2.) AHC (Algoritma Hierarchical clustering)

Data	Num_reactions	Num_likes	Num_Love
1	226	189	25
2	252	204	45
3	337	300	35
4	177	150	27
5	298	262	34
6	192	168	22
7	147	141	5
8	161	153	8
9	317	269	47
10	321	275	44
11	282	257	20
12	199	186	13

SINGLE LINK

Rumus Minskowsky = 4

* ITERASI 1

→ $d(x,y)_{1,1} = (|226-226|^4 + |189-189|^4 + |25-25|^4)^{1/4} = 0$ //

d1. $d(x,y)_{1,2} = (|226-252|^4 + |189-204|^4 + |25-45|^4)^{1/4}$

$= 28,584$ //

→ $d(x,y)_{1,3} = (|226-337|^4 + |189-300|^4 + |25-35|^4)^{1/4} = 132.$

→ $d(x,y)_{1,4} = (|226-177|^4 + |189-150|^4 + |25-27|^4)^{1/4} = 53.31$

→ $d(x,y)_{1,5} = (|226-298|^4 + |189-262|^4 + |25-34|^4)^{1/4} = 86.23$

→ $d(x,y)_{1,6} = (|226-192|^4 + |189-168|^4 + |25-22|^4)^{1/4} = 35.18$

→ $d(x,y)_{1,7} = (|226-147|^4 + |189-141|^4 + |25-5|^4)^{1/4} = 81.64$

→ $d(x,y)_{1,8} = (|226-161|^4 + |189-153|^4 + |25-8|^4)^{1/4} = 66.56$

→ $d(x,y)_{1,9} = (|226-317|^4 + |189-269|^4 + |25-47|^4)^{1/4} = 102.36$

→ $d(x,y)_{1,10} = (|226-321|^4 + |189-275|^4 + |25-44|^4)^{1/4} = 108.05$

→ $d(x,y)_{1,11} = (|226-282|^4 + |189-257|^4 + |25-20|^4)^{1/4} = 74.75$

→ $d(x,y)_{1,12} = (|226-199|^4 + |189-186|^4 + |25-13|^4)^{1/4} = 27.26.$

	1	2	3	4	5	6	7	8	9	10	11	12
1	0											
2	28.58	0										
3	132	108.22	0									
4	53.31	79.65	184.61	0								
5	86.23	63.06	45.80	138.85	0							
6	35.18	62.15	165.25	19.88	119.56	0						
7	81.69	108.75	209.96	32.02	164.65	46.60	0					
8	66.55	93.71	194.36	21.09	149.08	31.72	15.60	0				
9	102.36	77.30	32.42	155.51	20.09	136.64	182.40	166.88	0			
10	108.05	83.27	26.08	161.14	23.75	142.14	189.70	172.16	6.36	0		
11	74.75	54.91	59.60	126.07	17.98	106.49	150.52	134.92	37.85	40.72	0	
12	27.26	54.89	151.86	37.38	106.70	18.37	58.13	42.53	124.81	129.95	92.39	0

→ Nilai Terkecil dari Matriks adalah jarak 9 dan 10 Mempunyai Nilai Terkecil 6.36 kemudian bergabung Menjadi1Cluster

→ Menghitung Jarak antara Cluster (9.10) dengan Obyek lain

1. $d(9.10)_1 = \text{Min}(dg.1 ; d10.1) = \text{Min}(102.36 ; 108.05) = 102.36$
2. $d(9.10)_2 = \text{Min}(dg.2 ; d10.2) = \text{Min}(77.30 ; 83.27) = 77.30$
3. $d(9.10)_3 = \text{Min}(dg.3 ; d10.3) = \text{Min}(32.42 ; 26.08) = 26.08$
4. $d(9.10)_4 = \text{Min}(dg.4 ; d10.4) = \text{Min}(155.51 ; 161.14) = 155.51$
5. $d(9.10)_5 = \text{Min}(dg.5 ; d10.5) = \text{Min}(20.04 ; 23.75) = 20.04$
6. $d(9.10)_6 = \text{Min}(dg.6 ; d10.6) = \text{Min}(136.64 ; 142.14) = 136.64$
7. $d(9.10)_7 = \text{Min}(dg.7 ; d10.7) = \text{Min}(182.40 ; 189.70) = 182.40$
8. $d(9.10)_8 = \text{Min}(dg.8 ; d10.8) = \text{Min}(166.88 ; 172.16) = 166.88$
9. $d(9.10)_{11} = \text{Min}(dg.11 ; d10.11) = \text{Min}(37.85 ; 40.72) = 37.85$
10. $d(9.10)_{12} = \text{Min}(dg.12 ; d10.12) = \text{Min}(124.81 ; 129.95) = 124.81$

