
| **p4** | 0.3688 | 0.2932 | 0.2216 | 0 |  |  |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.2216 |  |
| so p25 and p36 forms 3rdcluster | | | | | |  |
|  | **p1** | **p(25)(36)** | **p4** |  |  |  |
| **p1** | 0 | 0.3421 | 0.3688 |  |  |  |
| **p(25)(36)** | 0.3421 | 0 | 0.2932 |  |  |  |
| **p4** | 0.3688 | 0.2932 | 0 |  |  |  |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.2932 |  |
| so p(25)(36)and p1 forms 4thcluster | | | | | |  |
|  | **p1(25)(36)** | **p4** |  |  |  |  |
| **p1(25)(36)** | 0 | 0.1483 |  |  |  |  |
| **p4** | 0.3688 | 0 |  |  |  |  |

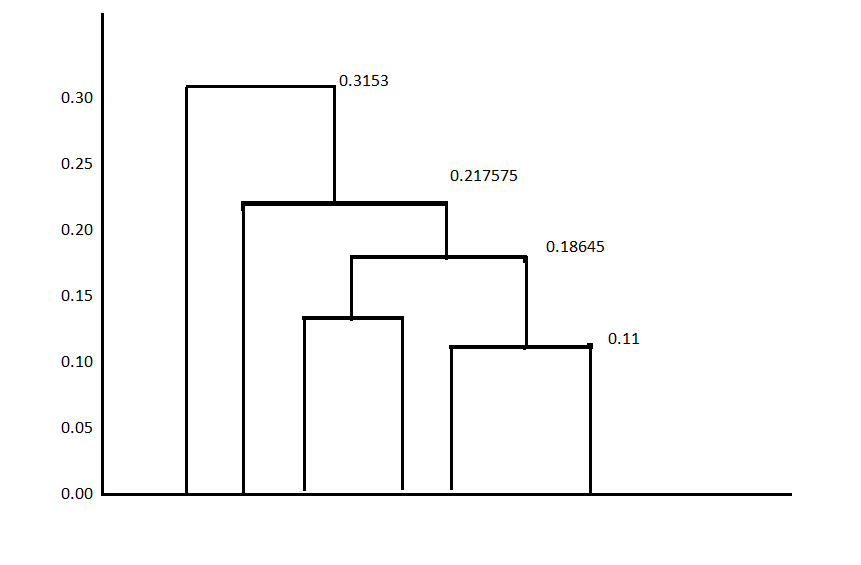


**4 1 2 5 3 6**

Average Link Proximity:

* In **Average Linkage,**the distance between two clusters is the average of all distances between members of the two clusters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **p1** | **p2** | **p3** | **p4** | **p5** | **p6** |
| **p1** | 0 | 0.2357 | 0.2218 | 0.3688 | 0.3421 | 0.2347 |
| **p2** | 0.2357 | 0 | 0.1483 | 0.2042 | 0.1388 | 0.254 |
| **p3** | 0.2218 | 0.1483 | 0 | 0.1513 | 0.2843 | 0.11 |
| **p4** | 0.3688 | 0.2042 | 0.1513 | 0 | 0.2932 | 0.2216 |
| **p5** | 0.3421 | 0.1388 | 0.2843 | 0.2932 | 0 | 0.3921 |
| **p6** | 0.2347 | 0.254 | 0.11 | 0.2216 | 0.3921 | 0 |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.11 |  |
| so p3 and p6 forms first cluster | | | | | |  |
|  | **p1** | **p2** | **p36** | **p4** | **p5** |  |
| **p1** | 0 | 0.2357 | 0.22825 | 0.3688 | 0.3421 |  |
| **p2** | 0.2357 | 0 | 0.20115 | 0.2042 | 0.1388 |  |
| **p36** | 0.22825 | 0.20115 | 0 | 0.18645 | 0.3382 |  |
| **p4** | 0.3688 | 0.2042 | 0.18645 | 0 | 0.2932 |  |
| **p5** | 0.3421 | 0.1388 | 0.3382 | 0.2932 | 0 |  |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.1388 |  |
| so p2 and p5 forms 2nd cluster | | | | | |  |
|  | **p1** | **p25** | **p36** | **p4** |  |  |
| **p1** | 0 | 0.2889 | 0.2347 | 0.3688 |  |  |
| **p25** | 0.2889 | 0 | 0.269675 | 0.2487 |  |  |
| **p36** | 0.2347 | 0.269675 | 0 | 0.18645 |  |  |
| **p4** | 0.3688 | 0.2487 | 0.18645 | 0 |  |  |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.18645 |  |
| so p25 and p36 forms 3rdcluster | | | | | |  |
|  | **p1** | **p(25)(36)** | **p4** |  |  |  |
| **p1** | 0 | 0.2618 | 0.3688 |  |  |  |
| **p(25)(36)** | 0.2618 | 0 | 0.217575 |  |  |  |
| **p4** | 0.3688 | 0.217575 | 0 |  |  |  |
|  |  |  |  |  |  |  |
| smallest distance is | | | | | 0.217575 |  |
| so p(25)(36)and p1 forms 4thcluster | | | | | |  |
|  | **p1(25)(36)** | **p4** |  |  |  |  |
| **p1(25)(36)** | 0 | 0.3153 |  |  |  |  |
| **p4** | 0.3153 | 0 |  |  |  |  |



