

# Studi Kasus 6

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## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
library(Biobase)

## Loading required package: BiocGenerics

##
## Attaching package: 'BiocGenerics'

## The following objects are masked from 'package:stats':
##       IQR, mad, sd, var, xtabs

## The following objects are masked from 'package:base':
##       anyDuplicated, aperm, append, as.data.frame, basename, cbind,
##       colnames, dirname, do.call, duplicated, eval, evalq, Filter, Find,
##       get, grep, grepl, intersect, is.unsorted, lapply, Map, mapply,
##       match, mget, order, paste, pmax, pmax.int, pmin, pmin.int,
##       Position, rank, rbind, Reduce, rownames, sapply, setdiff, sort,
##       table, tapply, union, unique, unsplit, which.max, which.min

## Welcome to Bioconductor
##
## Vignettes contain introductory material; view with
##   'browseVignettes()'. To cite Bioconductor, see
##   'citation("Biobase")', and for packages 'citation("pkgname")'.
```

```
library(dendextend)

##
## -----
## Welcome to dendextend version 1.17.1
## Type citation('dendextend') for how to cite the package.
```

```

## 
## Type browseVignettes(package = 'dendextend') for the package vignette.
## The github page is: https://github.com/talgalili/dendextend/
## 
## Suggestions and bug-reports can be submitted at: https://github.com/talgalili/dendextend/issues
## You may ask questions at stackoverflow, use the r and dendextend tags:
##   https://stackoverflow.com/questions/tagged/dendextend
## 
## To suppress this message use: suppressPackageStartupMessages(library(dendextend))
## -----
## 
## Attaching package: 'dendextend'