	1	2	3	4	5	6	7	8	9.10	11	12
1	0										
2	28.58	0									
3	132.00	108.22	0								
4	53.31	79.65	184.61	0							
5	86.23	63.06	45.80	138.85	0						
6	35.18	62.15	165.25	19.88	119.56	0					
7	81.69	108.75	209.96	32.02	164.65	46.60	0				
8	66.55	93.79	194.36	21.09	149.08	31.72	15.60	0			
9.10	102.36	77.30	26.08	155.51	20.09	136.64	182.40	166.88	0		
11	74.75	54.91	59.60	126.07	17.98	106.49	150.52	134.92	37.85	0	
12	27.26	54.89	151.86	37.38	106.70	18.37	58.13	42.53	124.81	92.39	0

→ Nilai terkecil dari Matriks adalah jarak 7 dan 8 Punya Nilai terkecil 15.60 kemudian digabungkan kedalam 1 Cluster

→ Menghitung Jarak antara Cluster (7.8) dengan obyek lain

1. $d(7.8)_1$ = Min $(d7.1 ; d8.1)$ = Min $(81.64 ; 66.55)$ = 66.55
2. $d(7.8)_2$ = Min $(d7.2 ; d8.2)$ = Min $(108.75 ; 93.74)$ = 93.74
3. $d(7.8)_3$ = Min $(d7.3 ; d8.3)$ = Min $(209.96 ; 194.36)$ = 194.36
4. $d(7.8)_4$ = Min $(d7.4 ; d8.4)$ = Min $(32.02 ; 21.04)$ = 21.04
5. $d(7.8)_5$ = Min $(d7.5 ; d8.5)$ = Min $(164.65 ; 149.08)$ = 149.08
6. $d(7.8)_6$ = Min $(d7.6 ; d8.6)$ = Min $(46.60 ; 31.72)$ = 31.72
7. $d(7.8)(9.10)$ = Min $(d7.9\&8 ; d8.(9.10))$ = Min $(182.40 ; 166.88)$ = 166.88
8. $d(7.8)_{11}$ = Min $(d7.11 ; d8.11)$ = Min $(150.52 ; 134.92)$ = 134.92
9. $d(7.8)_{12}$ = Min $(d7.12 ; d8.12)$ = Min $(90.13 ; 42.53)$ = 42.53

	1	2	3	4	5	6	7.8	9.10	11	12
1	0									
2	20584	0								
3	132.00	108.22	0							
4	53.31	79.65	184.61	0						
5	86.23	63.06	45.80	138.85	0					
6	35.18	62.15	161.25	19.088	119.56	0				
7.8	66.55	93.74	194.36	21.04	149.08	31.72	0			
9.10	102.36	77.30	26.08	155.51	20.04	136.94	166.88	0		
11	74.75	54.01	59.60	126.07	17.98	106.41	134.92	37.85	0	
12	27.26	54.84	51.88	37.38	106.70	18.37	42.53	124.81	92.39	0

→ Nilai terkecil dari matriks adalah jarak 5 dan 11 mempunyai nilai terkecil yaitu 17,983 kemudia bergabung menjadi 1 cluster

→ menghitung jarak antara cluster (5.11)

1. $d(5.11)_1$ = min $(d5_1 ; d11_1)$ = min (86,226 ; 74,747) = 74,747
2. $d(5.11)_2$ = min $(d5_2 ; d11_2)$ = min (63,056 ; 54,910) = 54,910
3. $d(5.11)_3$ = min $(d5_3 ; d11_3)$ = min (45,796 ; 59,603) = 45,796
4. $d(5.11)_4$ = min $(d5_4 ; d11_4)$ = min (138,852 ; 126,073) = 126,073
5. $d(5.11)_6$ = min $(d5_6 ; d11_6)$ = min (119,561 ; 106,439) = 106,439
6. $d(5.11),(7,8)$ = min $(d5_7 ; d5_8)$; $(d11_7 ; d11_8)$ = (164 ; 149,076), (150,517 ; 134,920) = 134,920
7. $d(5.11).(9,10)$ = d(20,040 ; 23,754), d(37,852 ; 40,723) = 20,040
8. $d.(5.11)_{12}$ = min d(106,700 ; 92,393) = 92,393

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	1	2	3	4	5, 11	6	7,8	9,10	12
1	0								
2	28,589	0							
3	132,003	108,217	0						
4	53,313	79,656	184,614	0					
5, 11	74,747	54,916	45,796	126,073	0				
6	35,175	62,156	165,248	19,881	106,439	0			
7,8	66,549	93,740	194,359	21,039	139,926	31,722	0		
9,10	102,358	77,298	26,081	155,511	20,040	136,640	166,883	0	
12	27,261	54,839	151,858	37,380	92,393	18,872	42,530	129,812	0

1. $d(6,12)_1 = \min d(35,175 : 27,261), = 27,261$
2. $d(6,12)_2 = \min d(62,150 : 54,839) = 54,839$
3. $d(6,12)_3 = \min d(165,248 : 151,858) = 151,858$
4. $d(6,12)_4 = \min d(19,881 : 37,38) = 19,881$
5. $d(6,12),(5,11) = \min d(119,861 : 106,700), (106,439 : 92,393) = 92,393$
6. $d(6,12),(7,8) = \min d(46,600 : 31,722), (58,128 : 42,530) = 31,722$
7. $d(6,12),(9,10) = \min d(136,640 : 142,199), (124,812 : 129,953) = 129,812$

	1	2	3	4,6,12	5.11	7.8	9.10
1	0						
2	28.58	0					
3	132	108.21	0				
4,6,12	27.26	54,83	151,85	0			
5.11	74,74	54.91	45,79	92,39	0		
7.8	66,54	93,74	194,35	21,03	131,92	0	
9.10	102,35	77,29	26,08	124,81	20,09	146,88	0

→ Nilai terkecil dari Matriks adalah 4,6,12 dan 7.8 Mempunyai nilai terkecil 21.03 kemudian bergabung menjadi 1 cluster.

