**Ans1:**

**a)**

Dissim(0001, 0150) = 1 - = = 0.6

Dissim(0001, 0553) = 1 - = ≈ 0.857

Dissim(0001, 1011) = 1 - = 1

Dissim(0001, 3997) = 1 - = ≈ 0.833

Dissim(0150, 0553) = 1 - = 1

Dissim(0150, 1011) = 1 - = 1

Dissim(0150, 3997) = 1 - = 1

Dissim(0553, 1011) = 1 - = = 0.5

Dissim(0553, 3997) = 1 - = = 0.6

Dissim(1011, 3997) = 1 - = 1

dissimilarity matrix:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 0001 | 0150 | **0553** | 1011 | 3997 |
| 0001 | 0 | - | - | - | - |
| 0150 | 0.6 | 0 | - | - | - |
| 0553 | 0.857 | 1 | 0 | - | - |
| **1011** | 1 | 1 | **0.5** | 0 | - |
| 3997 | 0.833 | 1 | 0.6 | 1 | 0 |

**b)**

merge 0553 and 1011 (0.5), we have:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 0553&1011 | **0001** | 0150 | 3997 |
| 0553&1011 | 0 | - | - | - |
| 0001 | 0.857 | 0 | - | - |
| **0150** | 1 | **0.6** | 0 | - |
| 3997 | 0.6 | 0.833 | 1 | 0 |

merge 0001 and 0150 (0.6), we have:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **0553&1011** | 0001&0150 | 3997 |
| 0553&1011 | 0 | - | - |
| 0001&0150 | 0.857 | 0 | - |
| **3997** | **0.6** | 0.833 | 0 |

merge 0553&1011 and 3997 (0.6), we have:

|  |  |  |
| --- | --- | --- |
|  | 0001&0150 | 0553&1011&3997 |
| 0001&0150 | 0 | - |
| 0553&1011&3997 | 0.833 | 0 |

Step4

Step3

Step2

Step1

Step0

3997

0553&1011&3997

0553

0001&0150

&1011

0553&1011  
&3997&0001&0150

0553&1011

0150

0001

1011

**c)**

**Ans2**

**a)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 |
| P1 | 0 |  |  |  |  |  |  |  |
| P2 | 4 | 0 |  |  |  |  |  |  |
| P3 | 8.49 | 6.32 | 0 |  |  |  |  |  |
| P4 | 3.61 | 3.61 | 5 | 0 |  |  |  |  |
| P5 | 7.81 | 5.39 | 1 | 4.47 | 0 |  |  |  |
| P6 | 7.21 | 4.47 | 2 | 4.12 | 1 | 0 |  |  |
| P7 | 8.06 | 4.12 | 7.28 | 7.21 | 6.32 | 5.39 | 0 |  |
| P8 | 2.24 | 3.61 | 6.40 | 1.41 | 5.83 | 5.39 | 7.62 | 0 |

**b)**

initial centroids:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Group 1 | Group 2 | Group 3 |
| Record | P1 | P4 | P7 |
| Cluster Mean | (2,10) | (5,8) | (1,2) |

Calculate distances to cluster mean:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Group 1 | Group 2 | Group 3 |
|  | Distance to P1 | Distance to P4 | Distance to P7 |
| P1 | **0** | - | - |
| P2 | 4 | **3.61** | 4.12 |
| P3 | 8.49 | **5** | 7.28 |
| P4 | - | **0** | - |
| P5 | 7.81 | **4.47** | 6.32 |
| P6 | 7.21 | **4.12** | 5.39 |
| P7 | - | - | **0** |
| P8 | 2.24 | **1.41** | 7.62 |

New centroids:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Group 1 | Group 2 | Group 3 |
| Record | P1 | Mean of (P2, P3, P4, P5, P6, P8) | P7 |
| Cluster Mean | (2, 10) | (5.33, 5.833) | (1, 2) |

**i)** the new cluster: C1={P1}, C2={P2, P3, P4, P5, P6, P8}, C3={P7}

**ii)** The centroids of the new clusters: (2, 10) of C1, (5.33, 5.833) of C2, (1, 2) of C3