## The following object is masked from 'package:stats':
## 
##     cutree

```

## Loading data

```

## [1] "con"          "edata"        "fdata"        "montpick.eset"
## [5] "pdata"

```

## Clustering-1

```

#Cek distribusi data
dist1 = dist(t(edata))
dist1

```

	NA06985	NA06986	NA06994	NA07000	NA07037	NA07051
## NA06986	15657.624					
## NA06994	15974.269	13463.514				
## NA07000	23094.820	22662.098	17383.704			
## NA07037	21051.182	17488.885	16641.466	15560.537		
## NA07051	21542.207	14937.858	16023.215	25848.918	18227.592	
## NA07346	25043.262	23257.203	15625.463	13460.303	18662.736	26014.699
## NA07347	21485.858	20096.254	14445.171	12295.204	14409.488	22441.801
## NA07357	24357.376	28756.459	26281.665	35037.512	33475.867	29952.050
## NA10847	23371.501	26005.950	19344.754	21675.785	23268.073	28670.637
## NA10851	22855.754	26171.217	22325.343	26190.020	26714.919	29710.573
## NA11829	17689.368	17723.582	19331.117	27790.205	23082.698	19354.709
## NA11830	15968.621	15481.976	14987.394	24048.355	19184.691	14718.727
## NA11831	40117.267	38252.308	39408.006	46074.692	45627.864	36111.595
## NA11832	40131.980	38805.530	45188.425	49319.041	44015.608	38231.455
## NA11840	39536.402	41709.416	48405.740	53271.860	47378.659	44212.501
## NA11881	19880.263	21673.326	14499.567	15252.862	19563.578	24689.597
## NA11894	34484.295	33641.842	36382.858	38735.905	36674.708	36652.498
## NA11918	40200.342	40125.001	30862.777	26165.915	34786.526	40749.404
## NA11920	47600.862	46533.803	53058.166	59212.086	52516.335	49122.494
## NA11931	47778.283	46731.245	53694.915	58969.125	53627.630	47987.173

## NA11992	53922.893	57776.371	61191.589	67929.375	65115.039	60594.675
## NA11993	32857.310	38939.449	38474.716	43900.438	42879.097	42814.149
## NA11994	24210.020	26277.906	30242.353	35003.776	31506.916	29151.721
## NA11995	25179.622	25060.295	29475.337	36339.891	32932.756	27527.506
## NA12003	32334.622	33183.405	36625.762	48054.051	42474.266	33670.981
## NA12004	34020.971	32588.328	22555.013	21481.733	28201.817	32701.249
## NA12005	30525.152	28788.280	34693.592	42490.311	38051.562	31397.019
## NA12006	52529.238	53373.066	57227.050	61291.340	60363.106	56880.344
## NA12043	36296.711	35855.476	42416.857	47412.530	41578.129	36896.619
## NA12044	38127.773	42007.292	47976.052	54395.917	50104.545	45739.251
## NA12045	65628.658	68917.362	69403.012	69574.565	71579.475	71792.245
## NA12144	19636.087	17977.710	9107.876	15846.618	19157.785	19338.838
## NA12154	49051.422	49821.241	54197.815	61106.040	58121.731	51325.993
## NA12155	21115.518	24414.534	28223.204	31175.677	28362.051	28249.035
## NA12156	15850.468	13963.861	11770.734	20775.285	18885.390	13551.378
## NA12234	27721.170	25467.854	27737.594	35374.441	32958.864	24688.793
## NA12249	29879.862	28410.322	33009.402	40349.852	37675.584	29953.919
## NA12287	32870.672	29958.532	37749.274	44550.768	34148.119	28910.061
## NA12414	33391.780	30445.652	35181.491	38165.650	32441.506	29066.421
## NA12489	35108.518	37464.277	36343.204	40140.948	40413.380	41906.639
## NA12716	34295.294	38648.536	38042.570	43994.101	45327.837	42206.527
## NA12717	27902.195	31561.827	27534.094	34461.065	34982.636	35026.579
## NA12750	25747.605	26249.006	19444.019	22818.124	28758.389	26617.114
## NA12751	19844.551	19200.163	17645.391	16460.828	20997.219	22668.876
## NA12760	31588.619	31740.390	37392.970	43873.659	38740.867	33540.716
## NA12761	22012.109	24875.537	25018.055	26035.122	26369.224	28963.337
## NA12762	28824.059	27238.395	18790.720	14279.621	22127.034	28740.765
## NA12763	16572.867	16081.188	14198.037	20979.268	21896.429	19399.765
## NA12776	42849.357	39356.534	46852.221	52274.742	44916.982	39395.862
## NA12812	38946.315	41044.812	46097.049	47373.343	43752.939	44560.909
## NA12813	29744.197	30983.863	23431.083	19363.542	28455.353	33503.680
## NA12814	41786.808	42709.469	45786.030	51039.665	49459.060	44661.882
## NA12815	22111.788	21904.271	23719.038	33865.709	30599.883	22338.644
## NA12828	30848.338	27680.761	34874.432	40420.224	34122.749	29774.794
## NA12872	32877.655	33701.743	37307.932	40789.781	37330.942	35711.449
## NA12873	57851.273	57109.391	62419.106	70932.080	66135.536	56216.691
## NA12874	58673.709	62773.451	58691.773	59706.187	65926.180	65880.150
## NA12891	26106.639	25243.345	29954.504	36623.335	31705.711	30511.444
## NA12892	33329.378	32933.371	23618.678	21115.655	28969.900	34814.274
## NA18486	50987.071	53237.342	56506.140	60188.695	58740.563	57021.003
## NA18498	74412.209	75594.016	80158.405	80466.078	79760.308	78330.220
## NA18499	58811.126	57846.180	65047.407	72225.988	66408.460	59507.687
## NA18501	28526.608	27930.044	26336.153	22211.734	26142.193	31322.004
## NA18502	54754.946	54586.490	61991.499	67113.460	61454.362	57489.946
## NA18504	33237.799	32828.665	36174.674	43780.390	42336.377	36175.520
## NA18505	39834.203	39059.609	42939.689	41739.266	42264.055	42783.755
## NA18507	53511.271	53951.616	60072.653	60892.302	57934.502	56239.757
## NA18508	51732.784	51444.190	58167.234	61815.475	57528.026	53555.260
## NA18510	36482.314	36111.795	42911.070	47826.482	40295.840	38040.349
## NA18511	72354.874	73915.756	79330.672	84599.668	81070.725	74883.864
## NA18516	29998.695	29824.990	30878.066	27847.915	28163.710	33121.055
## NA18517	79950.615	81805.824	87198.692	89803.645	86765.329	85454.084
## NA18519	70081.049	71109.002	77903.516	84657.440	78314.765	73226.465
## NA18520	67261.218	68592.878	73796.618	74421.053	71971.908	71123.960

## NA18522	52188.012	51096.388	58096.706	59609.043	55082.800	53892.618
## NA18523	23843.597	25195.334	24708.920	23930.308	25754.014	28687.351
## NA18852	48024.843	47218.139	55067.425	59497.669	53493.550	48931.387
## NA18853	126127.686	132432.629	129986.544	130795.259	134968.376	136375.404
## NA18855	55149.150	56040.652	62471.866	67857.073	62942.613	58322.445
## NA18856	33992.797	33422.641	25340.648	18245.292	28195.810	35273.907
## NA18858	55189.236	55483.839	62606.476	65352.521	59942.826	58157.343
## NA18861	35653.886	34913.606	37680.757	37276.807	39016.385	38317.384
## NA18862	57985.200	60231.785	62406.189	64684.206	65020.433	62834.674
## NA18870	31731.033	32494.960	37585.603	38298.891	35734.047	35810.874
## NA18871	37645.199	38108.363	41475.070	41783.696	40504.198	38505.216
## NA18909	65084.806	66714.225	71957.427	75676.661	72922.151	67641.977
## NA18912	28811.259	30709.265	24637.942	26193.907	31881.068	33407.192
## NA18913	62524.213	64148.115	70533.560	75281.551	70309.651	66007.362
## NA18916	71861.529	71036.429	73016.147	78658.953	79522.041	70449.222
## NA19093	73043.677	70350.828	76374.066	79779.360	77446.745	70832.353
## NA19098	59433.968	60350.541	65412.686	67670.141	65963.334	63262.107
## NA19099	60688.920	60415.197	67122.787	69828.427	66284.922	62146.730
## NA19101	49870.501	50902.075	56312.983	58612.854	56363.391	52964.314
## NA19102	31599.036	33051.508	26166.853	24787.548	32319.893	35168.353
## NA19108	65337.375	66835.485	71687.144	74373.464	72894.615	68574.026
## NA19114	100760.641	103234.577	104792.915	110569.430	111181.176	104666.470
## NA19116	69109.585	71619.903	76561.446	79870.034	78732.828	75702.628
## NA19119	35601.951	35592.916	26409.144	22619.632	31289.880	36850.831
## NA19127	53784.319	55978.922	57160.584	56512.181	57552.017	58187.127
## NA19128	77707.166	80942.790	82310.256	81989.833	83195.306	84067.866
## NA19130	57528.972	55962.262	61753.922	63553.390	61134.154	58688.351
## NA19131	63510.746	63421.974	68324.835	72752.630	70986.942	64479.061
## NA19137	46075.015	44058.259	50869.937	52992.167	47365.264	46929.572
## NA19138	67725.977	67005.891	74146.428	80086.299	75907.011	68477.690
## NA19140	55135.890	56384.014	59818.887	61185.052	59692.971	58778.062
## NA19143	55581.671	57517.007	62786.924	62609.232	60139.222	58871.011
## NA19144	61221.085	62741.243	68428.347	71552.190	67729.196	65478.818
## NA19147	54830.188	57424.236	61756.020	62097.202	60749.365	59491.018
## NA19152	72697.612	73803.572	80436.451	83839.484	78585.527	75401.194
## NA19153	46307.980	45525.095	50622.486	56525.018	54759.023	48199.052
## NA19159	52970.341	52948.786	58876.568	64135.618	60539.251	56874.324
## NA19160	56435.134	58254.742	63494.801	64768.449	62089.722	60304.688
## NA19171	27582.065	25345.433	20317.428	16579.335	22624.189	27685.043
## NA19172	67768.241	67240.346	74226.369	81059.079	77444.129	69235.265
## NA19190	44218.446	45627.761	49898.487	49763.070	50139.497	48035.461
## NA19192	55302.309	55035.311	60890.710	66524.202	62996.293	57954.390
## NA19193	71827.512	75963.681	75694.711	77763.005	79425.062	78913.043
## NA19200	25491.733	21259.394	19564.516	26280.628	28420.811	23104.136
## NA19201	60916.063	61298.575	67025.246	71578.973	68860.099	64400.555
## NA19203	46779.447	48175.101	51552.762	52432.202	51902.950	50172.499
## NA19204	48046.759	46505.762	53568.700	59340.745	53950.010	49357.451
## NA19209	84178.806	84328.853	92006.878	96844.552	91901.326	87965.196
## NA19210	77161.823	79993.256	82590.475	83624.137	83108.151	83634.401
## NA19222	31980.111	30606.511	32914.966	30969.056	30668.661	34191.485
## NA19225	41250.494	42698.532	44573.061	44385.541	46759.300	44599.239
## NA19238	40977.281	40915.459	43952.545	45365.745	45691.500	43074.657
## NA19239	46800.506	45377.197	49621.393	49701.116	47628.252	47528.823
## NA19257	44397.789	47126.028	50528.808	48850.888	48811.846	48970.574

	NA07346	NA07347	NA07357	NA10847	NA10851	NA11829
## NA06986						
## NA06994						
## NA07000						
## NA07037						
## NA07051						
## NA07346						
## NA07347	11382.951					
## NA07357	34438.963	30727.295				
## NA10847	19748.155	17982.845	21688.897			
## NA10851	25719.365	23482.923	18229.601	10454.515		
## NA11829	30162.970	25245.519	25268.829	28839.215	28605.364	
## NA11830	25792.463	20790.547	21071.952	22357.981	21790.327	14775.825
## NA11831	50095.600	45305.026	39254.855	47875.750	45433.026	33792.762
## NA11832	54175.695	46878.228	42786.487	49424.051	45655.335	38908.928
## NA11840	58204.761	51494.006	42945.924	52186.772	47746.829	37445.362
## NA11881	15950.906	13601.792	23668.469	13659.553	17783.357	23133.795
## NA11894	41857.835	38066.467	40234.663	39338.950	37783.076	37944.531
## NA11918	21595.459	26068.447	45746.248	30514.885	37742.643	45382.486
## NA11920	61055.186	55871.001	47190.417	53348.977	48859.611	48110.497
## NA11931	61655.280	56414.870	50342.501	56550.654	51476.132	50372.352
## NA11992	71218.016	65791.318	45839.185	58665.070	51926.362	54970.715
## NA11993	45791.275	42037.027	28968.228	35726.643	32414.549	35604.179
## NA11994	38992.941	32550.493	27765.348	32521.831	28795.648	28117.931
## NA11995	39835.927	33860.242	26334.745	34645.975	31114.736	22572.999
## NA12003	49889.283	44868.115	30809.008	42481.843	38417.870	29182.981
## NA12004	15757.741	21577.998	41493.546	27856.173	34976.569	36987.147
## NA12005	45542.473	40591.917	31013.738	40328.216	35727.769	26752.486
## NA12006	64630.390	59882.855	48936.225	57181.312	51041.299	52082.020
## NA12043	52454.784	45440.642	38703.867	46253.536	41784.919	35386.186
## NA12044	57842.880	52586.400	36986.978	49029.964	42610.643	40979.592
## NA12045	71245.560	66898.910	55803.471	59684.868	54975.807	69872.857
## NA12144	15387.417	13557.749	27382.699	19770.934	23150.208	22416.847
## NA12154	63466.552	57857.887	42061.151	54389.871	47942.776	48192.458
## NA12155	36423.268	30167.363	26913.439	30546.171	26978.430	24774.131
## NA12156	21692.677	18091.694	24129.423	22045.358	22127.959	18403.116
## NA12234	39355.711	33940.505	29264.606	36053.817	33357.104	22621.671
## NA12249	44452.070	39523.309	32165.096	40327.820	36442.956	26520.219
## NA12287	46356.253	40677.024	40609.649	44387.218	41854.322	33125.127
## NA12414	40704.493	34564.062	41554.876	40583.665	40167.773	36101.293
## NA12489	38604.260	36361.481	28691.070	26280.806	22518.048	41486.327
## NA12716	45118.599	42334.320	24753.342	33822.928	26675.039	38593.030
## NA12717	31077.080	30042.960	23309.000	22132.517	21825.563	34739.821
## NA12750	23945.644	22064.524	27202.832	24235.513	26272.286	28379.100
## NA12751	21731.267	18541.053	30768.887	24758.897	25156.494	24828.191
## NA12760	47966.820	40712.949	33104.856	41497.589	37580.159	30740.582
## NA12761	31428.886	25400.040	28607.658	28255.809	27551.946	21575.049
## NA12762	12486.308	16788.913	38762.734	24623.829	30969.320	32364.421
## NA12763	24154.523	20482.028	25217.381	24263.656	24470.943	17007.325
## NA12776	54317.542	48638.864	46879.218	51557.949	48047.173	42162.745
## NA12812	52991.939	45996.617	40767.888	44244.765	39332.797	40471.905
## NA12813	18779.103	18888.336	33695.744	21231.584	25849.672	36352.853
## NA12814	54013.845	48125.100	32710.041	43394.283	37160.517	40052.003
## NA12815	35247.063	31067.677	20312.202	28573.714	24600.082	21152.688

## NA12828	42419.410	37230.416	36961.101	39886.721	36290.415	31994.141
## NA12872	43981.233	37087.576	31689.001	35634.484	31183.084	35215.869
## NA12873	73888.800	69176.803	53098.521	66513.501	60597.376	53270.542
## NA12874	59113.984	58277.124	46941.686	48701.494	45861.299	64506.959
## NA12891	37294.455	32988.921	27977.441	30303.860	26523.454	28294.940
## NA12892	14524.245	20395.446	39778.127	24261.925	31275.180	39090.316
## NA18486	62605.821	57784.402	44281.929	51574.833	44716.820	52444.678
## NA18498	84401.240	78845.634	69830.301	75583.276	69380.595	76997.104
## NA18499	75620.877	69637.126	55284.796	67481.533	61582.951	56338.797
## NA18501	25670.794	21337.758	35287.288	26008.451	27317.628	34350.145
## NA18502	70728.626	65129.321	53830.165	62277.636	56202.926	55419.685
## NA18504	45454.885	41777.912	28756.665	37684.191	31723.677	34421.318
## NA18505	47421.460	42061.323	42935.685	42475.812	39435.123	43139.904
## NA18507	66674.150	60025.757	53524.939	60327.452	55360.962	52880.945
## NA18508	66607.057	60215.669	51091.685	59231.844	53808.812	51405.542
## NA18510	51787.687	45112.641	39898.010	44969.249	41021.529	35538.101
## NA18511	88910.210	83002.982	65193.472	79106.616	72181.165	70508.928
## NA18516	32730.989	27371.620	36528.425	29402.982	29617.111	35089.149
## NA18517	94224.226	87783.274	74644.922	82749.470	76240.830	80660.851
## NA18519	87624.607	82152.284	65397.464	78178.535	71940.564	68979.424
## NA18520	79529.820	72262.600	64929.912	70425.504	65013.402	67947.799
## NA18522	64818.677	58479.950	53430.106	58059.249	53138.041	53105.770
## NA18523	27392.201	20877.247	27990.214	23519.098	22563.553	27939.140
## NA18852	63827.083	56752.174	48406.497	57510.337	52704.723	44476.309
## NA18853	131768.370	130811.303	115352.824	119109.561	113721.118	131769.890
## NA18855	72908.738	66556.338	53369.086	64913.932	59472.963	51280.816
## NA18856	16625.644	19214.690	40870.548	25217.621	31473.386	39629.909
## NA18858	70568.664	63577.211	55681.993	62398.955	57107.667	54637.369
## NA18861	42222.395	36476.456	38579.979	39530.001	36997.010	38073.647
## NA18862	67471.482	62429.381	49564.165	56462.348	50787.320	59989.759
## NA18870	44439.744	37460.119	36486.599	39862.978	36371.352	31347.049
## NA18871	47747.652	39892.759	39024.151	42758.233	39670.836	36386.274
## NA18909	81282.999	74908.220	61337.831	73210.939	67151.067	62973.834
## NA18912	24960.451	25138.857	29765.254	22194.990	24008.251	35597.043
## NA18913	80148.232	73391.830	58846.725	70462.655	64064.174	60945.849
## NA18916	81972.622	78739.688	63447.749	76523.691	71406.593	66817.341
## NA19093	85538.694	79461.979	72022.207	80908.979	76031.107	68993.884
## NA19098	72358.319	66446.153	56199.026	64082.930	58183.095	61125.928
## NA19099	75544.252	68718.084	60537.825	69733.570	64467.884	58333.034
## NA19101	63778.142	57036.958	48400.640	56478.391	51293.425	50051.816
## NA19102	23950.518	26151.126	35010.350	25882.384	28743.751	37909.783
## NA19108	79607.165	73115.522	60950.460	71496.242	65584.049	65128.625
## NA19114	113252.399	110061.016	90027.099	102785.461	96107.293	100425.515
## NA19116	83954.525	78868.231	63824.503	73764.487	66652.886	71407.281
## NA19119	18557.573	23643.764	41638.312	27769.741	34350.513	40773.860
## NA19127	60260.889	55710.142	48589.262	50788.976	46753.421	56940.524
## NA19128	85245.657	81417.396	71700.847	74292.444	69434.249	82406.575
## NA19130	67590.749	61548.317	56925.498	60884.873	56224.310	59005.476
## NA19131	77708.911	71864.878	59403.212	70502.926	64705.685	60718.965
## NA19137	57135.199	50848.451	49171.269	51627.918	47503.319	44993.929
## NA19138	85325.820	79033.503	66719.849	79191.228	73503.736	63218.543
## NA19140	65218.209	59466.164	51067.452	55858.638	50785.988	57541.150
## NA19143	69380.438	61852.063	57077.711	63804.437	59619.340	53604.521
## NA19144	76257.942	69571.420	58669.457	66596.201	61074.717	62066.648

## NA19147	67736.443	62295.686	54071.286	60985.750	55612.544	55588.303
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## NA19153	59517.399	54562.429	42732.565	52518.168	46892.198	46882.255
## NA19159	67929.249	62917.198	50536.445	59912.050	54636.776	50267.822
## NA19160	70582.963	62914.377	54465.271	62027.863	56862.257	56426.346
## NA19171	18284.400	15602.750	35276.310	23538.047	28009.969	31565.314
## NA19172	83760.280	78959.753	64366.782	77012.389	70556.015	66428.361
## NA19190	56197.731	50476.143	48290.457	52878.035	48881.342	45356.357
## NA19192	69115.381	63680.445	50501.284	60018.046	53670.095	55196.519
## NA19193	79870.383	76907.276	61629.550	67005.346	61569.363	75618.359
## NA19200	27654.219	25243.973	30025.613	29354.771	29865.706	25652.392
## NA19201	74757.864	69691.599	55873.874	65838.881	59594.164	61677.356
## NA19203	57106.174	52199.761	43755.923	48676.975	43989.124	48385.272
## NA19204	61412.602	55861.990	47418.788	54961.702	49120.800	47243.545
## NA19209	100733.258	95049.154	81128.081	91354.674	84765.417	84277.589
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## NA19222	34926.848	28650.758	37718.705	32393.436	31868.440	35741.588
## NA19225	50223.868	45687.985	41256.427	45853.042	41860.106	42449.422
## NA19238	49728.446	43790.088	39942.771	43144.418	39310.795	43640.628
## NA19239	53622.881	46941.239	47390.581	47969.188	45118.112	48652.847
## NA19257	55657.927	49382.473	46375.329	50657.725	47099.421	44934.607
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## NA11931	47516.777	50944.098	26019.220	35744.798	57635.360	44867.420
## NA11992	52997.137	51804.088	43620.593	41082.803	61227.697	49505.190
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## NA12003	28086.287	33361.865	34355.206	29867.084	41839.503	43452.409
## NA12004	33792.767	53990.334	63814.770	68644.855	23261.084	50089.080
## NA12005	25865.500	33482.069	30626.996	25619.879	37742.594	41545.414
## NA12006	50558.935	45037.620	40826.350	39558.924	57334.081	47067.561
## NA12043	33405.575	38769.452	17713.394	21161.380	45576.136	40454.023
## NA12044	39394.161	46766.510	31784.395	26439.267	49534.882	46378.000
## NA12045	65033.205	67658.762	58798.228	65230.058	64343.652	61874.792
## NA12144	17725.178	37610.834	45316.871	50828.400	13565.939	35815.581

## NA12154	45499.292	39691.602	32392.893	34111.093	55073.126	49457.796
## NA12155	21040.432	36263.190	27308.094	27182.055	28385.710	34122.201
## NA12156	10989.511	33937.106	37293.230	41906.158	18281.020	34867.128
## NA12234	21034.341	17975.215	29151.411	33556.881	31629.695	37011.381
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## NA12287	31132.662	46108.562	27709.153	31374.211	43633.223	38110.129
## NA12414	32109.806	45646.237	30221.720	43911.389	39544.782	41166.416
## NA12489	36019.130	53001.306	46831.266	51446.240	33747.177	40859.434
## NA12716	33230.041	41042.117	44915.969	46210.978	36162.537	43808.078
## NA12717	29129.375	50349.980	50939.918	53189.455	26493.665	39505.188
## NA12750	23549.171	33927.407	45172.860	52224.532	18623.995	37977.196
## NA12751	20573.360	36032.706	39758.444	45756.210	18663.311	33335.299
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## NA12761	20436.412	36675.741	40599.970	39926.350	21759.631	34546.404
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## NA12872	30818.383	41788.589	23724.299	31479.391	37307.052	37852.366
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## NA18501	29380.069	46800.253	42767.256	49529.075	25239.336	38546.844
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## NA18504	30891.198	35315.251	33659.265	37632.766	37906.126	35757.986
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## NA18507	52155.266	51978.517	31533.224	36409.685	59059.862	49100.884
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## NA18510	34722.721	47095.698	26835.037	26607.461	45460.140	41298.137
## NA18511	69645.412	61647.161	48954.472	47875.166	79311.192	68922.364
## NA18516	31156.384	48326.756	38756.129	47677.479	29867.423	34297.333
## NA18517	79089.625	78620.938	58974.893	57776.873	85856.366	71900.405
## NA18519	69224.984	71696.401	52025.208	48548.461	79457.674	69171.817
## NA18520	66120.046	66260.774	44869.253	51253.598	72363.483	60060.476
## NA18522	51265.344	56365.950	32824.902	36284.092	59089.263	49382.080
## NA18523	23347.326	40412.257	37156.380	44112.301	22156.672	32359.344
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## NA18858	53975.173	57908.667	32679.315	33246.581	63337.742	52767.341
## NA18861	34964.715	38458.336	32700.511	40451.227	36442.059	40293.310
## NA18862	56931.001	57804.645	47877.060	54799.938	59586.581	53261.628
## NA18870	30374.944	38395.402	27943.854	30743.966	36479.242	36431.404
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## NA18912	30357.820	46659.784	50601.238	58374.264	22461.767	37845.480
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## NA18916	66985.543	45864.110	60405.455	62834.625	73557.325	71189.275
## NA19093	69278.876	53367.972	47868.950	53485.643	77876.569	67116.047
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## NA18516	42105.500	47718.451	46122.120	57195.329	42821.899	28425.781
## NA18517	105889.962	53185.471	54854.446	43373.350	69486.180	63692.381
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## NA18520	89875.468	48465.286	46122.101	46352.053	62394.077	51671.045
## NA18522	78334.341	37448.346	32270.784	45686.263	54583.573	36729.394
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## NA19127	67028.396	52705.108	50453.714	49333.020	51466.511	45396.294
## NA19128	89822.911	67549.290	66279.894	60084.592	69812.215	68207.116
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## NA19137	72849.404	34677.685	32899.001	46649.884	50146.677	34383.672
## NA19138	99018.595	54840.267	49250.871	47391.585	66939.227	54650.972
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## NA18517
## NA18519
## NA18520
## NA18522
## NA18523
## NA18852
## NA18853
## NA18855
## NA18856
## NA18858
## NA18861
## NA18862
## NA18870
## NA18871
## NA18909
## NA18912
## NA18913
## NA18916
## NA19093
## NA19098
## NA19099
## NA19101
## NA19102
## NA19108
## NA19114
## NA19116
## NA19119
## NA19127
## NA19128
## NA19130
## NA19131
## NA19137
## NA19138
## NA19140
## NA19143
## NA19144
## NA19147
## NA19152
## NA19153
## NA19159
## NA19160
## NA19171
## NA19172
## NA19190
## NA19192
## NA19193
## NA19200
## NA19201
```

```

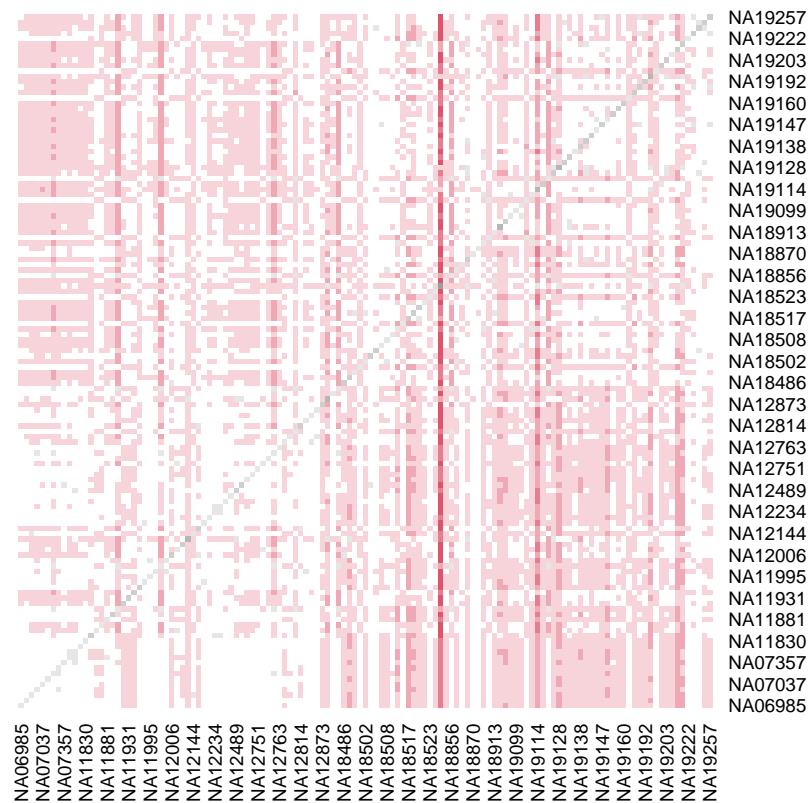
## NA19203
## NA19204
## NA19209
## NA19210
## NA19222
## NA19225
## NA19238
## NA19239 18932.766
## NA19257 33444.999 36869.645

