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# LAMPIRAN

**Lampiran 1.** Data Indikator Pendidikan Menurut Ijazah dan Jenis Kelamin Tahun 2018.

Provinsi	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$	$x_8$	$x_9$	$x_{10}$
Selayar	27.66	30.25	27.7	24	13.65	14.23	22.57	16.56	8.43	14.95
Bulukumba	23.95	25.16	24	26.71	21.21	19.64	23.12	16.56	7.73	11.92
Bantaeng	33.7	35.56	23.68	19.43	14.04	15.97	20.46	18.21	8.11	9.84
Jeneponto	36.69	36.74	16.75	21.87	19.98	17.35	18.58	14.74	8.01	9.29
Takalar	27.53	30.21	22.36	24.28	17.9	19.17	27	17.88	5.21	8.45
Gowa	24.06	28.68	21.2	21.82	19.22	18.4	26.42	20.46	9.11	10.63
Sinjai	25.09	25.95	30.38	28.21	16.71	18.84	19.08	15.95	8.74	11.04
Maros	21.93	30.7	20.29	21.07	16.1	17.69	34.74	21.34	6.95	9.2
Pangkep	22.82	26.72	28.14	27.6	16.14	15.58	26.67	19.26	7.23	10.84
Barru	19.35	20.64	32.53	31.82	17.53	17.99	22.29	18	8.31	11.54
Bone	22.32	28.91	33.35	30.25	16.56	14.68	19.97	15.46	7.8	10.7
Soppeng	21.96	26.02	25.01	24.02	20.92	19.73	22.63	18.92	9.48	11.3
Wajo	28.21	31.42	33.48	34	14.38	15.93	15.08	8.62	8.83	10.04
Sidrap	19.22	25.27	28.8	26.62	20.43	19.94	21.89	16.03	9.66	12.14
Pinrang	15.49	24.53	31.98	28.92	18.08	18.34	26.97	17.26	7.48	10.95
Enrekang	13.78	18.79	25	21.53	20.43	24.06	30.73	21.51	10.05	14.12
Luwu	17.89	21.75	20.8	23.41	27.13	23.97	27.54	20.35	6.64	10.52
Tator	23.96	24.5	19.35	22.01	20.53	18.74	27.02	24.03	9.14	10.72
Luwu Utara	20.65	26.16	28.27	28.89	21.94	19.94	23.39	15.74	5.79	9.26
Luwu Timur	15.38	22.24	25.15	22.42	17.33	22.23	34.18	21.46	7.96	11.65
Toraja Utara	24.29	29.93	18.61	17.67	22.37	21.52	25.67	23.22	9.06	10.67
Makassar	12.29	15.87	15.16	14.11	16.6	17.62	37.08	33.02	18.86	19.37
Parepare	8.42	10.99	12.83	16.74	23.34	23.66	37.87	31.35	17.54	17.27
Palopo	11.61	9.69	15.55	14.37	19.46	24.41	36.58	31.82	16.79	19.71

**Lampiran 2. Matriks Varians Kovarians**

Var	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$	$x_8$	$x_9$	$x_{10}$
$x_1$	45.706	41.453	8.275	10.389	-7.717	-12.569	-32.192	-25.785	-14.009	-13.673
$x_2$	41.453	44.592	13.478	13.250	-7.974	-13.103	-29.912	-28.388	-16.967	-16.196
$x_3$	8.275	13.478	36.577	28.674	-8.137	-8.412	-24.615	-26.463	-11.922	-7.984
$x_4$	10.389	13.250	28.674	27.284	-3.823	-6.872	-23.341	-25.120	-11.721	-9.160
$x_5$	-7.717	-7.974	-8.137	-3.823	10.243	7.098	4.605	5.041	0.897	0.328
$x_6$	-12.569	-13.103	-8.412	-6.872	7.098	8.705	10.364	8.666	3.3605	3.058
$x_7$	-32.192	-29.912	-24.615	-23.341	4.605	10.364	39.346	31.412	12.871	11.669
$x_8$	-25.785	-28.388	-26.463	-25.120	5.041	8.666	31.412	32.333	15.753	13.020
$x_9$	-14.009	-16.967	-11.922	-11.721	0.897	3.360	12.871	15.753	12.058	9.601
$x_{10}$	-13.67	-16.19	-7.984	-9.160	0.328	3.058	11.669	13.020	9.601	9.207