**4 1 2 5 3 6**

Question 2

2.a

Text

Description automatically generated

Text

Description automatically generated

2.b

Graphical user interface, text, application

Description automatically generated

Text

Description automatically generated

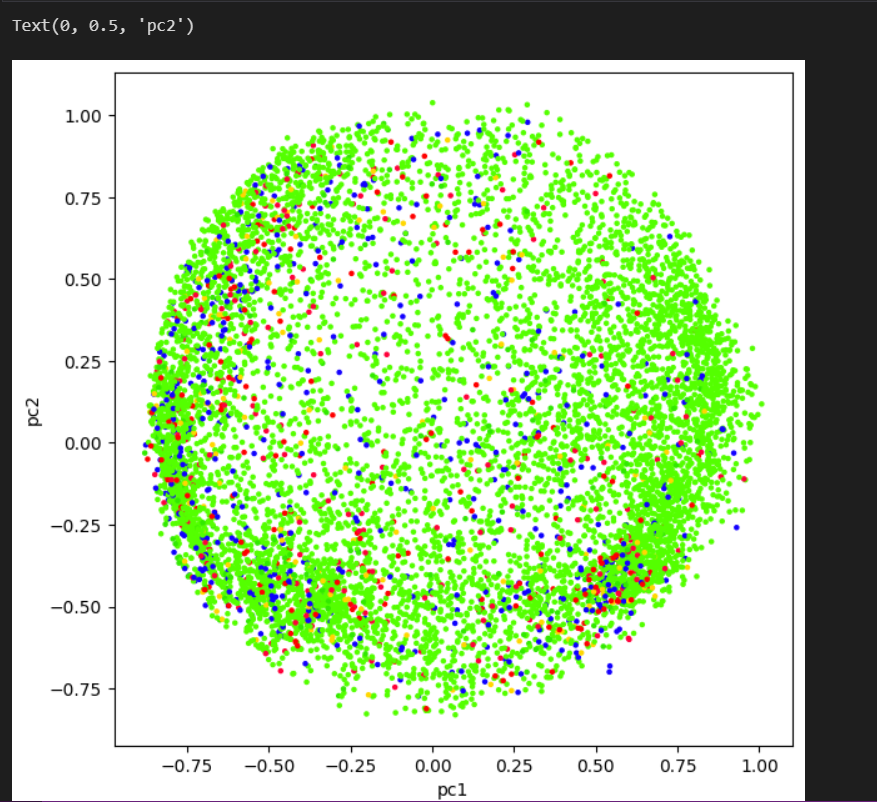
Graphical user interface, text, application

Description automatically generated

2.c

Text

Description automatically generated



2.d For K = 2

Chart

Description automatically generated

For K = 3

Chart

Description automatically generated

For K = 4

Chart

Description automatically generated

For K = 5

Chart

Description automatically generated

2.e. Bar Chart:

Text

Description automatically generated

Chart, bar chart

Description automatically generated