```

```

#Buat heatmap
colramp = colorRampPalette(c("white", "red"))(9)
heatmap(as.matrix(dist1), col=colramp, Colv=NA, Rowv=NA)

```



```

#Cluster Dendrogram
hclust1 = hclust(dist1)
hclust1

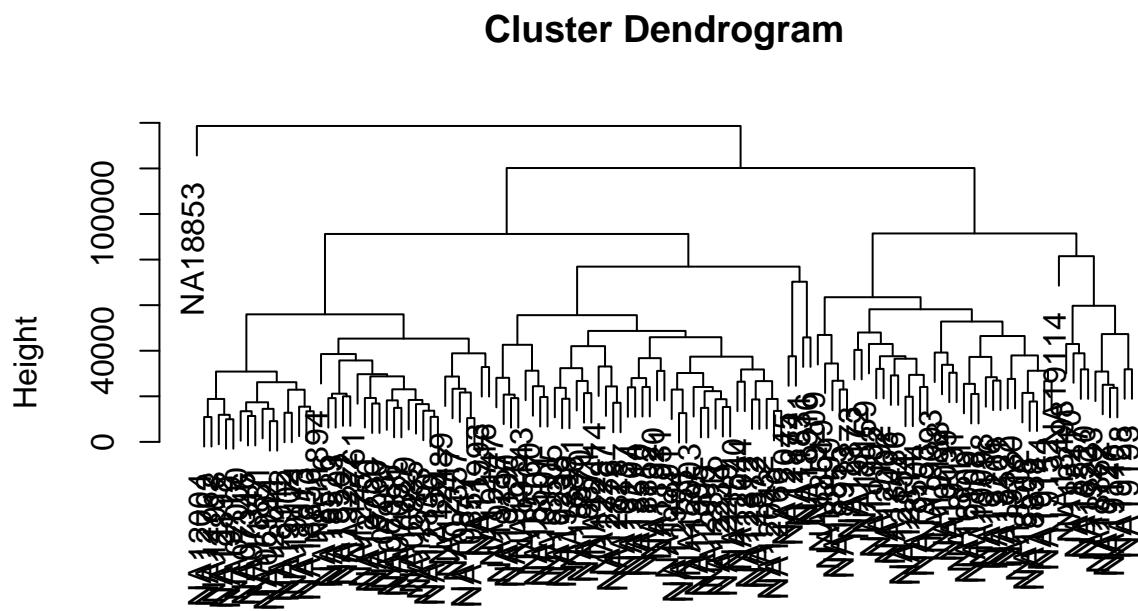
```

```

##
## Call:
## hclust(d = dist1)
##
## Cluster method : complete
## Distance       : euclidean
## Number of objects: 129

```

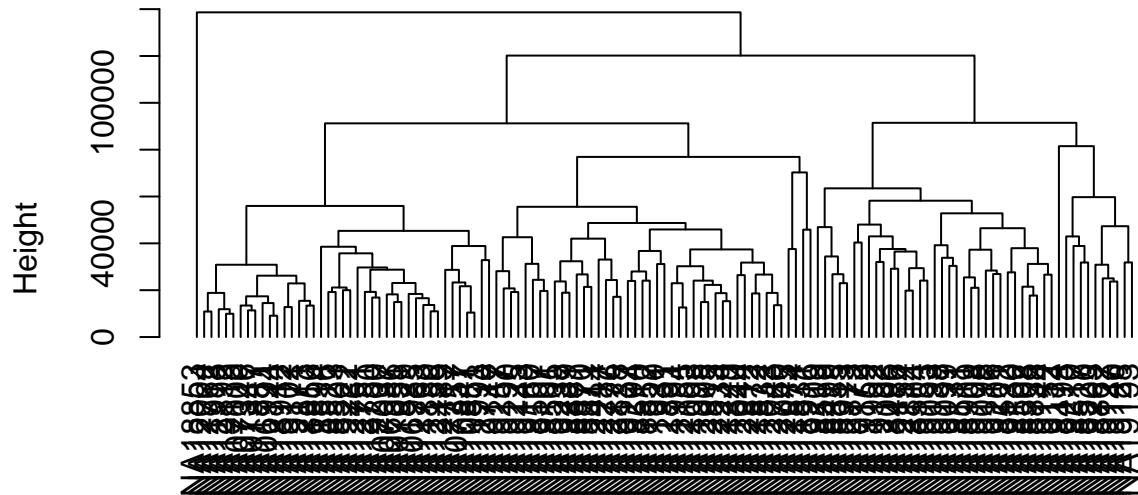
```
plot(hclust1)
```



```
dist1  
hclust (*, "complete")
```

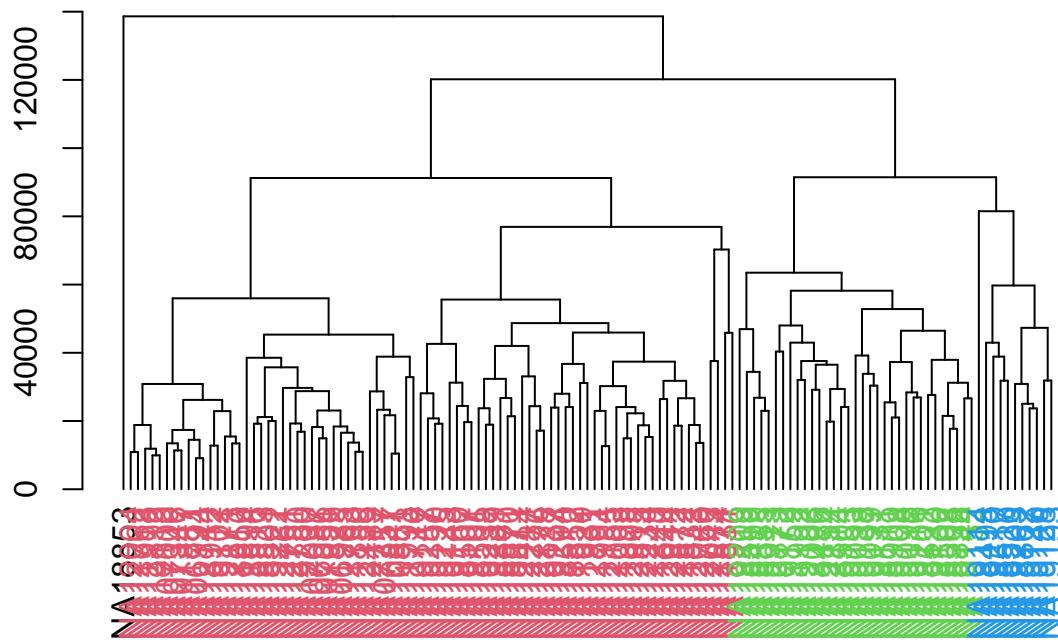
```
plot(hclust1,hang=-1)
```

## Cluster Dendrogram

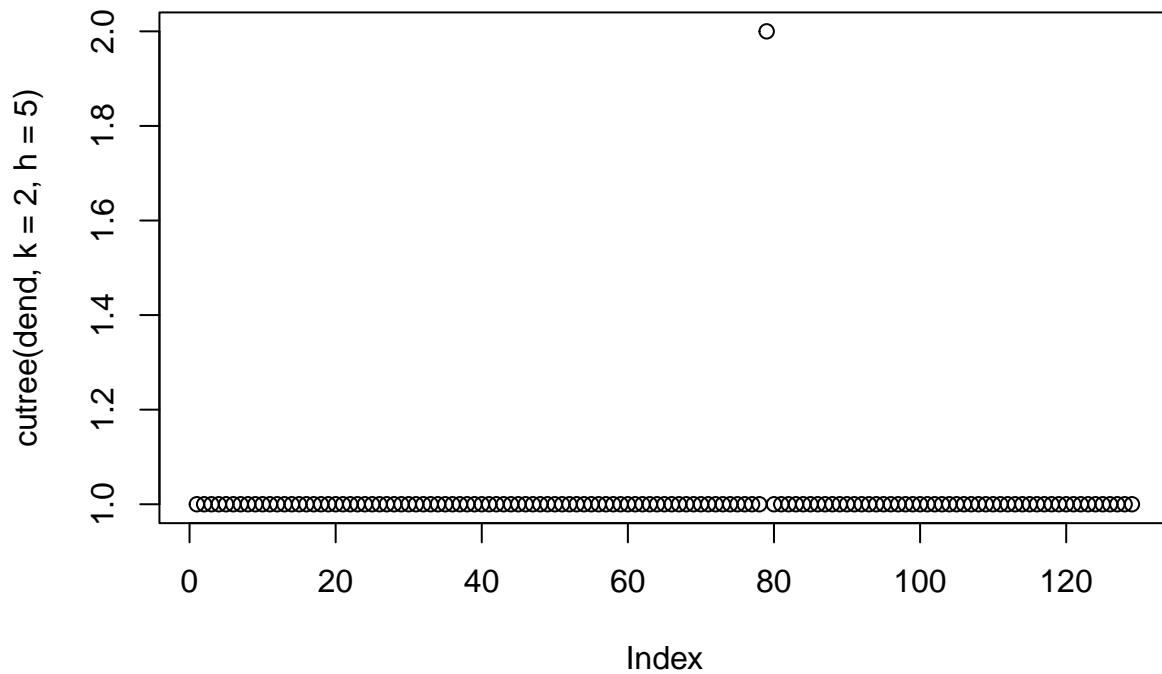


dist1  
hclust (\*, "complete")

```
#Clustering dendrogram
dend = as.dendrogram(hclust1)
dend = color_labels(hclust1,4,col=1:4)
plot(dend)
```



```
#Cutree  
plot(cutree(dend, k=2, h=5))
```



### Clustering dengan kmeans

```

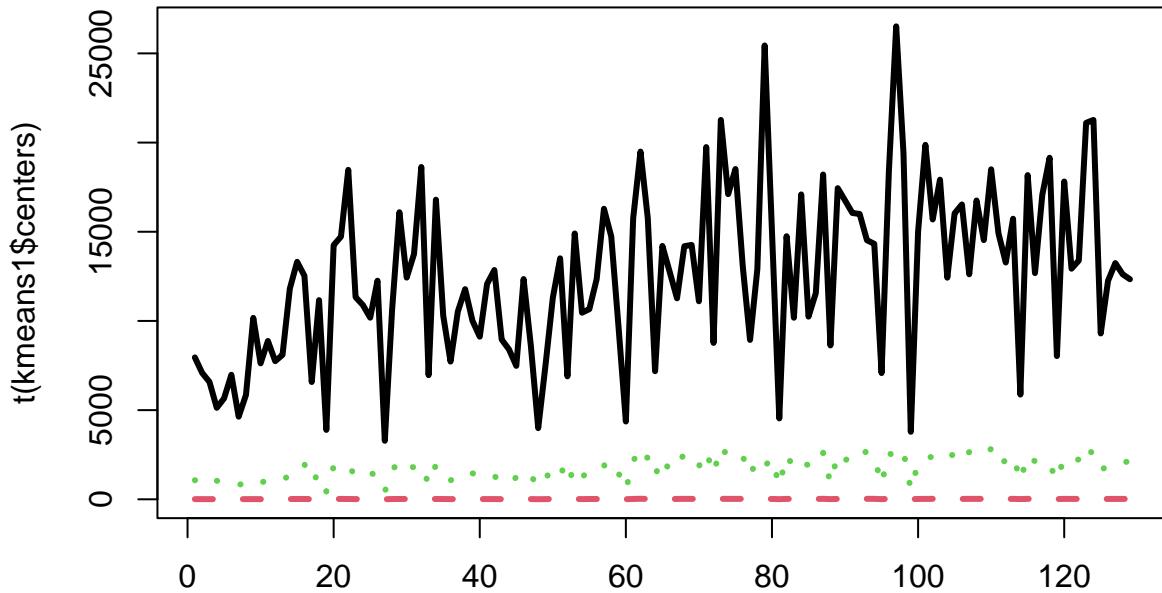
kmeans1 = kmeans(edata,centers=3)
names(kmeans1)

## [1] "cluster"      "centers"       "totss"        "withinss"      "tot.withinss"
## [6] "betweenss"    "size"          "iter"         "ifault"

####Plot pusat cluster

matplot(t(kmeans1$centers),col=1:3,type="l",lwd=3)

```



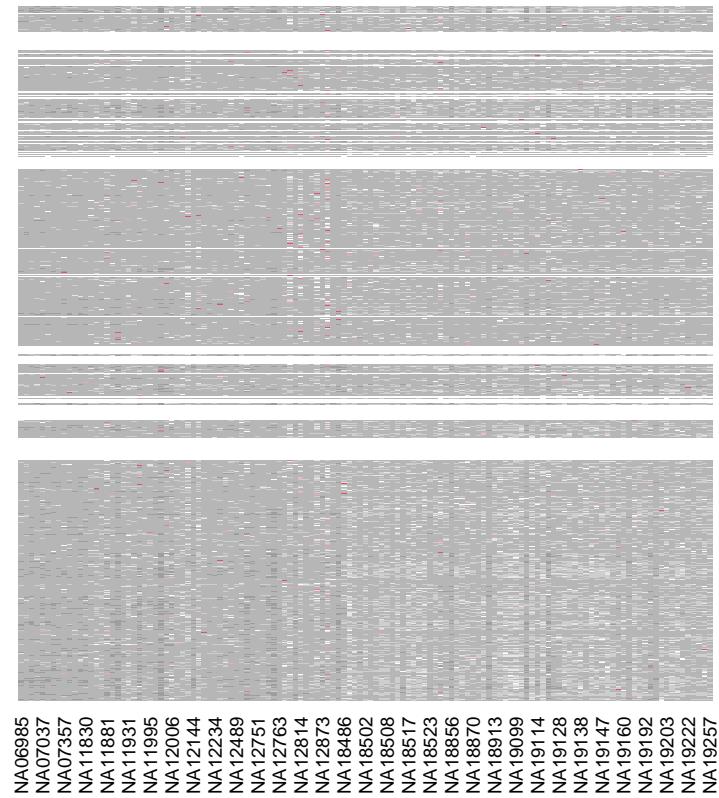
```
# cek berapa banyak gen di masing2 cluster
table(kmeans1$cluster)
```

```
##
##      1      2      3
##    14 52095   471
```

```
# cek cluster mana yang dikasih ke setiap gen
kmeans1$cluster[1:15]
```

```
## ENSG0000000003 ENSG0000000005 ENSG00000000419 ENSG00000000457 ENSG00000000460
##           2           2           2           2           2
## ENSG00000000938 ENSG00000000971 ENSG00000001036 ENSG00000001084 ENSG00000001167
##           2           2           2           2           2
## ENSG00000001460 ENSG00000001461 ENSG00000001497 ENSG00000001561 ENSG00000001617
##           2           2           2           2           2
```

```
#Heatmap dengan cluster yang sudah disortir
heatmap(as.matrix(edata)[order(kmeans1$cluster),], col=colramp, Colv=NA, Rowv=NA)
```



Conclusion : 1. The heatmap shows that the distance of each gene expression not showing significant difference. 2. Using dendrogram with three clusters, however the number of gene expression in cluster 1 is dominant compared to other clusters. 3. There's no overlap in the distance of each cluster.