**Lampiran 3. Koefisien *Principal Component* (PC)**

Var	<i>PC</i> <sub>1</sub>	<i>PC</i> <sub>2</sub>	<i>PC</i> <sub>3</sub>	<i>PC</i> <sub>4</sub>	<i>PC</i> <sub>5</sub>	<i>PC</i> <sub>6</sub>	<i>PC</i> <sub>7</sub>	<i>PC</i> <sub>8</sub>	<i>PC</i> <sub>9</sub>	<i>PC</i> <sub>10</sub>
<i>x</i> <sub>1</sub>	-4.1e-1	5.1e-1	-7.9e-2	1.9e-1	1.9e-1	-4.6e-1	2.5e-1	-6.4e-2	4.8e-2	-4.3e-1
<i>x</i> <sub>2</sub>	-4.3e-1	4.0e-1	-2.6e-2	-3.6e-1	-2.4e-1	4.6e-1	-2.5e-1	5.9e-2	4.1e-1	1.1e-2
<i>x</i> <sub>3</sub>	-3.1e-1	-5.8e-1	-2.3e-1	-1.3e-1	-4.0e-1	7.3e-2	3.4e-1	-4.2e-2	1.6e-3	-4.4e-1
<i>x</i> <sub>4</sub>	-2.9e-1	-4.5e-1	9.2e-2	-2.0e-2	6.5e-1	-5.6e-2	-1.3e-1	1.3e-1	4.7e-1	2.7e-2
<i>x</i> <sub>5</sub>	9.2e-2	4.0e-5	6.9e-1	1.8e-1	8.1e-2	3.9e-1	3.4e-2	-3.2e-1	-1.1e-2	-4.4e-1
<i>x</i> <sub>6</sub>	1.4e-1	-4.5e-2	4.5e-1	5.6e-2	-4.6e-1	-4.5e-1	-1.8e-2	3.7e-1	4.4e-1	1.9e-3
<i>x</i> <sub>7</sub>	4.2e-1	4.8e-2	-7.5e-2	-6.9e-1	1.5e-1	-2.2e-1	-2.0e-1	-1.0e-1	4.5e-2	-4.4e-1
<i>x</i> <sub>8</sub>	4.0e-1	1.5e-1	-1.7e-1	7.0e-3	1.4e-1	2.9e-1	6.8e-1	1.4e-1	4.1e-1	2.7e-2
<i>x</i> <sub>9</sub>	2.0e-1	1.9e-2	-3.1e-1	4.3e-1	1.2e-1	2.2e-1	-4.0e-1	4.9e-1	8.5e-3	-4.6e-1
<i>x</i> <sub>10</sub>	1.7e-1	-4.9e-2	-3.0e-1	3.2e-1	-1.6e-1	-1.1e-1	-2.3e-1	-6.6e-1	4.7e-1	2.3e-2

**Lampiran 4.** Proporsi varians dan proporsi varians kumulatif

PC	Nilai Eigen	Total Varian (%)	Total Kumulatif Varian (%)
<b>PC<sub>1</sub></b>	1.798044e+02	67.58	67.58
<b>PC<sub>2</sub></b>	5.065868e+01	19.04	86.62
<b>PC<sub>3</sub></b>	1.598370e+01	6.008	92.629
<b>PC<sub>4</sub></b>	1.165413e+01	4.38	97.01
<b>PC<sub>5</sub></b>	2.831431e+00	1.064	98.074
<b>PC<sub>6</sub></b>	2.307659e+00	0.008	98.941
<b>PC<sub>7</sub></b>	1.910927e+00	0.007	99.660
<b>PC<sub>8</sub></b>	8.360732e-01	0.003	99.974
<b>PC<sub>9</sub></b>	6.342069e-02	0	99.998
<b>PC<sub>10</sub></b>	6.199944e-03	0	100



**Lampiran 5.** Nilai atau *Principal Component Analysis Score*

No.	Kabupaten/Kota	$PC_1$	$PC_2$
1	Selayar	-9.5745621	2.3347165
2	Bulukumba	-4.4008236	-0.7776142
3	Bantaeng	-12.7301337	12.3005385
4	Jeneponto	-14.6074779	16.5455095
5	Takalar	-6.1795467	5.6892784
6	Gowa	-0.9883032	-0.9883032
7	Sinjai	-10.1253961	-4.4583015
8	Maros	2.3608983	6.6738422
9	Pangkep	-4.9190552	-2.7034543
10	Barru	-4.9989940	-11.9333139
11	Bone	-12.4899072	-7.1756368
12	Soppeng	-2.4953923	-0.4034358
13	Wajo	-21.9610569	-6.2585293
14	Sidrap	-4.2892702	-6.0313340
15	Pinrang	-2.5223980	-10.5939601
16	Enrekang	10.5386619	-5.8885825
17	Luwu	5.7207504	-1.2265727
18	Tator	3.2890351	5.2995937
19	Luwu Utara	-6.4194176	-5.5665026
20	Luwu Timur	8.0937669	-3.8429272
21	Toraja Utara	1.9445204	9.7375080
22	Makassar	26.5150001	3.5953819
23	Parepare	30.7439074	-0.6145589
24	Palopo	29.4951941	-0.1730271