→ Menghitung Jarak antara Cluster (4.6,12 . 78) dengan objek lain.

1. $d(4,6,12 . 7.8)_1 = \text{Min}(4,6,12.1 ; 7.8.1) = \text{Min}(27,26; 66,54) = 27,26$
2. $d(4,6,12 . 7.8)_2 = \text{Min}(4,6,12.2 ; 7.8.2) = \text{Min}(54,83 ; 93,74) = 54,83$
3. $d(4,6,12 . 78)_3 = \text{Min}(4,6,12.3 ; 7.8.3) = \text{Min}(151,85 ; 194,35) = 151,85$

	1	2	3	4,6,12,7.8	5.11	9.10
1	0					
2	28,58	0				
3	132	108,21	0			
4,6,12,7.8	27,26	54,83	151,85	0		
5.11	74,74	54,91	45,79	92,39	0	
9.10	102,35	77,29	26,08	6,35	20,09	0

→ Nilai terkecil dari Matriks adalah 4,6,12,7,8 dan 9.10 Mempunyai nilai terkecil 6,35 kemudian bergabung menjadi 1 cluster.

→ Menghitung Jarak antara Cluster (4,6,12,7,8 . 9.10) dengan objek lain.

1. $d(4,6,12,7.8 . 9.10)_1 = \text{Min}(4,6,12,7.8.1 ; 9.10.1) = \text{Min}(27,26 ; 102,35) = 27,26$
2. $d(4,6,12,7.8 . 9.10)_2 = \text{Min}(4,6,12,7.8.2 ; 9.10.2) = \text{Min}(54,83 ; 77,29) = 54,83$
3. $d(4,6,12,7.8 . 9.10)_3 = \text{Min}(4,6,12,7.8.3 ; 9.10.3) = \text{Min}(151,85 ; 26,08) = 26,08$

	1	2	3	4,6,7,8,9,10,12	5.11
1	0				
2	28.58	0			
3	132	108.21	0		
4,6,7,8,9,10,12	27.26	54,83	26,08	0	
5.11	79,79	54,91	45.79	20,090	0

→ Nilai terkecil dan Matriks adalah Jarak 4,6,7,8,9, 10,12 dan 5.11 Mempunyai nilai terkecil 20,09 kemudian bergabung menjadi 1 cluster.

→ Menghitung Jarak antara cluster (4,6,7,8,9,10,12 . 5.11) dengan objek la

1. $d(4,6,7,8,9,10,12 \,.\, 5.11)_1 = \text{Min}(4,6,7,8,9,10,12.1 \,;\, 5.11.1) = \text{Min}(27,26 \,;\, 79,79) = 27,26$
2. $d(4,6,7,8,9,10,12.5.11)_2 = \text{Min}(4,6,7,8,9,10,12.2 \,;\, 5.11.2) = \text{Min}(54,83 \,;\, 54,91) = 54,83$
3. $d(4,6,7,8,9,10,12.5.11)_3 = \text{Min}(4,6,7,8,9,10,12.3 \,;\, 5.11.3) = \text{Min}(26,08 \,;\, 45,79) = 26,08$

	1	2	3	4,5,6,7,8,9,10,11,12
1	0			
2	28,58	0		
3	132	108,21	0	
4,5,6,7,8,9,10,11,12	27,26	54,83	26,08	0

→ Nilai terkecil dan Matriks adalah Jarak 3 dan 4,5,6,7,8,9,10,11,12 Mempunyai nilai terkecil 26,08 kemudian bergabung menjadi 1 Cluster.

→ Menghitung Jarak antara Cluster (3 . 4,5,6,7,8,9,10,11,12) dengan objek lain.

1. $d(3 \,.\, 4,5,6,7,8,9,10,11,12)_1 = \text{Min}(3.1 \,;\, 4,5,6,7,8,9,10,11,12.1) = \text{Min}(132 \,;\, 27,26) = 27,26$
2. $d(3 \,.\, 4,5,6,7,8,9,10,11,12)_2 = \text{Min}(3.2 \,;\, 4,5,6,7,8,9,10,11,12.2) = \text{Min}(108,21 \,;\, 54,83) = 54,$

	1	2	3,4,5,6,7,8,9,10,11,12
1	0		
2	28,58	0	
3,4,5,6,7,8,9,10,11,12	27,26	54,83	0