## Clustering-2

```
#Filter gene with low expression
set.seed(123)
edata2 = edata[rowMeans(edata) < 100,]

dist2 = dist(t(edata2))
dist2
```

```
##          NA06985   NA06986   NA06994   NA07000   NA07037   NA07051   NA07346
## NA06986 1237.6716
## NA06994 1209.8789 1084.3468
## NA07000 1302.0995 1317.0505 1107.7220
## NA07037 1338.2746 1277.9476 1283.7500 1160.1440
## NA07051 1374.6403 1223.8901 1005.9259 1219.1583 1269.2923
## NA07346 1211.5317 1241.0109  978.7369 1014.0404 1292.8016 1166.2140
## NA07347 1110.6543 1158.2340 1023.1432 1009.3483 1028.2665 1112.4644 1044.8196
## NA07357 1227.9169 1207.2858 1059.0737 1313.9189 1414.1800 1154.4315 1172.6487
## NA10847 1195.7579 1160.7213  791.3002  870.4734 1077.7950  983.8918  876.9287
## NA10851 1122.3097 1112.0737  901.4988  995.6927 1116.9064  996.5656  954.9670
## NA11829 2392.9620 2220.1423 2186.9957 2431.6233 2382.4790 2049.2294 2340.5303
```

```

## NA11830 1248.5932 1254.5971 1024.7487 1088.3731 1212.6170 1046.3092 1092.0760
## NA11831 2085.4208 2012.3258 1919.2517 1895.8241 2024.0373 1797.3169 2029.3967
## NA11832 2294.9442 2220.6287 2303.2989 2084.3071 2214.1906 2046.6140 2327.6048
## NA11840 2040.2341 1976.4332 2146.9224 1774.8037 1858.7281 2026.5930 2085.0233
## NA11881 1415.5868 1317.3568 1116.4887 1111.4455 1199.1234 1202.8358 1194.2918
## NA11894 1735.9654 1631.7852 1549.3757 1614.6074 1725.3849 1600.5168 1656.3994
## NA11918 1510.5476 1610.2841 1132.0225 1363.2017 1671.3704 1378.8706 1234.1074
## NA11920 2088.6292 1940.1575 2032.6512 2023.9973 2108.7359 1952.1762 2048.0159
## NA11931 2694.5001 2593.0812 2716.2073 2723.5334 2814.3251 2556.6324 2769.9502
## NA11992 2069.4456 2022.4881 2066.5808 1837.3280 2069.1283 2075.1431 2092.8827
## NA11993 1818.9920 1819.0099 1678.4663 1648.4384 1839.1359 1856.9949 1711.7964
## NA11994 1710.8381 1629.1421 1650.3278 1367.6381 1620.8387 1567.6042 1639.9689
## NA11995 1724.7093 1579.3717 1679.3073 1551.1231 1659.6985 1623.2529 1688.2402
## NA12003 1340.1384 1302.5460 1073.2539 1247.7115 1488.0605 1222.2025 1258.8233
## NA12004 1523.8143 1594.6928 1070.4247 1388.3317 1642.1020 1449.1860 1240.1754
## NA12005 2009.6134 1805.1368 1929.7966 1973.0127 1994.4114 1874.1878 1998.0083
## NA12006 3010.2681 2932.3740 3045.9677 2930.0442 3010.1483 3000.7176 2998.6459
## NA12043 1907.9450 1753.0804 1874.9696 1636.0260 1723.5188 1686.1957 1898.8020
## NA12044 2013.5623 1995.1842 2152.7856 2116.4560 2273.2448 2108.8672 2186.2891
## NA12045 2893.4936 2768.8348 2944.5957 2667.0133 2804.4704 2757.5165 2798.3624
## NA12144 1223.8362 1196.7331 779.7410 1068.2958 1311.1895 1024.0942 978.1319
## NA12154 2208.3437 2048.0759 2212.4685 2134.5035 2218.1495 2022.0638 2257.3956
## NA12155 1515.2419 1434.3748 1485.1414 1226.6552 1467.9363 1408.6085 1507.8173
## NA12156 1087.6033 1111.7662 842.8523 996.4637 1290.2589 939.3588 960.6186
## NA12234 1512.1961 1388.6324 1325.6674 1265.8728 1402.8592 1214.1931 1470.5618
## NA12249 1482.9811 1349.8896 1378.9663 1305.8737 1527.8986 1363.4387 1481.7044
## NA12287 1760.1781 1574.8276 1696.3249 1601.8745 1516.2276 1387.4779 1650.1400
## NA12414 3648.7680 3642.3689 3676.3821 3619.2805 3674.8321 3541.1687 3676.2422
## NA12489 1435.8402 1435.3696 1323.8837 1438.1481 1547.2847 1369.2483 1367.7617
## NA12716 1407.0473 1472.2727 1454.9058 1414.9866 1552.0950 1520.8892 1426.1778
## NA12717 2447.5786 2462.7058 2391.0529 2528.8491 2696.4517 2510.7312 2361.6664
## NA12750 1334.7809 1367.3723 1046.3752 1165.2232 1490.1856 1136.3415 1198.2366
## NA12751 1340.6603 1283.4567 1138.4020 1175.3812 1462.6514 1179.5185 1285.9436
## NA12760 1686.2755 1578.0963 1640.4847 1452.8606 1621.3007 1583.1611 1692.6524
## NA12761 1641.1758 1569.1243 1498.1685 1407.4356 1506.9940 1557.3843 1571.0541
## NA12762 1259.8829 1290.2945 855.8084 1067.8436 1320.9481 1173.3614 1004.5706
## NA12763 1271.7169 1193.3118 1066.3363 1076.4362 1352.3502 1191.2615 1228.3342
## NA12776 2613.5185 2387.2650 2514.6582 2542.4103 2601.3812 2301.9755 2570.7781
## NA12812 2237.5480 2107.6636 2208.0824 1864.8019 2005.5154 2073.9636 2183.8864
## NA12813 1401.4503 1433.9072 1147.3378 1109.2700 1484.5525 1284.3695 1185.9713
## NA12814 2074.5530 1885.2493 2035.6304 1944.0013 2015.2461 1876.7232 2064.1562
## NA12815 1273.9576 1168.8777 996.4813 1186.2323 1392.6051 1104.7642 1210.8010
## NA12828 1663.1242 1558.8595 1688.5239 1715.3160 1775.7390 1582.0088 1729.6552
## NA12872 2170.3106 2048.5563 2104.3015 1875.4192 2019.3269 1914.7386 2088.3422
## NA12873 1964.9140 1826.4791 1873.6051 1929.2486 1966.1856 1786.1246 1961.5795
## NA12874 2192.9042 2131.3705 2130.3854 1905.9895 2304.2804 2169.6735 2007.2504
## NA12891 1744.4787 1631.7233 1668.8262 1703.3852 1852.6729 1754.2856 1725.1136
## NA12892 1310.7010 1362.0184 900.6253 1182.1345 1501.7243 1236.5076 1028.3531
## NA18486 2283.3272 2270.4911 2365.7971 2295.3693 2328.5459 2351.2450 2365.9243
## NA18498 3800.7197 3716.2289 3942.5135 3674.3823 3770.0723 3674.6314 3815.2967
## NA18499 2905.7794 2706.8700 2944.7616 2868.5078 2924.2826 2808.3675 2932.1386
## NA18501 2065.9910 2022.1810 2023.5059 1724.0093 2033.7728 1976.3904 1951.4226
## NA18502 2562.0585 2442.7884 2651.5397 2554.7902 2624.2761 2520.5238 2662.4547
## NA18504 1861.1827 1724.2900 1765.7225 1846.0282 2021.9822 1758.0646 1829.1080

```

```

## NA18505 2722.4746 2611.0322 2685.7586 2495.4424 2731.3215 2578.6675 2693.5640
## NA18507 3182.0456 3031.5846 3248.4798 2987.5199 3028.1319 3026.8852 3175.1367
## NA18508 2861.4161 2768.2317 2947.6643 2656.0860 2807.9051 2762.7740 2830.1525
## NA18510 2029.1134 1896.2294 1961.2088 1818.5500 1865.3096 1837.8713 1953.1759
## NA18511 3372.5556 3233.8172 3471.4372 3276.2772 3326.2174 3257.2938 3440.8577
## NA18516 1985.0683 1916.5706 1960.6731 1762.5921 1912.8819 1903.4873 1911.8570
## NA18517 3514.8846 3348.6781 3591.3784 3286.8473 3352.4169 3418.1337 3529.0054
## NA18519 3064.5089 2868.1977 3126.3592 3008.9071 3063.5404 3003.6190 3100.4345
## NA18520 3025.9643 2905.0747 3108.8327 2902.3382 2908.1236 2878.2783 3049.8084
## NA18522 3641.1020 3450.5957 3702.0709 3401.5054 3416.7471 3518.7120 3627.7733
## NA18523 1621.5049 1543.9641 1578.0111 1502.1601 1657.7844 1557.4736 1509.3929
## NA18852 2559.9838 2379.3491 2642.8031 2525.7728 2499.5632 2427.0420 2629.0219
## NA18853 3556.2243 3557.2006 3554.8249 3406.5155 3536.8319 3597.9209 3576.8715
## NA18855 2442.6254 2274.8600 2423.6452 2310.5869 2362.0826 2348.8016 2427.4336
## NA18856 1430.7760 1457.7013 1101.0018 1136.8628 1526.5101 1271.0020 1145.0725
## NA18858 2600.2396 2448.9285 2644.2048 2416.2237 2462.0526 2457.9345 2617.2533
## NA18861 2981.6308 2859.1728 3020.7994 2717.2466 2874.3436 2900.6189 2950.0280
## NA18862 2864.5256 2741.5911 2880.2410 2790.5874 2877.3224 2683.7360 2862.0566
## NA18870 2503.2016 2415.9373 2519.2822 2304.7688 2369.2959 2395.2144 2485.0286
## NA18871 2344.4846 2319.1557 2381.5434 2274.3269 2343.7732 2174.4489 2383.5832
## NA18909 3336.7859 3190.6988 3453.4529 3213.8552 3226.9523 3231.1422 3417.1759
## NA18912 1386.5659 1461.6723 1186.0371 1335.9401 1684.2007 1366.7710 1194.2027
## NA18913 2673.4156 2540.7629 2697.3168 2503.6394 2549.1285 2531.8454 2684.4508
## NA18916 2919.0879 2758.4719 2938.7999 2938.5001 3003.7761 2761.3374 2988.2097
## NA19093 3884.3571 3712.3355 3922.2112 3751.7312 3811.4217 3728.4394 3941.6475
## NA19098 3888.3054 3752.9786 3990.5784 3662.4451 3800.7128 3824.2017 3949.0862
## NA19099 3928.1903 3770.0804 4039.6403 3705.3505 3751.2435 3833.7959 3961.7004
## NA19101 3272.0923 3134.2254 3338.3644 3123.2766 3219.9309 3110.2476 3322.4508
## NA19102 1525.6513 1571.7497 1242.5051 1456.9485 1757.5326 1465.6446 1347.9863
## NA19108 3504.2921 3383.4902 3598.3104 3359.8497 3437.5229 3365.6867 3561.2953
## NA19114 2531.8286 2362.1924 2444.3737 2533.0876 2554.8869 2420.5437 2559.4267
## NA19116 3507.6380 3523.5225 3810.2219 3533.8377 3641.6380 3677.4045 3644.4943
## NA19119 1425.7850 1477.9154 1049.4227 1298.5946 1599.4093 1358.4841 1191.6317
## NA19127 2775.5174 2666.2498 2698.2150 2561.5819 2671.7242 2505.2315 2697.9136
## NA19128 3179.1431 3018.0808 3121.7732 2957.8452 3032.6355 2957.4153 3114.2145
## NA19130 3697.6956 3508.2394 3701.8244 3502.0200 3583.4316 3445.8617 3677.1886
## NA19131 2992.0879 2900.7321 3081.8214 2829.6535 2931.3023 2913.6977 3046.9977
## NA19137 2710.9126 2541.1761 2738.5668 2402.1074 2400.6033 2533.7141 2638.0766
## NA19138 3101.1275 2887.4104 3177.5486 3086.9294 3121.7497 3027.8791 3224.6766
## NA19140 2828.3221 2675.2916 2768.9848 2591.3516 2681.0507 2552.3569 2762.0089
## NA19143 3535.1296 3394.6682 3647.0062 3342.8877 3376.9557 3423.7764 3594.3575
## NA19144 3192.2927 3103.3053 3273.2583 2967.0234 3089.3708 3153.8486 3228.9791
## NA19147 3157.2116 3037.6563 3244.3089 3024.0886 3081.5421 3043.8536 3205.1200
## NA19152 3857.5777 3699.4706 3903.0079 3654.2675 3695.8134 3612.1058 3876.5470
## NA19153 2822.0691 2813.8108 2997.9451 2933.4712 3076.4351 2906.3957 2946.2276
## NA19159 3682.2116 3545.1695 3677.7503 3673.8409 3701.9034 3633.7306 3702.9409
## NA19160 3211.2877 3103.0781 3250.1249 3008.2483 3059.6173 3077.8007 3226.7838
## NA19171 1648.8526 1566.7252 1411.7726 1386.0570 1655.5283 1437.1698 1464.5552
## NA19172 3757.8163 3833.8730 4168.4491 4125.7945 4033.0510 4015.5252 4121.4250
## NA19190 2749.6412 2676.2089 2870.5111 2683.7679 2758.2259 2697.6484 2846.7009
## NA19192 2507.2563 2338.2436 2582.9698 2504.4506 2569.5461 2448.6049 2508.9653
## NA19193 2276.6998 2210.6531 2124.9774 2113.5834 2275.7441 2125.5338 2136.4950
## NA19200 1484.3264 1424.6670 1248.0280 1417.6304 1675.3352 1385.8149 1418.5493
## NA19201 3135.6001 2935.9576 3127.1049 3077.8400 3161.5264 2980.9670 3183.4345