**Lampiran 6. Jarak Euclidean Kabupaten/Kota**

D	1	2	3	4	5	6	7	8
1	0	6.037729	10.45348	15.075705	4.772758	9.141253	6.815315	12.699733
2	6.037729	0	15.505337	20.106377	6.707053	7.12006	6.805747	10.062062
3	10.45348	15.505337	0	4.641573	9.30693	13.583371	16.960052	16.105867
4	15.075705	20.106377	4.641573	0	13.743645	17.553296	21.476711	19.630986
5	4.772758	6.707053	9.30693	13.743645	0	5.195814	10.88775	8.597009
6	9.141253	7.12006	13.583371	17.553296	5.195814	0	13.493891	3.558519
7	6.815315	6.805747	16.96005	21.476711	10.88775	13.493891	0	16.728185
8	12.699733	10.062062	16.105867	19.630986	8.597009	3.558519	16.728185	0
9	6.859804	1.994348	16.915459	21.549667	8.48686	9.070764	5.494131	11.871454
10	14.983742	11.171725	25.43718	30.056053	17.662091	17.860826	9.063984	20.009854
11	9.947163	10.313485	19.477657	23.815476	14.329225	17.094853	3.602058	20.306514
12	7.590265	1.941823	16.313825	20.831931	7.119983	6.065048	8.640538	8.583206
13	15.075448	18.395712	20.727975	23.96037	19.794094	24.030132	11.971787	27.546392
14	9.895712	5.254904	20.181817	24.822959	11.872064	11.966991	6.044402	14.340371
15	14.726972	9.994455	25.067029	29.708584	16.688876	16.138422	9.769948	17.945015
16	21.729345	15.789561	29.534403	33.698914	20.335815	16.183934	20.713498	14.989674
17	15.704438	10.13153	22.878327	27.001551	13.763941	9.48019	16.172335	8.585171
18	13.200857	9.801346	17.48219	21.136599	9.476597	4.280787	16.588052	1.658311
19	8.50789	5.196939	18.948781	23.579343	11.258337	12.301703	3.868124	15.063864
20	18.717188	12.865105	26.348554	30.512864	17.163637	13.009241	18.229553	11.977822
21	13.69272	12.28134	14.896798	17.897417	9.076818	5.176996	18.633408	3.091831
22	36.111574	31.22357	40.199008	43.113385	32.761529	27.56721	37.51507	24.349488
23	40.426195	35.145109	45.351869	48.48934	37.457707	32.310554	41.049657	29.303856
24	39.150155	33.901409	44.029174	47.16519	36.153198	31.001661	39.851659	27.984811

D	9	10	11	12	13	14	15	16
1	6.859804	14.983742	9.947163	7.590265	15.075448	9.895712	14.726972	21.729345
2	1.994348	11.171725	10.313485	1.941823	18.395712	5.254904	9.994455	15.789561
3	16.915459	25.43718	19.477657	16.313825	20.727975	20.181817	25.067029	29.534403
4	21.549667	30.056053	23.815476	20.831931	23.96037	24.822959	29.708584	33.698914
5	8.48686	17.662091	14.329225	7.119983	19.794094	11.872064	16.688876	20.335815
6	9.070764	17.860826	17.094853	6.065048	24.030132	11.966991	16.138422	16.183934
7	5.494131	9.063984	3.602058	8.640538	11.971787	6.044402	9.769948	20.713498
8	11.871454	20.009854	20.306514	8.583206	27.546392	14.340371	17.945015	14.989674
9	0	9.230206	8.793078	3.341291	17.408859	3.386947	8.246457	15.78246
10	9.230206	0	8.874079	11.798564	17.886161	5.9445	2.815563	16.672058
11	8.793078	8.874079	0	12.072822	9.515449	8.280089	10.53737	23.064507
12	3.341291	11.798564	12.072822	0	20.327179	5.90688	10.19056	14.141195
13	17.408859	17.886161	9.515449	20.327179	0	17.673247	19.91626	32.501824
14	3.386947	5.9445	8.280089	5.90688	17.673247	0	4.89279	14.828619
15	8.246457	2.815563	10.53737	10.19056	19.91626	4.89279	0	13.88279
16	15.78246	16.672058	23.064507	14.141195	32.501824	14.828619	13.88279	0
17	10.741818	15.150816	19.157751	8.257273	28.135441	11.103434	12.477878	6.704223
18	11.463923	19.122357	20.11483	8.123063	27.76972	13.631604	16.922701	13.331631
19	3.232357	6.523334	6.28014	6.485001	15.557039	2.180274	6.360982	16.961138
20	13.062616	15.390736	20.851729	11.13375	30.151742	12.574925	12.580914	3.187823
21	14.208667	22.75603	22.235269	11.070301	28.76369	16.956312	20.816387	17.833507
22	32.058933	35.13221	40.46477	29.284696	49.46744	32.273468	32.318848	18.579262
23	35.724087	37.492255	43.728829	33.23997	53.006298	35.449471	34.730902	20.882224
24	34.507153	36.443838	42.565071	31.991416	51.814854	34.288625	33.670789	19.799437

