

LISTA 7

ANÁLISE MULTIVARIADA 1

Tailine J. S. Nonato

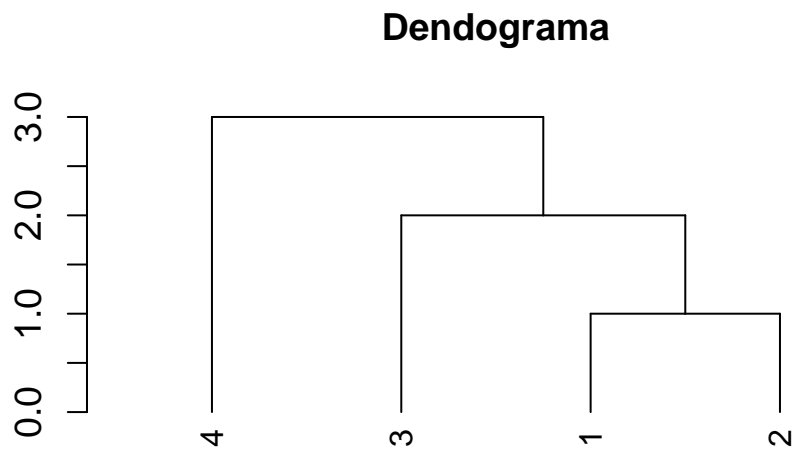
2023-12-13

Exercício 12.5

A matriz de distâncias é dada por:

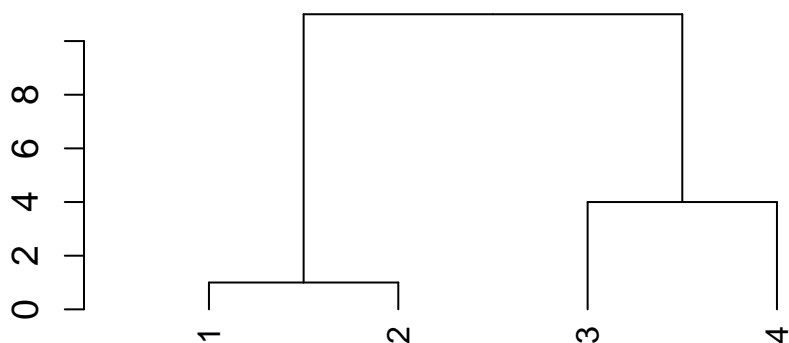
	[,1]	[,2]	[,3]	[,4]
[1,]	0	1	11	5
[2,]	1	0	2	3
[3,]	11	2	0	4
[4,]	5	3	4	0

Assim, os dendogramas de cada processo são dados por:



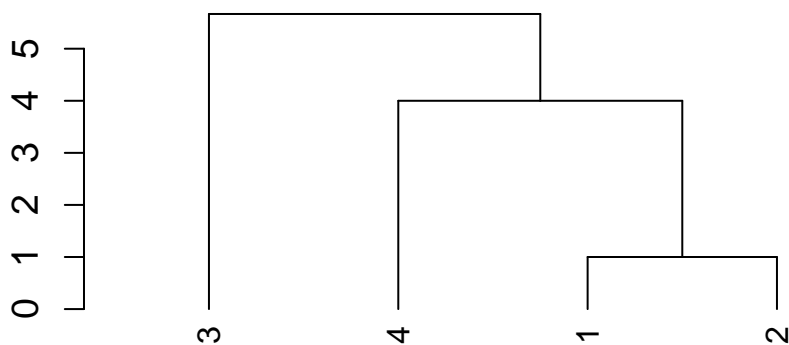
Ligação Simples

Dendograma



Ligação Completa

Dendograma



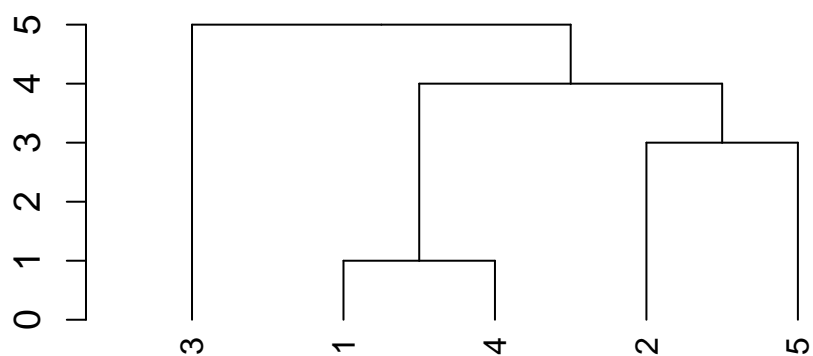
Ligação Média

Exercício 12.6

[,1] [,2] [,3] [,4] [,5]