```

```

## NA19203 2802.2521 2650.4886 2763.0975 2674.2311 2750.4341 2574.2403 2797.6647
## NA19204 3338.6771 3330.9440 3481.4170 3500.2994 3442.2173 3412.2138 3482.9551
## NA19209 3549.7480 3356.3534 3627.6648 3471.9375 3472.7329 3478.5585 3673.2253
## NA19210 3538.1465 3393.6296 3552.2756 3283.9808 3363.9985 3395.8087 3471.6544
## NA19222 2482.3978 2334.5017 2436.2771 2201.9001 2333.1065 2309.2464 2388.4049
## NA19225 2440.3444 2317.0304 2479.2866 2323.8167 2420.6123 2295.6265 2483.3506
## NA19238 2781.8869 2705.7162 2779.1441 2604.3525 2792.7413 2611.8336 2789.0991
## NA19239 3232.8297 3104.6924 3218.5818 3003.8617 3141.6316 3014.4525 3174.0399
## NA19257 2712.4061 2596.6629 2757.9801 2555.2092 2609.2685 2532.3386 2738.9739
## NA07347 NA07357 NA10847 NA10851 NA11829 NA11830 NA11831
## NA06986
## NA06994
## NA07000
## NA07037
## NA07051
## NA07346
## NA07347
## NA07357 1148.3645
## NA10847 868.2891 1100.6593
## NA10851 934.4164 1044.0091 733.2039
## NA11829 2329.3579 2229.5831 2274.4467 2250.7825
## NA11830 1006.7403 1022.9560 885.9199 897.1767 2207.0754
## NA11831 1868.0768 1804.4290 1936.5916 1884.1839 2491.8144 1777.3669
## NA11832 2123.7443 2197.3787 2238.3918 2151.2038 2911.9083 2184.1671 1843.8994
## NA11840 1842.4668 2010.5096 1967.8409 1891.0643 2868.4891 1890.2688 2102.0240
## NA11881 1123.2466 1182.6732 997.6347 1088.0970 2225.2099 1004.6865 1748.2351
## NA11894 1603.9984 1730.5600 1555.5189 1575.7389 2653.8913 1647.0674 2149.3780
## NA11918 1324.0895 1478.7332 1108.2567 1339.2636 2589.2650 1443.1552 2215.2562
## NA11920 2010.1749 2046.1031 1959.2414 1871.4553 2860.7305 2053.5075 2467.8695
## NA11931 2713.0079 2715.0527 2772.3917 2587.4354 3362.5318 2771.6223 2777.9404
## NA11992 1965.6195 2056.6383 2032.3518 1919.5296 2827.3659 1986.6303 2029.5233
## NA11993 1678.0343 1752.5410 1594.5661 1639.2971 2690.6076 1638.5924 2250.5759
## NA11994 1444.2389 1573.9069 1494.7254 1465.6029 2688.7852 1550.4515 1865.8164
## NA11995 1521.5068 1491.5274 1573.7411 1525.6058 2520.1704 1550.6615 1975.5617
## NA12003 1193.8007 1273.9572 1040.2394 1074.9865 2324.2638 1233.8468 1820.7067
## NA12004 1360.9067 1484.0317 1072.0947 1302.2776 2511.4225 1362.8290 2264.9887
## NA12005 1908.2633 1738.0259 1916.7856 1792.7317 2483.8424 1829.0962 2180.5467
## NA12006 2915.7478 2964.7850 2975.9404 2868.7679 3616.9132 2981.6554 3151.6916
## NA12043 1623.1965 1761.3569 1737.1203 1643.3487 2635.2106 1758.4360 1937.8880
## NA12044 2103.2732 1895.2633 2197.8599 1982.6523 2779.0984 2055.4386 2338.3436
## NA12045 2623.4813 2789.2506 2834.7092 2673.3971 3455.8359 2778.9199 2792.5907
## NA12144 951.3674 1061.1640 817.1597 953.2272 2242.4067 980.6141 1811.0155
## NA12154 2044.5960 2000.1415 2185.8868 1997.0756 2767.3957 2097.5102 2068.3631
## NA12155 1297.4849 1371.6931 1350.4011 1271.0787 2548.3659 1309.6362 1788.2075
## NA12156 970.2927 994.5597 798.8592 793.1444 2222.8999 948.3491 1750.9286
## NA12234 1240.3209 1323.2328 1277.8302 1240.6893 2202.0554 1252.5430 1399.0586
## NA12249 1326.8338 1343.8493 1326.8730 1246.4317 2468.4173 1267.7484 1793.0329
## NA12287 1467.4495 1674.3181 1606.9524 1549.0636 2591.8225 1597.5450 2060.6196
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## NA19204 3114.5560 3118.5016
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## NA19210 2944.9555 2932.3734 3646.2808 2948.1730
## NA19222 2326.0346 2156.9140 2997.7982 2779.2488 2378.9346
## NA19225 2193.6091 1928.3164 3132.8584 2543.5440 2588.9430 1846.1565
## NA19238 2220.2989 2022.5875 2951.1028 2693.8122 2650.7916 1498.0434 1846.0450
## NA19239 2375.9470 2314.0624 3188.8583 2765.8881 2529.6306 1576.2681 2106.6640
## NA19257 2387.4109 2194.4412 3244.0419 2682.9540 2563.4988 1976.4291 1279.9312
## NA19238 NA19239
## NA06986
## NA06994
## NA07000
## NA07037
## NA07051
## NA07346
## NA07347
## NA07357
## NA10847
## NA10851
## NA11829

```

```
## NA11830
## NA11831
## NA11832
## NA11840
## NA11881
## NA11894
## NA11918
## NA11920
## NA11931
## NA11992
## NA11993
## NA11994
## NA11995
## NA12003
## NA12004
## NA12005
## NA12006
## NA12043
## NA12044
## NA12045
## NA12144
## NA12154
## NA12155
## NA12156
## NA12234
## NA12249
## NA12287
## NA12414
## NA12489
## NA12716
## NA12717
## NA12750
## NA12751
## NA12760
## NA12761
## NA12762
## NA12763
## NA12776
## NA12812
## NA12813
## NA12814
## NA12815
## NA12828
## NA12872
## NA12873
## NA12874
## NA12891
## NA12892
## NA18486
## NA18498
## NA18499
## NA18501
## NA18502
## NA18504
```

```
## NA18505
## NA18507
## NA18508
## NA18510
## NA18511
## NA18516
## NA18517
## NA18519
## NA18520
## NA18522
## NA18523
## NA18852
## NA18853
## NA18855
## NA18856
## NA18858
## NA18861
## NA18862
## NA18870
## NA18871
## NA18909
## NA18912
## NA18913
## NA18916
## NA19093
## NA19098
## NA19099
## NA19101
## NA19102
## NA19108
## NA19114
## NA19116
## NA19119
## NA19127
## NA19128
## NA19130
## NA19131
## NA19137
## NA19138
## NA19140
## NA19143
## NA19144
## NA19147
## NA19152
## NA19153
## NA19159
## NA19160
## NA19171
## NA19172
## NA19190
## NA19192
## NA19193
## NA19200
## NA19201
```

```

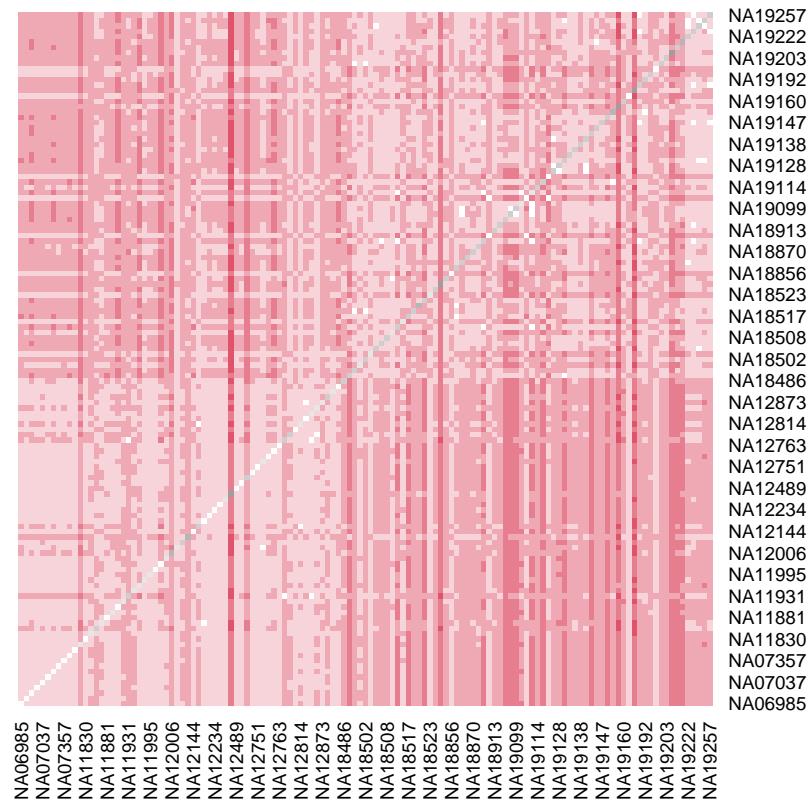
## NA19203
## NA19204
## NA19209
## NA19210
## NA19222
## NA19225
## NA19238
## NA19239 1418.3910
## NA19257 2084.2452 2186.6703

```

```

#Buat heatmap
colramp = colorRampPalette(c("white", "red"))(9)
heatmap(as.matrix(dist2), col=colramp, Colv=NA, Rowv=NA)

```



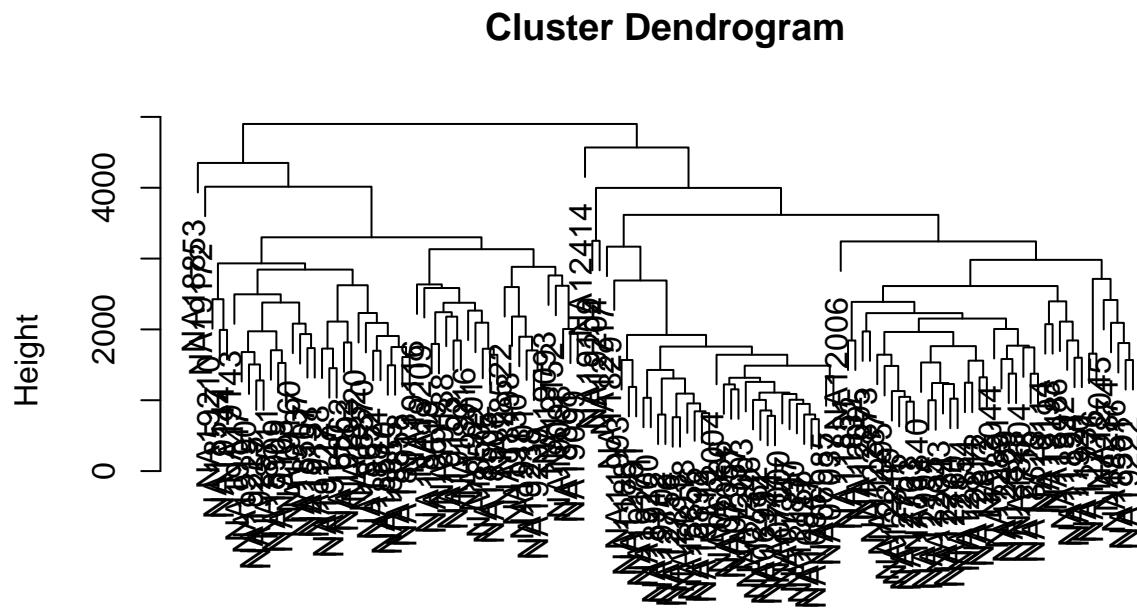
```

hclust2 = hclust(dist2)
hclust2

##
## Call:
## hclust(d = dist2)
##
## Cluster method : complete
## Distance       : euclidean
## Number of objects: 129

```

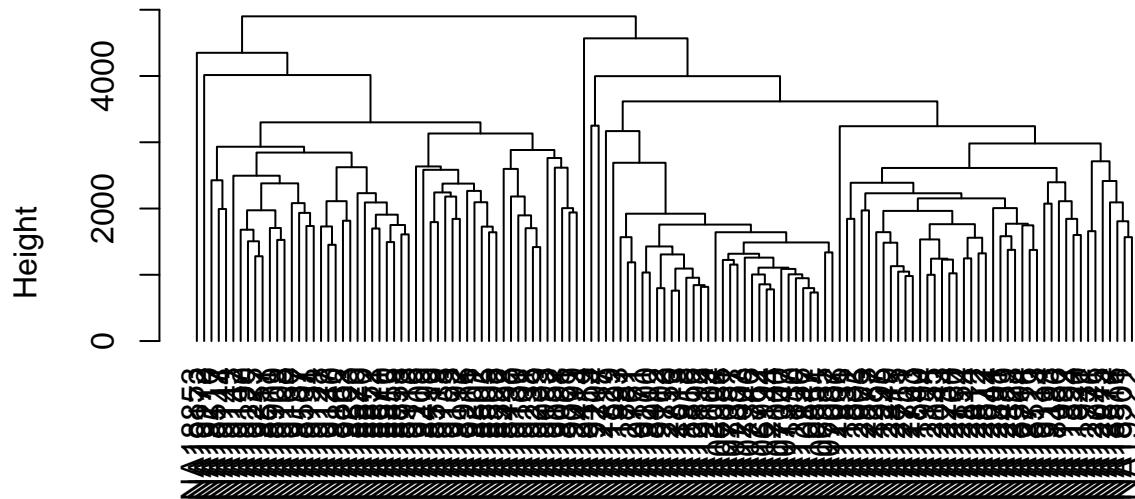
```
plot(hclust2)
```



```
dist2  
hclust (*, "complete")
```