D	17	18	19	20	21	22	23	24
1	15.704438	13.200857	8.50789	18.717188	13.69272	36.111574	40.426195	39.15016
2	10.13153	9.801346	5.196939	12.865105	12.28134	31.22357	35.145109	33.901409
3	22.878327	17.48219	18.948781	26.348554	14.896798	40.199008	45.351869	44.029174
4	27.001551	21.136599	23.579343	30.512864	17.897417	43.113385	48.48934	47.16519
5	13.763941	9.476597	11.258337	17.163637	9.076818	32.761529	37.457707	36.153198
6	9.48019	4.280787	12.301703	13.009241	5.176996	27.56721	32.310554	31.001661
7	16.172335	16.588052	3.868124	18.229553	18.63341	37.51507	41.049657	39.851659
8	8.585171	1.658311	15.063864	11.977822	3.091831	24.349488	29.303856	27.984811
9	10.741818	11.463923	3.232357	13.062616	14.208667	32.058933	35.724087	34.507153
10	15.150816	19.122357	6.523334	15.390736	22.75603	35.13221	37.492255	36.443838
11	19.157751	20.11483	6.28014	20.851729	22.235269	40.46477	43.728829	42.565071
12	8.257273	8.123063	6.485001	11.13375	11.070301	29.284696	33.23997	31.991416
13	28.135441	27.76972	15.557039	30.151742	28.76369	49.46744	53.006298	51.814854
14	11.103434	13.631604	2.180274	12.574925	16.956312	32.273468	35.449471	34.288625
15	12.477878	16.922701	6.360982	12.580914	20.816387	32.318848	34.730902	33.670789
16	6.704223	13.331631	16.961138	3.187823	17.833507	18.579262	20.882224	19.799437
17	0	6.964488	12.892582	3.532211	11.596162	21.346008	25.03064	23.797776
18	6.964488	0	14.571414	10.328172	4.637111	23.288405	28.084644	26.771484
19	12.892582	14.571414	0	14.615171	17.440419	34.185026	37.491792	36.317336
20	3.532211	10.328172	14.615171	0	14.907765	19.86631	22.879057	21.713803
21	11.596162	4.637111	17.440419	14.907765	0	25.326551	30.603431	29.278974
22	21.346008	23.288405	34.185026	19.86631	25.326551	0	5.967182	4.804421
23	25.03064	28.084644	37.491792	22.879057	30.603431	5.967182	0	1.324475
24	23.797776	26.771484	36.317336	21.713803	29.278974	4.804421	1.324475	0

**Lampiran 7. Cluster Membership**

Kabupaten/Kota	Cluster
Selayar	1
Bulukumba	1
Bantaeng	1
Jeneponto	1
Takalar	1
Gowa	1
Sinjai	1
Maros	1
Pangkep	1
Barru	1
Bone	1
Soppeng	1
Wajo	1
Sidrap	1
Pinrang	1
Enrekang	1
Luwu	1
Tator	1
Luwu Utara	1
Luwu Timur	1
Toraja Utara	1
Makassar	2
Parepare	2
Palopo	2