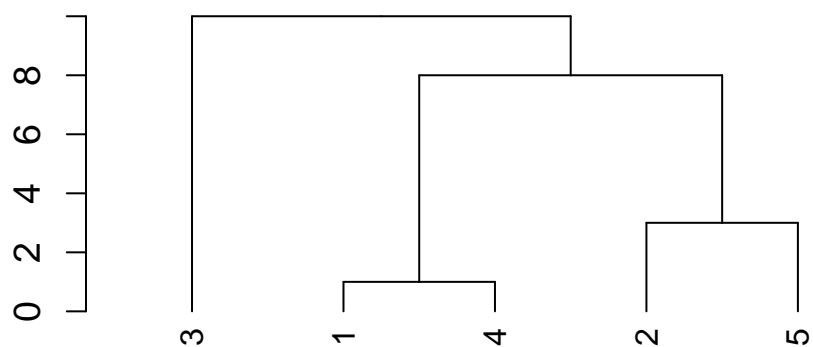
[1,]	0	4	6	1	6
[2,]	4	0	9	7	3
[3,]	6	9	0	10	5
[4,]	1	7	10	0	8
[5,]	6	3	5	8	0

Dendograma



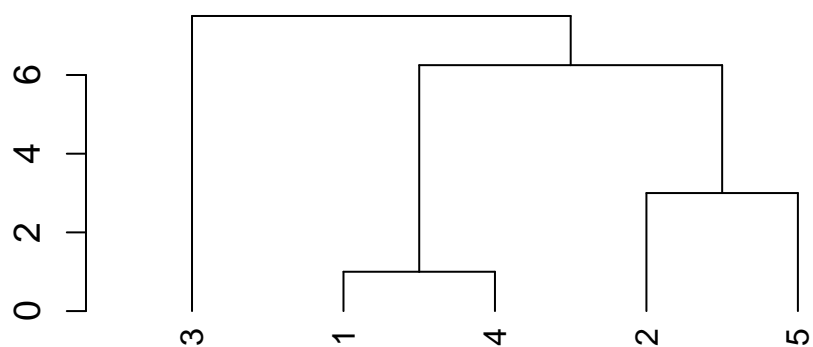
Ligação Simples

Dendograma



Ligação Completa

Dendograma

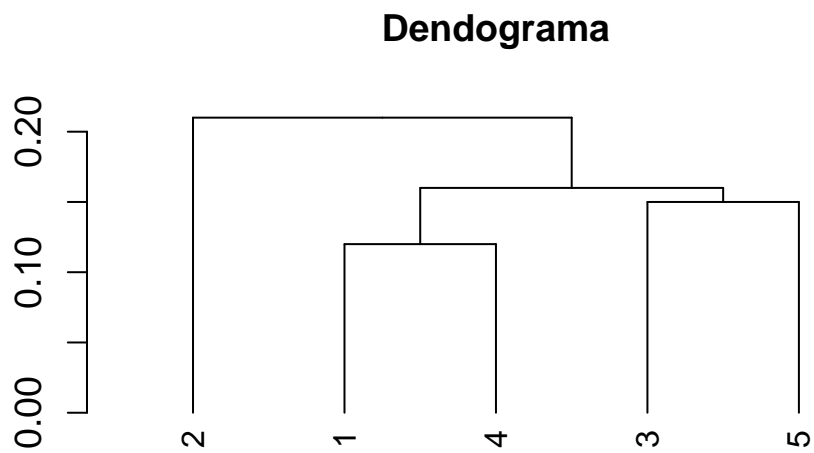


Ligação Média

Exercício 12.7

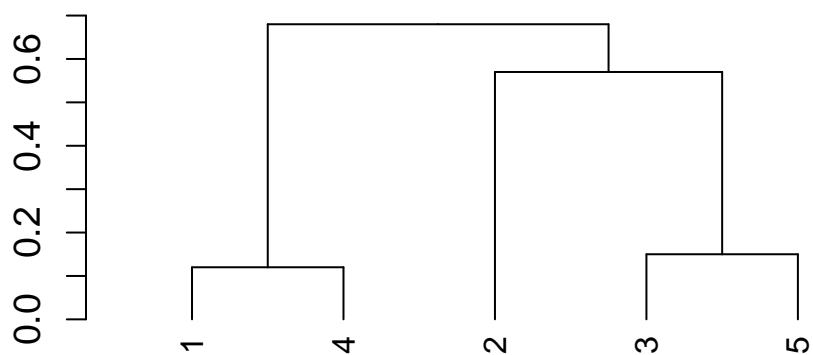
[,1] [,2] [,3] [,4] [,5]

[1,]	1.00	0.63	0.51	0.12	0.16
[2,]	0.63	1.00	0.57	0.32	0.21
[3,]	0.51	0.57	1.00	0.18	0.15
[4,]	0.12	0.32	0.18	1.00	0.68
[5,]	0.16	0.21	0.15	0.68	1.00



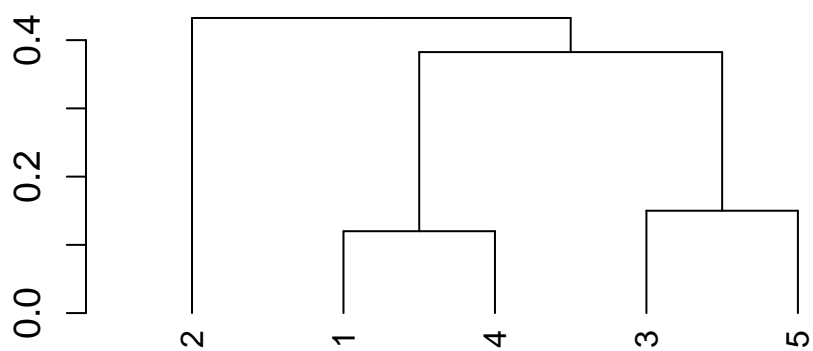
Ligação Simples

Dendograma



Ligação Completa

Dendograma



Ligação Média

Exercício 12.10

Obs: Foi orientado usar método de Ward e o R, no entanto, não encontrei informações suficientes.