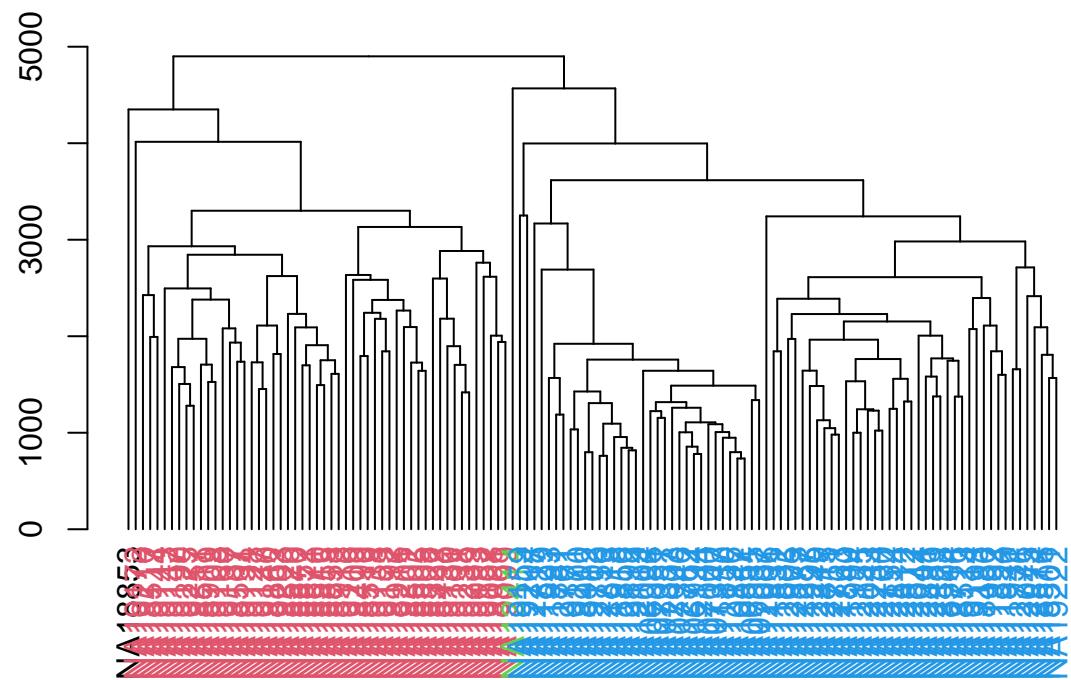
```
plot(hclust2,hang=-1)
```

## Cluster Dendrogram

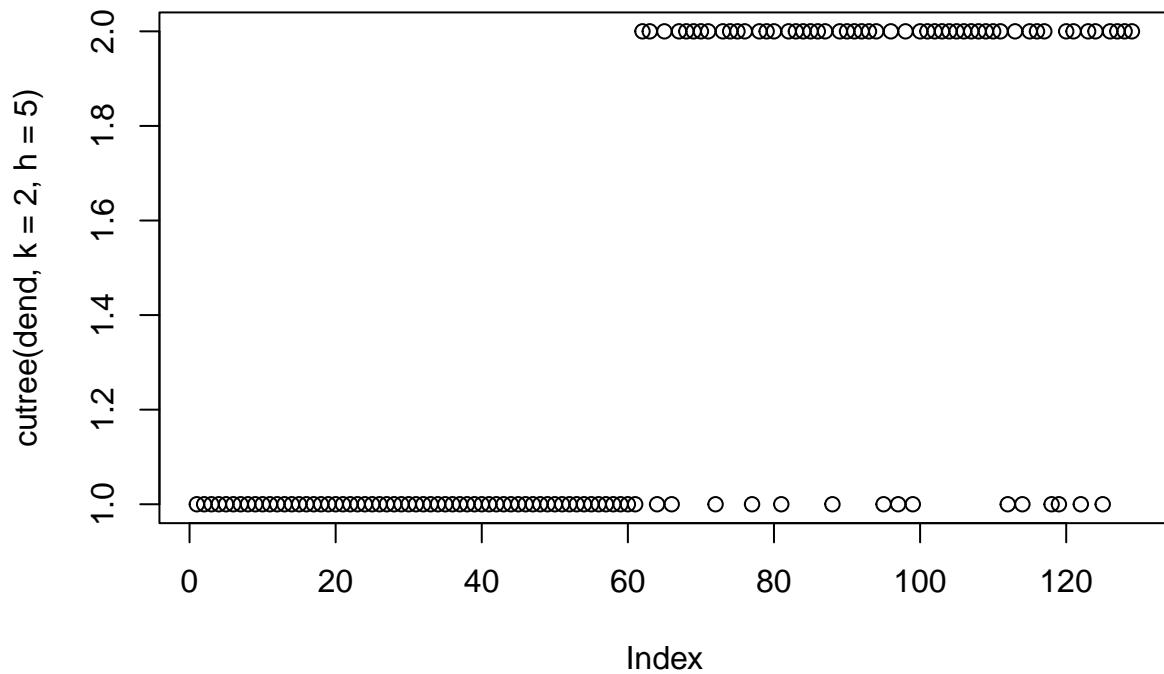


dist2  
hclust (\*, "complete")

```
#Buat dendrogram
dend = as.dendrogram(hclust2)
dend = color_labels(hclust2,4,col=1:4)
plot(dend)
```



```
#Cutree  
plot(cutree(dend, k=2, h=5))
```



Persebaran cluster dominan pada cluster gen merah dan biru.

### Clustering dengan kmeans

```

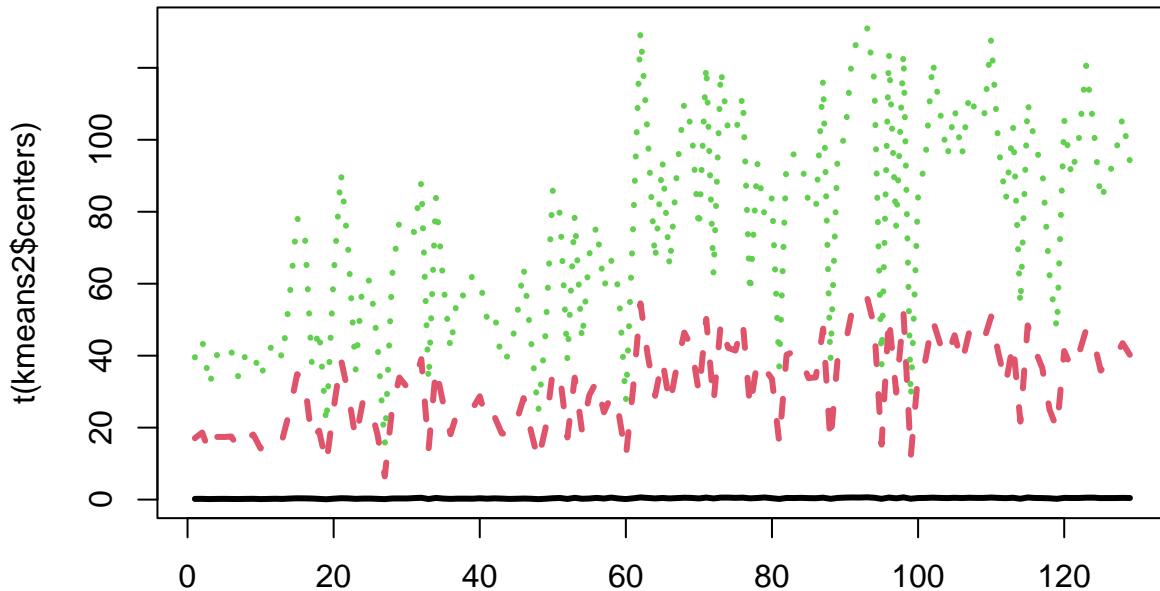
kmeans2 = kmeans(edata2, centers=3)
names(kmeans2)

## [1] "cluster"      "centers"       "totss"        "withinss"      "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"

###Plot pusat cluster

matplot(t(kmeans2$centers), col=1:3, type="l", lwd=3)

```



K-means dengan 3 centre masih menunjukkan pusat cluster yang overlap.

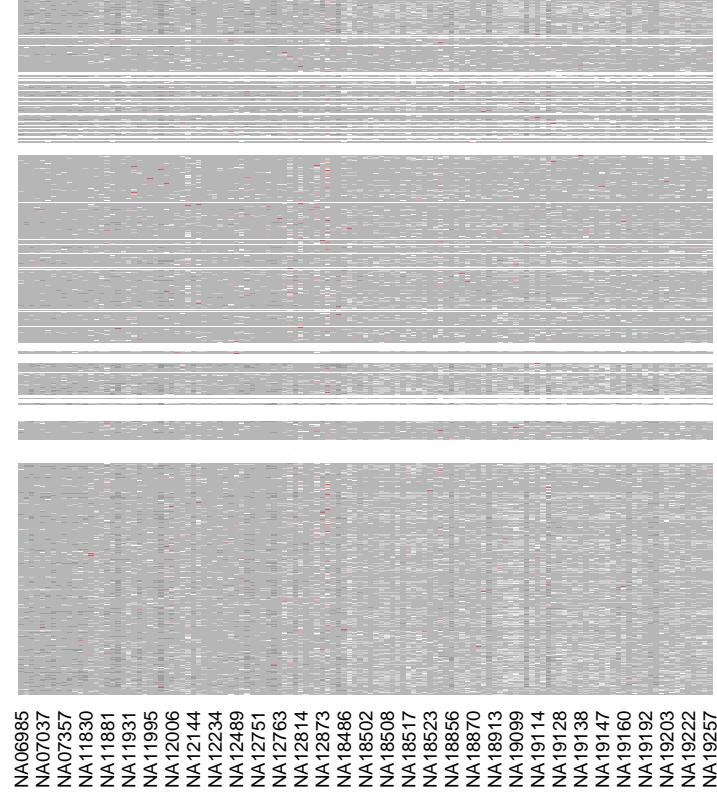
```
# cek berapa banyak gen di masing2 cluster
table(kmeans2$cluster)

##
##      1      2      3
## 47228 1429   851

# cek cluster mana yang dikasih ke setiap gen
kmeans2$cluster[1:15]

## ENSG0000000003 ENSG0000000005 ENSG00000000419 ENSG00000000457 ENSG00000000460
##           1           1           2           3           1
## ENSG00000000938 ENSG00000000971 ENSG00000001036 ENSG00000001084 ENSG00000001460
##           2           1           2           1           1
## ENSG00000001461 ENSG00000001497 ENSG00000001617 ENSG00000001626 ENSG00000001629
##           1           1           1           1           1

#Heatmap dengan cluster yang sudah disortir
heatmap(as.matrix(edata)[order(kmeans2$cluster),], col=colramp, Colv=NA, Rowv=NA)
```



Conclusion : 1. After the gene expression is filtered to expression >100, the heatmap shows that the distance of each gene expression showing some difference 2. Dendrogram shows two big clusters with one cluster (red and blue). However the cluster center distance is found overlapping with other clusters.

### Clustering-3

```
edata3 = log2(edata + 1)
```

```
dist3 = dist(t(edata3))
dist3
```

```
##          NA06985    NA06986    NA06994    NA07000    NA07037    NA07051    NA07346
## NA06986  93.19999
## NA06994  93.76137  95.74995
## NA07000 103.12867 107.73710 103.42584
## NA07037 121.58682 116.93695 117.89046 108.95138
## NA07051 107.40334  98.90786  98.01909 110.12445 119.24930
## NA07346 102.09264 104.54698  99.51901 102.98811 118.65114 106.60946
## NA07347 100.83150  97.59923 101.34975  92.51646 109.86914 103.64360  99.71184
## NA07357  97.32154  97.54991  98.00660 111.44670 125.75115 100.84981 108.04235
## NA10847 101.32197 101.33088  90.96334  90.95736 105.46068 101.54746  96.08374
## NA10851  95.56939  92.62654  92.06177  94.51520 112.07995  97.55724  98.59246
## NA11829 114.10679 109.75441 108.01753 124.68143 126.87948 108.84619 118.45777
## NA11830 104.04948 105.46369  99.97791  96.89765 109.21394  99.96192 104.16902
## NA11831 122.59570 119.66792 122.39917 113.02338 136.19591 116.44754 130.63163
```

```

## NA11832 141.78717 135.84761 150.73128 125.38650 154.24290 136.97338 152.56231
## NA11840 135.11909 132.04330 147.88914 117.25155 146.02305 141.80405 146.41467
## NA11881 126.71941 124.29553 123.01555 114.79523 125.79466 126.60162 124.77363
## NA11894 124.75393 117.67157 120.51218 119.29345 131.63059 122.67252 127.04209
## NA11918 157.65481 166.40794 142.60492 154.98446 171.76273 154.52780 144.78235
## NA11920 126.92215 115.70074 131.11017 129.50527 144.51518 124.35951 132.59473
## NA11931 141.88155 135.00437 151.81599 142.62046 170.86328 141.73520 156.80323
## NA11992 133.18918 128.15223 141.42350 122.38520 149.49287 141.25435 146.42238
## NA11993 140.10218 144.47512 138.24993 136.54009 146.06579 151.92621 142.09706
## NA11994 123.73779 119.31164 130.62836 104.10833 137.80221 123.48312 133.05210
## NA11995 125.04575 120.29665 132.86741 116.44030 138.48061 128.93591 133.48907
## NA12003 112.40993 110.75253 105.86415 114.83438 137.27839 117.34310 121.10331
## NA12004 194.71147 203.51670 176.29450 199.63524 199.12893 196.75609 184.07182
## NA12005 146.01182 138.75406 144.08684 146.70200 160.47485 145.50366 151.73511
## NA12006 183.34767 182.24747 183.06585 179.95193 189.28043 188.33850 183.80210
## NA12043 131.55613 123.08525 139.27986 116.65295 143.91852 130.20089 143.00857
## NA12044 126.53670 125.19407 143.51578 131.11491 159.48609 139.26393 149.81341
## NA12045 170.75273 164.62961 180.45312 151.60267 182.40933 167.38831 170.69855
## NA12144 103.01246 99.89185 90.88469 98.89607 116.51497 100.14817 101.54950
## NA12154 154.58721 146.30040 163.54949 148.23825 172.16680 154.65376 166.03399
## NA12155 117.71032 114.18760 126.30050 102.10087 134.08529 120.24148 128.65350
## NA12156 90.04482 93.11878 91.79416 93.62457 119.29939 93.49647 97.62171
## NA12234 115.96730 109.91250 117.58927 101.30344 128.77047 111.72909 125.24551
## NA12249 120.02105 114.18543 124.74898 112.27830 138.65433 122.19669 131.35958
## NA12287 119.85489 110.22132 125.12416 111.09359 126.54109 106.01705 121.97085
## NA12414 136.59738 133.96600 144.62706 127.60805 149.09386 128.42149 141.70637
## NA12489 118.63146 112.95860 116.18592 118.81531 142.82956 117.81152 120.97345
## NA12716 117.15222 117.66026 127.28157 116.72706 139.54654 129.11718 128.09651
## NA12717 135.64356 138.64930 136.53392 148.13960 167.41141 145.07372 134.78974
## NA12750 107.36537 109.04640 102.79401 101.25855 131.54290 104.12860 113.10549
## NA12751 106.22053 106.37420 108.31619 101.62003 132.63128 110.29110 115.98143
## NA12760 125.38508 118.73389 132.06734 110.97109 139.25149 127.38868 136.37586
## NA12761 128.06206 125.93441 128.15845 116.19501 125.96663 132.17166 129.84483
## NA12762 128.60298 132.92234 114.55328 128.04030 133.84332 132.07045 123.27425
## NA12763 100.01179 100.46525 100.88876 97.01904 126.31514 110.72826 113.81858
## NA12776 142.35952 130.58908 147.21620 141.46975 165.30847 132.33174 152.18800
## NA12812 157.47348 152.55419 164.19765 134.31592 164.38939 158.33144 164.10873
## NA12813 115.15230 118.73596 113.01661 99.98801 131.68055 117.27325 114.44086
## NA12814 159.57695 149.26150 166.00110 150.72459 173.59029 158.93995 169.25037
## NA12815 102.67159 98.32843 100.57722 104.54226 123.76207 104.82923 112.73504
## NA12828 115.97078 107.01342 124.06523 118.71643 143.69973 117.57478 130.77228
## NA12872 163.61913 156.73488 168.81511 145.55872 172.81428 159.58404 167.76176
## NA12873 132.95176 128.36183 134.48187 136.09772 145.98117 132.20489 141.97590
## NA12874 171.94163 167.41192 177.83306 161.36923 192.13716 176.36861 172.44958
## NA12891 125.12330 117.56760 124.92628 125.17647 149.17373 130.92164 133.10562
## NA12892 118.61834 121.22877 102.20656 122.57201 144.22265 121.54678 112.67739
## NA18486 147.80187 142.60402 155.46439 141.42702 162.25893 155.59476 155.53134
## NA18498 192.69601 184.38199 206.56188 180.92742 209.53568 191.33804 202.26010
## NA18499 164.54504 152.68127 174.70675 160.84516 184.27638 165.19177 178.38066
## NA18501 142.76956 141.58950 149.82186 122.92221 159.51325 147.03654 147.75593
## NA18502 159.47462 149.29493 169.12787 158.39222 183.72835 161.72825 174.96613
## NA18504 131.08399 122.32636 137.03046 133.46489 158.82458 132.41731 140.70073
## NA18505 161.87395 154.78465 168.84078 148.56863 181.48053 162.18846 173.02283
## NA18507 181.50416 171.63505 193.18692 166.43046 192.02778 179.68975 189.62047