**Lampiran 8. Rata-Rata Variabel (*Centroid*) Cluster 1**

No	Kab/Kota	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$
1	Selayar	27.66	30.25	27.70	24.00	13.65
2	Bulukumba	23.95	25.16	24.00	26.71	21.21
3	Bantaeng	33.70	35.56	23.68	19.43	14.04
4	Jeneponto	36.69	36.74	16.75	21.87	19.98
5	Takalar	27.53	30.21	22.36	24.28	17.90
6	Gowa	24.06	28.68	21.20	21.82	19.22
7	Sinjai	25.09	25.95	30.38	28.21	16.71
8	Maros	21.93	30.70	20.29	21.07	16.10
9	Pangkep	22.82	26.72	28.14	27.60	16.14
10	Barru	19.35	20.64	32.53	31.82	17.53
11	Bone	22.32	28.91	33.35	30.25	16.56
12	Soppeng	21.96	26.02	25.01	24.02	20.92
13	Wajo	28.21	31.41	33.48	34.00	14.38
14	Sidrap	19.22	25.27	28.80	26.62	20.43
15	Pinrang	15.49	24.53	31.98	28.92	18.08
16	Enrekang	13.78	18.79	25.00	21.53	20.43
17	Luwu	17.89	21.75	20.80	23.41	27.13
18	Tator	23.96	24.50	19.35	22.01	20.53
19	Luwu Utara	20.65	26.16	28.27	28.89	21.94
20	Luwu Timur	15.38	22.24	25.15	22.42	17.33
21	Toraja Utara	24.29	29.93	18.61	17.67	22.37
Total		485.93	570.12	536.83	526.55	392.58
Rata-rata		23.13952	27.14857	25.56333	25.07381	18.69429

No.	Kab/Kota	$x_6$	$x_7$	$x_8$	$x_9$	$x_{10}$
1	Selayar	14.23	22.57	16.56	8.43	14.95
2	Bulukumba	19.64	23.12	16.56	7.73	11.92
3	Bantaeng	15.97	20.46	18.21	8.11	9.84
4	Jeneponto	17.35	18.58	14.74	8.01	9.29
5	Takalar	19.17	27.00	17.88	5.21	8.45
6	Gowa	18.40	26.42	20.46	9.11	10.63
7	Sinjai	18.84	19.08	15.95	8.74	11.04
8	Maros	17.69	34.74	21.34	6.95	9.20
9	Pangkep	15.58	25.67	19.26	7.23	10.84
10	Barru	17.99	22.29	18.00	8.31	11.54
11	Bone	14.68	19.97	15.46	7.80	10.70
12	Soppeng	19.73	22.63	18.92	9.48	11.30
13	Wajo	15.93	15.08	8.62	8.83	10.04
14	Sidrap	19.94	21.89	16.03	9.66	12.14
15	Pinrang	18.34	26.97	17.26	7.48	10.95
16	Enrekang	24.06	30.73	21.51	10.05	14.12
17	Luwu	23.97	27.54	20.35	6.64	10.52
18	Tator	18.74	27.02	24.03	9.14	10.72
19	Luwu Utara	19.94	23.39	15.74	5.76	9.26
20	Luwu Timur	22.23	34.18	21.46	7.96	11.65
21	Toraja Utara	21.52	25.67	23.22	9.06	10.67
Total		393.94	515	381.56	169.69	229.77
Rata-rata		18.75905	24.52381	18.16952	8.080476	10.94143

**Lampiran 9. Rata-Rata Variabel (*Centroid*) Cluster 2**

No	Kab/Kota	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$
1	Makassar	12.29	15.87	15.16	14.11	16.60
2	Parepare	8.42	10.99	12.83	16.74	23.34
3	Palopo	11.61	9.69	15.55	14.37	19.46
Total		32.32	36.55	43.54	45.22	59.4
Rata-Rata		10.77333	12.18333	14.51333	15.07333	19.8

No	Kab/Kota	$x_6$	$x_7$	$x_8$	$x_9$	$x_{10}$
1	Makassar	17.62	37.08	33.03	18.86	19.37
2	Parepare	23.66	37.87	31.35	17.54	17.27
3	Palopo	24.41	36.58	31.82	16.79	19.71
Total		65.69	111.53	96.2	53.19	56.35
Rata-Rata		21.89667	37.17667	32.06667	17.73	18.78333



**Lampiran 10. Rata-Rata Variabel pada Setiap Kabupaten/Kota**

*Cluster 1*

No	Kab/Kota	Total
1	Selayar	200
2	Bulukumba	200
3	Bantaeng	199
4	Jeneponto	200
5	Takalar	199.99
6	Gowa	200
7	Sinjai	199.99
8	Maros	200.01
9	Pangkep	200
10	Barru	200
11	Bone	200
12	Soppeng	199.99
13	Wajo	199.98
14	Sidrap	200
15	Pinrang	200
16	Enrekang	200
17	Luwu	200
18	Tator	200
19	Luwu Utara	200
20	Luwu Timur	200
21	Toraja Utara	203.01
Total		4201.97
Rata-rata		200.09