```

```

## NA18508 171.20136 162.81227 182.47415 156.95774 185.36043 170.76906 180.31007
## NA18510 141.19529 131.36578 145.91215 128.19030 152.07106 138.42109 148.43234
## NA18511 184.44906 175.69998 197.48797 173.95956 201.34317 185.08930 197.31768
## NA18516 139.41557 134.37331 147.13234 123.55891 151.76723 142.41223 143.12758
## NA18517 187.53626 177.97595 199.02056 170.00778 197.17784 189.46675 196.91681
## NA18519 168.40800 158.66802 180.12656 169.67067 191.43759 172.57772 185.21220
## NA18520 175.36139 167.49453 187.02338 160.89957 184.61120 172.90368 182.22317
## NA18522 181.19399 169.00168 193.01634 162.90610 191.36335 179.94411 190.02979
## NA18523 131.24455 127.69056 140.90818 123.41382 147.45748 135.96791 133.03899
## NA18852 156.59680 146.62776 168.52761 150.91104 172.98629 157.61136 167.86859
## NA18853 174.93488 175.90866 184.08680 160.78011 188.14232 184.83345 182.53828
## NA18855 154.47544 144.86991 161.87248 145.48889 166.95775 156.18442 165.22479
## NA18856 123.43140 126.25723 116.39825 108.86014 142.16379 123.12622 117.55686
## NA18858 167.79561 158.29249 178.98892 152.83793 178.80256 167.73132 177.61325
## NA18861 166.48997 159.06668 177.03830 148.77593 181.00061 168.00200 174.18142
## NA18862 171.46370 161.70014 179.04221 163.67086 189.90937 166.32781 178.12936
## NA18870 153.23408 147.32349 162.94822 136.90216 162.33215 154.20749 160.87951
## NA18871 150.73526 147.48322 159.91957 141.42424 166.77472 147.25312 159.26738
## NA18909 181.53748 172.66420 194.32635 169.10133 195.39621 181.37908 194.49973
## NA18912 119.15198 122.03881 118.98792 126.47013 151.57101 124.09821 125.62546
## NA18913 168.14544 159.04294 177.96520 155.08131 179.37351 166.49255 178.15556
## NA18916 168.74593 159.17195 178.14219 165.20970 191.66236 166.70283 181.21743
## NA19093 189.43245 179.88563 199.53603 175.80597 204.19334 185.86213 202.03193
## NA19098 188.99842 180.91317 202.54507 174.12118 204.85996 192.50698 201.96966
## NA19099 195.63821 186.73037 209.77482 179.24025 206.80840 196.40200 207.22999
## NA19101 180.25828 171.15861 190.20810 168.25373 196.81278 178.06417 192.03191
## NA19102 129.84824 133.40976 123.51041 136.57193 158.45805 132.84910 134.14798
## NA19108 187.59062 180.04683 200.97114 175.21255 203.55591 187.34148 200.53239
## NA19114 145.60416 137.38016 151.78806 144.57051 163.42178 148.37934 158.55304
## NA19116 186.61542 179.08476 202.72688 179.52250 206.98260 193.61988 200.45628
## NA19119 143.97941 146.98799 133.57798 143.98222 161.70567 146.98939 141.34017
## NA19127 169.84093 160.81315 172.71313 153.94914 178.80437 163.49177 172.62281
## NA19128 176.78315 166.01411 180.95612 160.96143 185.62608 172.17375 181.41813
## NA19130 188.92455 176.57885 195.96648 173.55768 201.83944 182.09628 196.27067
## NA19131 173.94924 168.03574 185.81420 159.52846 188.93025 175.67186 184.06485
## NA19137 162.85623 153.50417 172.63006 142.73402 168.11570 162.83320 167.75766
## NA19138 170.48363 159.84987 183.53822 165.76628 191.69108 173.52064 187.40569
## NA19140 169.02709 160.00247 174.32480 153.00929 179.15377 163.41838 174.58796
## NA19143 180.96524 172.27665 194.47192 166.53741 191.50345 181.91658 192.80059
## NA19144 173.73302 166.91738 185.33411 157.57277 186.06347 178.76787 184.78988
## NA19147 171.35969 164.22541 184.62921 159.67978 185.67767 172.00279 183.49763
## NA19152 192.68994 183.68627 203.36459 175.79889 203.76988 190.50804 202.49625
## NA19153 160.99676 151.19316 171.34219 161.48462 188.26300 162.21017 175.68290
## NA19159 154.52476 145.53980 162.59691 152.85770 172.79764 158.68197 165.73853
## NA19160 181.09040 172.95333 191.58911 164.04048 189.65570 179.50862 189.85600
## NA19171 128.96570 123.10159 125.60650 113.82680 145.09613 124.91279 128.74403
## NA19172 169.49679 163.43809 188.39425 178.81339 201.03217 176.32598 187.57225
## NA19190 161.83546 156.34886 176.45373 153.37360 180.85482 165.95626 176.03029
## NA19192 156.72292 142.33751 165.22682 155.20654 176.96345 155.56443 166.63181
## NA19193 151.98472 146.58971 150.18218 141.52907 162.45344 148.94123 152.87503
## NA19200 115.95965 110.46436 113.96800 117.55512 144.58627 118.21208 125.41307
## NA19201 170.18320 158.51164 179.30427 165.59539 192.32607 168.72227 182.43202
## NA19203 166.33204 156.72815 171.06338 160.57428 184.79816 160.81219 175.96862
## NA19204 154.64274 145.53354 167.87850 156.39522 180.38437 157.48704 166.89426

```

```

## NA19209 181.78519 170.96313 193.42361 173.03497 197.68295 184.62607 196.35716
## NA19210 187.26611 177.39211 196.39544 167.12016 192.74592 185.47796 190.31414
## NA19222 160.69231 151.90986 168.25756 141.50714 170.04327 159.26514 164.26951
## NA19225 157.60345 149.04012 167.74202 147.12953 174.26701 156.52341 169.67939
## NA19238 164.80193 160.00436 173.37567 150.13048 184.19887 163.54012 174.13768
## NA19239 178.99117 170.50960 185.71087 160.91720 191.32179 173.84015 183.76337
## NA19257 163.32217 156.52274 174.86857 149.09669 175.55919 161.12576 173.13340
##          NA07347   NA07357   NA10847   NA10851   NA11829   NA11830   NA11831
## NA06986
## NA06994
## NA07000
## NA07037
## NA07051
## NA07346
## NA07347
## NA07357  99.07939
## NA10847  91.60805 100.19152
## NA10851  93.49200 94.32014  86.75289
## NA11829 113.16591 105.37047 109.95992 107.81882
## NA11830  94.30007 95.55822  89.32584  89.06900 102.94979
## NA11831 108.15824 109.17633 120.30502 112.43437 125.27649 108.94817
## NA11832 125.65851 135.38728 143.30801 130.89242 156.28906 135.38283 103.88041
## NA11840 121.04519 133.19376 134.62194 124.68961 151.91397 127.66674 112.34847
## NA11881 114.78745 117.44487 112.27674 114.38834 125.73788 107.74158 123.59165
## NA11894 119.24724 127.79830 120.34626 121.50436 139.97967 121.57154 131.19444
## NA11918 154.05558 163.27683 146.85326 161.72151 176.27415 164.56399 180.05638
## NA11920 123.05605 125.95395 126.11196 115.76346 139.14321 128.66438 129.05008
## NA11931 142.47754 143.30738 152.53377 134.60034 168.61385 153.52690 129.66975
## NA11992 122.86966 132.49371 135.35672 122.06914 147.85726 128.64495 113.25484
## NA11993 137.09904 141.17762 129.80610 138.04530 144.89270 128.16370 150.91039
## NA11994 107.63821 117.68987 121.36919 113.27409 144.34242 118.53449 99.76602
## NA11995 114.65053 118.82940 123.12730 117.28015 136.34652 118.14352 113.99855
## NA12003 113.32026 111.22148 108.64343 105.13128 124.59652 114.73873 116.58744
## NA12004 199.96485 200.29883 181.20412 197.04017 194.79497 191.06530 228.83378
## NA12005 144.08123 138.37236 142.91879 135.23083 148.79041 140.31507 147.76253
## NA12006 179.92835 185.21997 178.90777 175.91201 193.10828 179.81981 189.28626
## NA12043 114.58491 125.14851 130.53122 119.05443 149.22289 127.47722 104.55998
## NA12044 129.27924 124.87123 143.09078 124.00745 150.58481 133.73053 118.99364
## NA12045 147.04267 165.13984 169.25020 154.57506 183.44823 164.10180 141.35985
## NA12144  92.42520 100.14660  94.70367  94.64172 111.46616  92.75269 107.28017
## NA12154 141.10272 143.49124 157.35152 140.35262 164.72799 149.43467 121.48534
## NA12155 103.54454 111.71729 117.00192 105.64805 137.45908 110.34929 99.19002
## NA12156  94.36885  89.75531  91.14768  84.46935 110.35753  91.38217 101.12647
## NA12234 101.06415 106.86407 110.39801 103.01405 125.59837 105.68955 82.55692
## NA12249 113.77430 116.30016 120.06882 110.74742 134.55386 113.97065 110.06389
## NA12287 104.33679 119.48724 121.19105 114.27196 137.06151 116.52460 112.92776
## NA12414 120.86281 138.56284 141.59290 133.27732 155.56926 134.26335 129.49373
## NA12489 116.26310 119.19650 115.56617 103.41021 136.82905 125.16508 129.80791
## NA12716 111.63971 116.51884 122.73027 108.20911 132.18252 114.91706 112.75819
## NA12717 140.95440 136.56015 142.62681 139.60654 150.33331 147.67743 157.99372
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## NA19172 132.75985 153.10743
## NA19190 97.24525 124.82806 121.67044
## NA19192 115.41313 126.58721 109.21893 108.59765
## NA19193 132.79680 132.54484 154.67162 134.83863 124.70844
## NA19200 145.00206 87.00661 150.69662 132.57237 129.61090 131.84477
## NA19201 109.44420 126.30433 108.40759 103.49303 94.16391 138.05059 131.17292
## NA19203 118.93312 129.92862 127.57469 114.57740 111.89710 123.91668 135.34681
## NA19204 122.12073 129.94023 104.55325 110.45327 90.32301 139.32479 134.20568
## NA19209 104.67865 142.79278 118.14950 104.54386 99.30400 141.49407 149.36859
## NA19210 106.16170 139.26224 144.24443 117.73690 115.92550 135.80215 156.41327
## NA19222 103.74232 102.95313 132.57780 102.37650 112.04118 134.97111 124.69932
## NA19225 98.33031 119.08704 123.46958 78.30484 103.67813 124.91607 126.31672
## NA19238 104.39399 112.89897 121.38853 96.10982 104.21789 132.41074 125.49949
## NA19239 101.41957 116.49324 132.42859 100.68503 109.55046 142.44898 136.89731
## NA19257 98.48880 122.28675 132.52301 83.35663 110.42310 132.06321 135.41399
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## NA19204 95.35258 117.95762
## NA19209 88.50137 116.73778 102.86304
## NA19210 123.70133 133.19518 126.96669 116.17747
## NA19222 108.42487 118.91590 112.15972 115.08980 107.39091
## NA19225 99.39836 110.23886 110.83445 102.86344 115.41259 102.78730
## NA19238 98.49667 110.06881 105.36453 106.39035 119.12573 90.95791 98.58136
## NA19239 104.29390 114.48628 110.06301 108.96878 109.35075 87.45397 103.46045
## NA19257 106.97922 117.55742 115.85143 108.63558 114.26250 103.28031 80.44143
## NA19238 NA19239
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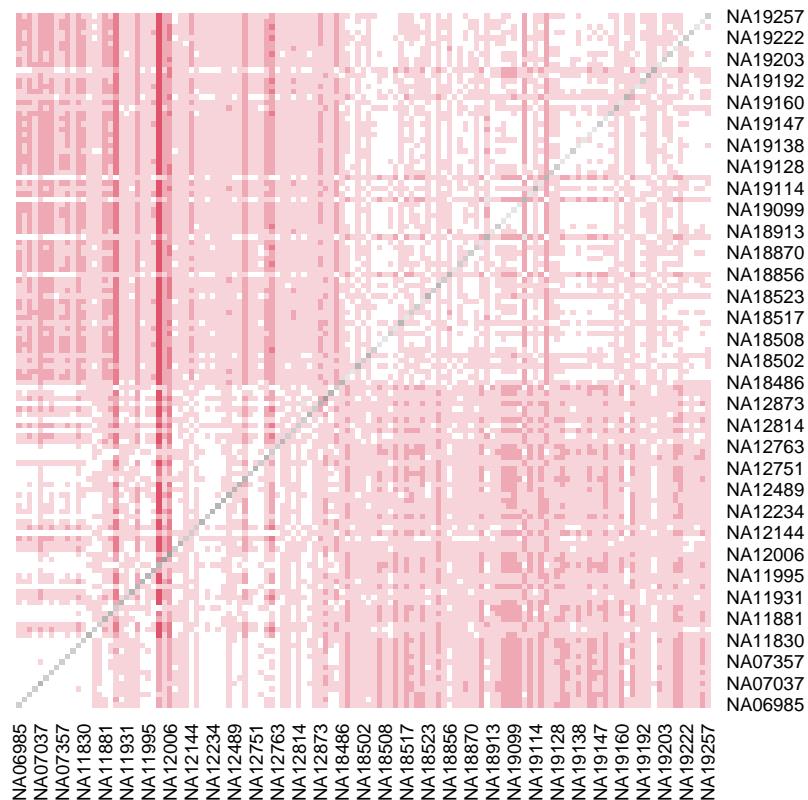
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## NA19209  
## NA19210  
## NA19222  
## NA19225  
## NA19238  
## NA19239 82.47305  
## NA19257 106.65242 104.07779
```

```
#Buat heatmap  
colramp = colorRampPalette(c(8,"white",18))(9)  
heatmap(as.matrix(dist3),col=colramp,Colv=NA,Rowv=NA)
```