*Cluster 2*

No	Kab/Kota	Total
22	Makassar	199.99
23	Parepare	200.01
24	Palopo	199.99
Total		599.99
Rata-rata		199.99

**Lampiran 11. Agglomeration Schedule Algoritma Centroid Linkage**

```

| |--leaf 22
| `--[dendrogram w/ 2 branches and 2 members at h = 1.32]
|   |--leaf 23
|   `--leaf 24
|--[dendrogram w/ 2 branches and 21 members at h = 15.1]
| |--leaf 13
| `--[dendrogram w/ 2 branches and 20 members at h = 14.2]
|   |--[dendrogram w/ 2 branches and 2 members at h = 4.64]
|   | |--leaf 3
|   | `--leaf 4
|   `--[dendrogram w/ 2 branches and 18 members at h = 8.3]
|     |--[dendrogram w/ 2 branches and 3 members at h = 4.32]
|     | |--leaf 17
|     | `--[dendrogram w/ 2 branches and 2 members at h = 3.19]
|     |   |--leaf 16
|     |   `--leaf 20
|     `--[dendrogram w/ 2 branches and 15 members at h = 8.92]
|       |--[dendrogram w/ 2 branches and 4 members at h = 3.3]
|       | |--leaf 6
|       | `--[dendrogram w/ 2 branches and 3 members at h = 3.45]
|       |   |--leaf 21
|       |   `--[dendrogram w/ 2 branches and 2 members at h = 1.6
6]
|         |--leaf 8
|         `--leaf 18
|       `--[dendrogram w/ 2 branches and 11 members at h = 6.58]
|         |--[dendrogram w/ 2 branches and 2 members at h = 2.82]
|         | |--leaf 10
|         | `--leaf 15
|         `--[dendrogram w/ 2 branches and 9 members at h = 5.4]
|           |--[dendrogram w/ 2 branches and 2 members at h = 4.7
7]
|             |--leaf 1
|             `--leaf 5
|           `--[dendrogram w/ 2 branches and 7 members at h = 5.2
]
|             |--[dendrogram w/ 2 branches and 5 members at h =
3.56]
|               |--[dendrogram w/ 2 branches and 2 members at h
= 2.18]
|                 |--leaf 14
|                 `--leaf 19
|                 `--[dendrogram w/ 2 branches and 3 members at h
= 2.18]
|                   |--leaf 9
|                   `--[dendrogram w/ 2 branches and 2 members a
t h = 1.94]
|                     |--leaf 2
|                     `--leaf 12
|                   `--[dendrogram w/ 2 branches and 2 members at h =
3.6]
|                     |--leaf 7
|                     `--leaf 11

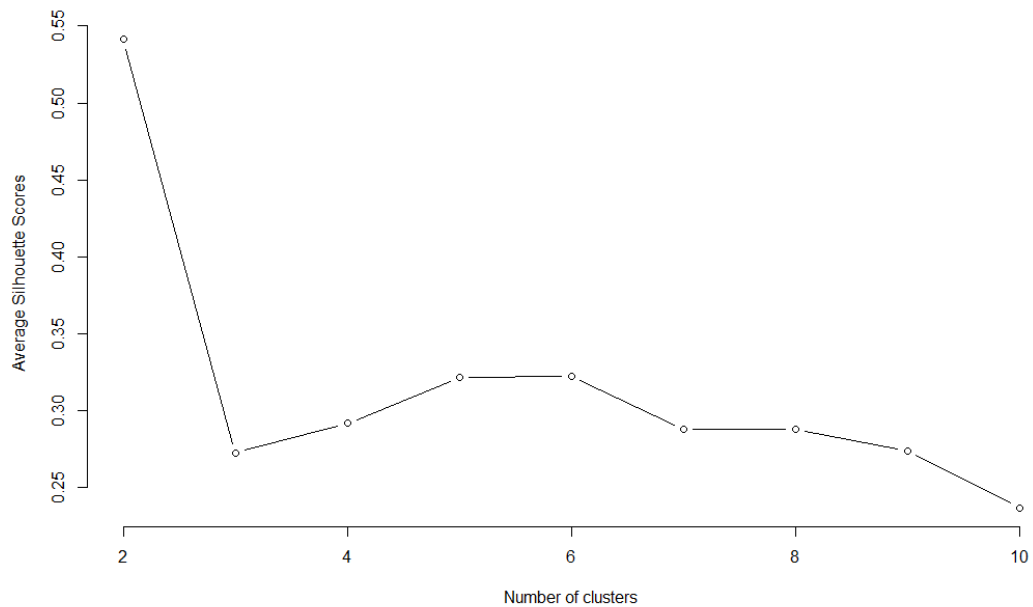
```

## Lampiran 12. Output Algoritma *K-Medoids*

```
> pam.res <- pam(PCA_scores, 2)
> print(pam.res)
Medoids:
      ID      PC1      PC2
[1,]  2 -4.400824 -0.7776142
[2,] 24 29.495194 -0.1730271
Clustering vector:
[1] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2
Objective function:
      build      swap
8.585975 8.483564

Available components:
[1] "medoids"  "id.med"   "clustering" "objective" "isolation" "clusinfo"
[7] "silinfo"  "diss"     "call"       "data"
```

## Lampiran 13. Output Plot Indeks Validitas *Silhouette*



**Lampiran 14.** Perhitungan manual algoritma *k-medoids*

Langkah-langkah algoritma *k-medoids* :

1. Ditentukan *k* (jumlah *cluster*) dari *n* objek adalah 2 berdasarkan data PCA *Score* (Lampiran 5).
2. Tentukan *centroid* awal sebagai medoids dengan asumsi seperti pada tabel berikut.

Nama	Ket	PC1	PC2
C1	Diambil dari data ke 2 sebagai pusat <i>cluster</i> 1	-4.4008236	-0.7776142
C2	Diambil dari data ke 4 sebagai pusat <i>cluster</i> 2	-14.6074779	16.5455095

3. Tempatkan objek-objek non medoids ke dalam *cluster* yang paling dekat dengan medoids berdasarkan jarak *Euclidean*. Berikut contoh perhitungan jarak pada data ke 1:

$$d_{x1.c1} = \sqrt{(-9.5745621 - (-4.4008236))^2 + (2.3347165 - (-0.7776142))^2} = 10.20557996$$

$$d_{x1.c2} = \sqrt{(-9.5745621 - (-14.6074779))^2 + (2.3347165 - 16.5455095)^2} = 26.60053$$

Cara yang sama dapat dilakukan untuk perhitungan jarak data ke 2 sampai data ke 24. sehingga diperoleh tabel berikut.

Data ke- <i>i</i>	Jarak ke medoid		<i>Cluster</i> yang diikuti
	C1	C2	
1	10.2056	26.6005	1
2	0	23.3007	1
3	14.5685	29.3358	1
4	17.1884	0	1
5	5.68724	24.2375	1
6	3.41902	22.2017	1
7	10.9614	27.0449	1
8	7.45461	38.8637	1
9	4.17374	23.5498	1
10	4.26355	23.59	1
11	14.2342	29.1125	1
12	2.56543	22.5668	1

13	27.5155	39.2024	1
14	3.51343	23.2498	1
15	2.56374	22.5751	1
16	18.7416	25.8536	1
17	12.0281	23.0307	1
18	8.69894	22.2715	1
19	5.99205	24.381	1
20	15.3237	24.2235	1
21	6.90459	22.0717	1
22	41.2392	42.3137	1
23	47.2097	47.522	1
24	45.4465	45.9646	1
Jumlah	329.899	653.064	
Total cost	982.962157		

4. Tentukan objek non medoids dengan asumsi sebagai berikut.

Nama	Ket	PC1	PC2
E1	Diambil dari data ke 3 sebagai pusat <i>cluster</i> 1	-12.7301337	12.3005385
E2	Diambil dari data ke 6 sebagai pusat <i>cluster</i> 2	-0.9883032	-0.9883032

Ulangi langkah 3 untuk objek non medoids sehingga diperoleh tabel berikut.

$$d_{x1,E1} = \sqrt{(-9.5745621 - (-12.7301337))^2 + (2.3347165 - 12.3005385)^2} = 22.1015$$

$$d_{x1,E2} = \sqrt{(-9.5745621 - (-0.9883032))^2 + (2.3347165 - (-0.9883032))^2} = 12.1428$$

Data ke- <i>i</i>	Jarak ke medoid		Cluster yang diikuti
	E1	E2	
1	22.1015	12.1428	2
2	18.6631	4.82603	2
3	0	16.6055	1
4	26.9734	19.2604	2
5	19.8757	7.34153	2
6	17.7331	0	2
7	22.5767	12.9218	2
8	38.058	34.7858	2