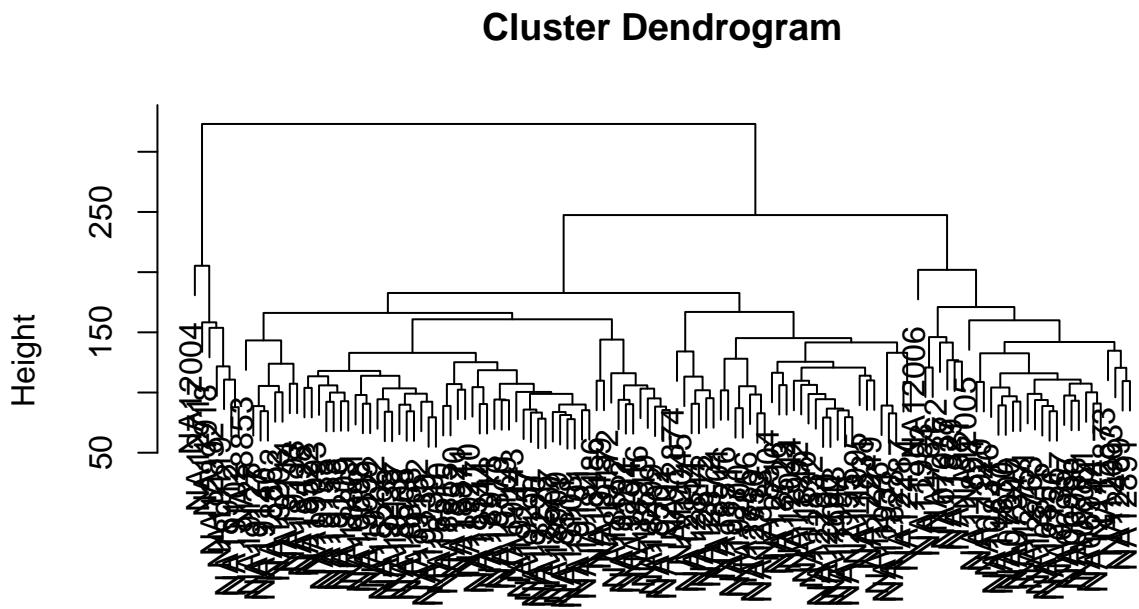
```
hclust3 = hclust(dist3)  
hclust3
```

```

## Call:
## hclust(d = dist3)
##
## Cluster method : complete
## Distance       : euclidean
## Number of objects: 129

```

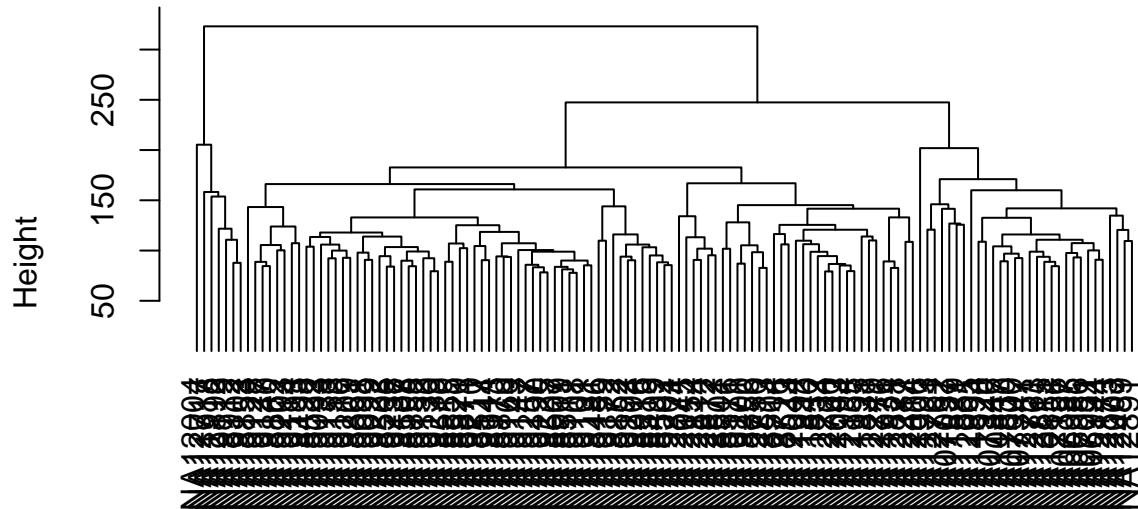
```
plot(hclust3)
```



```
dist3  
hclust (*, "complete")
```

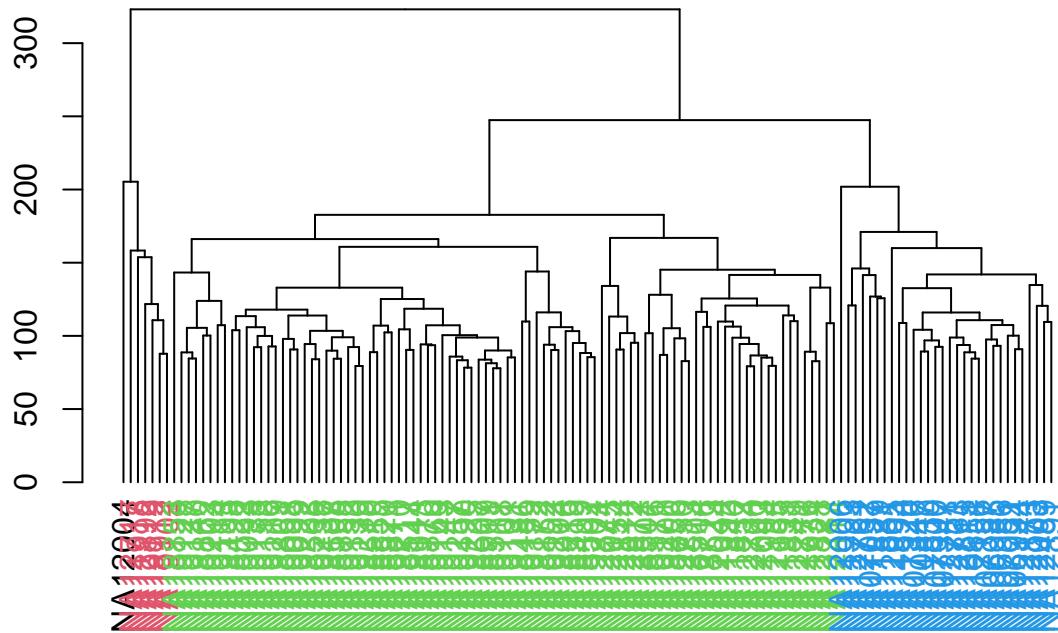
```
plot(hclust3,hang=-1)
```

## Cluster Dendrogram

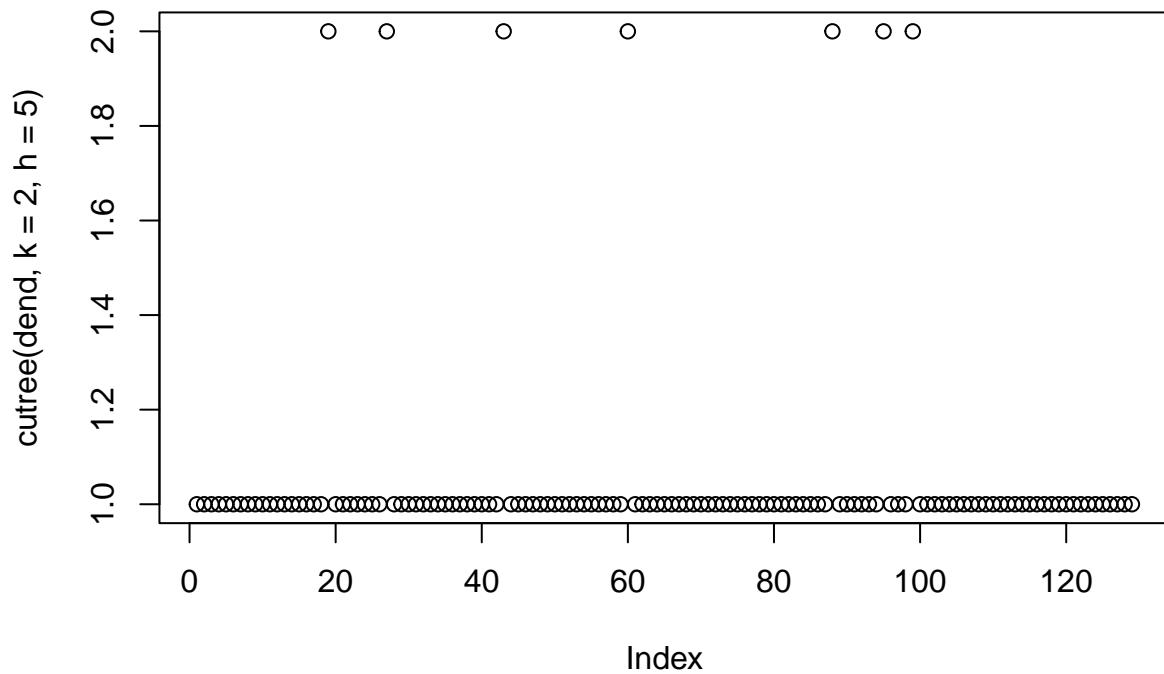


```
dist3  
hclust (*, "complete")
```

```
#Buat dendrogram  
dend = as.dendrogram(hclust3)  
dend = color_labels(hclust3,4,col=1:4)  
plot(dend)
```



```
#Cutree  
plot(cutree(dend, k=2, h=5))
```



### Clustering dengan kmeans

```

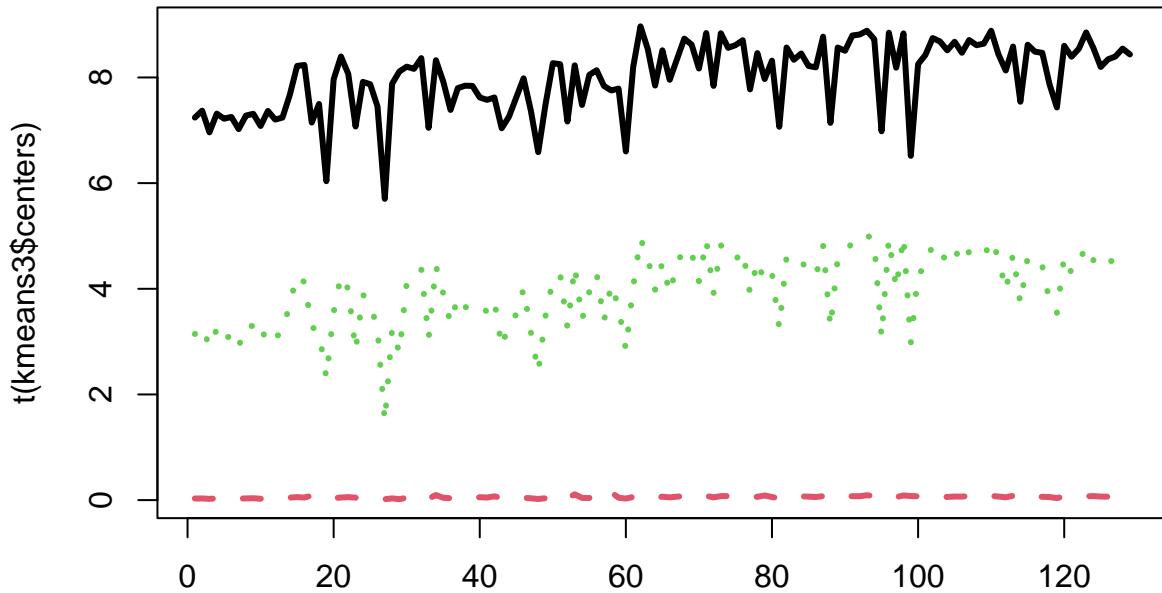
kmeans3 = kmeans(edata3,centers=3)
names(kmeans3)

## [1] "cluster"      "centers"       "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"          "iter"         "ifault"

####Plot pusat cluster

matplot(t(kmeans3$centers),col=1:3,type="l",lwd=3)

```



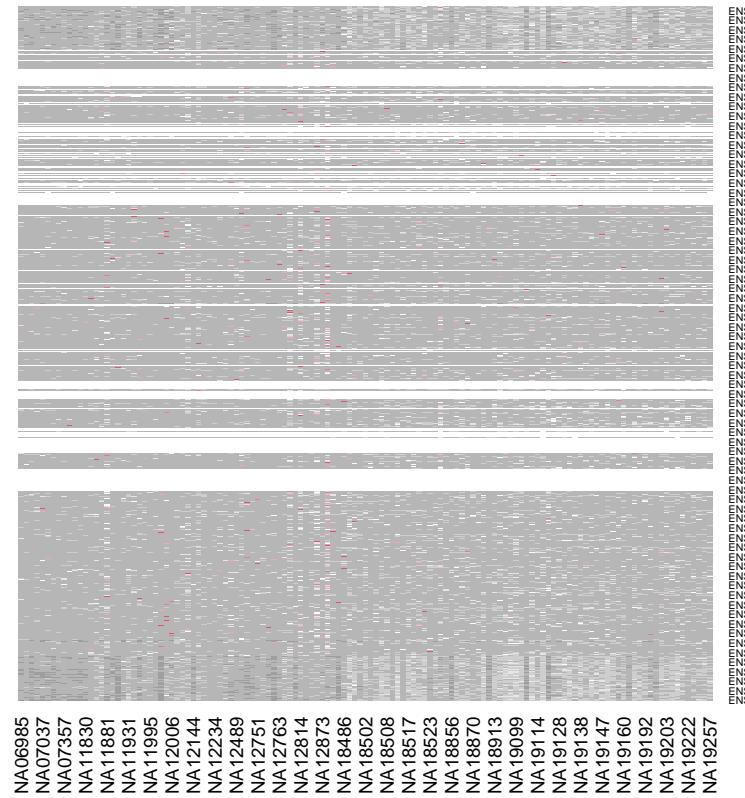
```
# cek berapa banyak gen di masing2 cluster
table(kmeans3$cluster)
```

```
##
##      1      2      3
## 3425 45890 3265
```

```
# cek cluster mana yang dikasih ke setiap gen
kmeans3$cluster[1:15]
```

```
## ENSG0000000003 ENSG0000000005 ENSG00000000419 ENSG00000000457 ENSG00000000460
##          2          2          3          3          3
## ENSG0000000938 ENSG0000000971 ENSG00000001036 ENSG00000001084 ENSG00000001167
##          3          2          3          2          1
## ENSG00000001460 ENSG00000001461 ENSG00000001497 ENSG00000001561 ENSG00000001617
##          2          2          3          1          2
```

```
#Heatmap dengan cluster yang sudah disortir
heatmap(as.matrix(edata)[order(kmeans3$cluster),], col=colramp, Colv=NA, Rowv=NA)
```



Conclusion :

1. Using log data of gene expression, the heatmap shows more prominent expression.
2. Dendrogram shows three main clusters and each distance to cluster center shows more significant difference.
3. Log data could be the solution for better clustering analysis as it separated each gene more prominently/