9	18.9084	5.55892	2
10	18.9485	5.67197	2
11	24.7916	16.2657	2
12	17.9908	2.13135	2
13	35.4833	29.66	2
14	18.6137	4.66827	2
15	17.9977	2.16954	2
16	23.3354	16.3016	2
17	19.589	9.48804	2
18	18.3799	6.04907	2
19	19.7551	7.68076	2
20	21.2446	12.844	2
21	17.9609	4.14764	2
22	41.7401	38.8955	2
23	47.2245	44.8761	2
24	45.592	43.1102	2
Jumlah	573.537	357.403	
Total cost	930.939492		

5. Hitung nilai S dengan persamaan sebagai berikut (Setyawati, 2017):

$$\begin{aligned}
S &= \text{total cost baru} - \text{total cost lama} \\
&= 930.939492 - 982.962157 \\
&= -52.023
\end{aligned}$$

Karena nilai  $S < 0$  maka tukar non medoids dengan medoids, sehingga E1 dan E2 menjadi objek medoids.

6. Tentukan objek non medoids baru dengan asumsi sebagai berikut.

Nama	Ket	PC1	PC2
F1	Diambil dari data ke 2 sebagai pusat <i>cluster</i> 1	-4.4008236	-0.7776142
F2	Diambil dari data ke 24 sebagai pusat <i>cluster</i> 2	29.4951941	-0.1730271

Ulangi langkah 3 untuk objek non medoids baru sehingga diperoleh tabel berikut.

$$d_{x1.E1} = \sqrt{(-9.5745621 - (-4.4008236))^2 + (2.3347165 - (-0.7776142))^2} = 10.20558$$

$$d_{x1.E2} = \sqrt{(-9.5745621 - 29.4951941)^2 + (2.3347165 - (-0.1730271))^2} = 40.185006$$

Data ke- <i>i</i>	Jarak ke medoids		Cluster yang diikuti
	E1	E2	
1	10.20558	40.185006	1
2	0	34.158663	1
3	14.568464	44.052914	1
4	17.188395	46.404731	1
5	5.6872428	36.176863	1
6	3.4190182	30.494398	1
7	10.961376	40.851448	1
8	7.4546055	27.252354	1
9	4.173739	34.739967	1
10	4.2635496	34.830145	1
11	14.234152	43.754477	1
12	2.5654298	32.074772	1
13	27.515451	55.879012	1
14	3.5134274	34.034299	1
15	2.5637381	32.103672	1
16	18.741567	21.773617	1
17	12.028092	24.494097	1
18	8.6989404	26.433854	1
19	5.9920504	36.453762	1
20	15.323714	22.942558	1
21	6.9045932	27.631931	1
22	41.23924	26.853908	2
23	47.209728	30.942142	2
24	45.446484	0	2
Jumlah	329.89858	784.51859	
Total cost	1114.417167		

Hitung kembali nilai S sebagai berikut:

$$\begin{aligned} S &= \text{total cost baru} - \text{total cost lama} \\ &= 1114.417167 - 930.939492 \\ &= 183.478 \end{aligned}$$

7. Karena nilai  $S > 0$  maka proses pengklasteran dihentikan. Sehingga diperoleh anggota tiap kluster sebagai berikut.

Data ke- <i>i</i>	PC1	PC2	<i>Cluster</i> yang diikuti
1	-9.5745621	2.3347165	1
2	-4.4008236	-0.7776142	1
3	-12.7301337	12.3005385	1
4	-14.6074779	16.5455095	1
5	-6.1795467	5.6892784	1
6	-0.9883032	-0.9883032	1
7	-10.1253961	-4.4583015	1
8	23.608983	6.6738422	1
9	-4.9190552	-2.7034543	1
10	-4.998994	-11.9333139	1
11	-12.4899072	-7.1756368	1
12	-2.4953923	-0.4034358	1
13	-21.9610569	-6.2585293	1
14	-4.2892702	-6.031334	1
15	-2.522398	-10.5939601	1
16	10.5386619	-5.8885825	1
17	5.7207504	-1.2265727	1
18	3.2890351	5.2995937	1
19	-6.4194176	-5.5665026	1
20	8.0937669	-3.8429272	1
21	1.9445204	9.737508	1
22	26.5150001	3.5953819	2
23	30.7439074	-0.6145589	2
24	29.4951941	-0.1730271	2