Item A

$$ESS_1 = (2 - 2)^2 = 0$$

$$ESS_2 = (1 - 1)^2 = 0$$

$$ESS_3 = (5 - 5)^2 = 0$$

$$ESS_4 = (8 - 8)^2 = 0$$

$$ESS = ESS_1 + ESS_2 + ESS_3 + ESS_4 = 0$$

Item B

Clusters			Aumento ESS
{12}	{3}	{4}	0, 5
{13}	{2}	{4}	4, 5
{14}	{2}	{3}	18
{1}	{23}	{4}	8
{1}	{24}	{3}	24, 5
{1}	{2}	{34}	4, 5

Item C

Clusters		Aumento ESS
{12}	{34}	5
{123}	{4}	8, 7

Assim,

$$ESS = (2 - 4)^2 + (1 - 4)^2 + (5 - 4)^2 + (8 - 4)^2 = 30$$

Exercício 12.11

	[,1]	[,2]
[1,]	5	4
[2,]	1	-2
[3,]	-1	1
[4,]	3	1

Dada a matriz, os centroides dos clusters (AB) e (CD) são dados por:

	[,1]	[,2]
[1,]	3	1
[2,]	1	1

Utilizando a função `kmeans` tem-se que o cluster final é:

```
[1] 1 2 2 1
```

Ou seja, 1:(AD) e 2:(BC). E os novos centroides são dados por:

	[,1]	[,2]
1	4	2.5
2	0	-0.5

Exercício 12.12

Dada a matriz, os centroides dos clusters (AC) e (BD) são dados por:

	[,1]	[,2]
[1,]	2.0	2.0
[2,]	2.5	-0.5

O cluster final é:

```
[1] 1 2 2 1
```

Ou seja, 1:(AD) e 2:(BC). E os centroides são dados por:

	[,1]	[,2]
1	4	2.5
2	0	-0.5

Resultado similar ao do item anterior.

Exercício 12.13

Dada a matriz, os centroides dos clusters (AB) e (CD) são dados por:

	[,1]	[,2]
[1,]	1	1
[2,]	1	3

O cluster final é:

[1] 2 1 1 2

Ou seja, 1:(AD) e 2:(BC). E os centroides são dados por:

	[,1]	[,2]
1	-0.5	0
2	2.5	4

Exercício 12.14

Item A

	1	2	3	4	5	6	7
2	116.036632						
3	15.508062	121.651141					
4	6.363961	117.894020	10.000000				
5	103.201260	61.627916	100.623059	102.102889			
6	72.821700	44.119157	78.361343	74.434535	54.263247		
7	86.385763	71.874891	82.504545	84.894052	22.315914	52.368884	
8	15.313393	121.519546	1.414214	10.099505	100.593240	78.310280	82.383251
9	46.233105	72.601653	54.662601	48.867167	75.756188	32.085822	65.184354
10	54.863467	122.993902	68.873072	59.527305	134.668111	87.778129	122.513265
11	81.277303	154.678699	94.675762	85.810838	169.580364	121.272421	156.982483
12	42.278836	114.197198	31.336879	38.496753	81.074040	75.282800	60.207973
13	163.231431	163.438062	177.918521	168.092237	208.014423	155.352824	205.119477
14	46.727936	90.779954	60.448325	51.516987	103.802697	55.421115	92.924701
15	60.328269	170.490469	50.019996	56.586217	141.467311	127.818230	121.536003
16	46.856163	90.774446	60.522723	51.604263	103.817147	55.511260	92.876262
17	23.140873	100.960388	21.633308	21.633308	81.418671	58.527771	63.647467
18	265.703782	221.122138	280.007143	270.562377	278.917551	233.885656	283.346078

19	68.157905	181.868084	60.456596	65.230361	155.865326	138.720943	136.191042
20	116.634043	70.978870	113.159180	115.347302	19.697716	69.867732	32.062439
21	103.031549	217.697037	96.586749	100.642933	191.676811	174.675413	171.604196
22	98.577381	160.074982	112.645462	103.387620	181.322916	130.466471	170.170503
23	57.995689	102.791050	49.081565	54.854353	62.449980	68.128555	41.255303
24	68.084506	181.791089	60.440053	65.215029	155.833244	138.692105	136.110249
25	49.431771	120.991735	36.193922	44.833024	82.504545	82.082276	62.777384
26	182.834625	290.317068	185.954295	183.790642	285.559101	250.436619	267.162872
27	134.660685	99.884934	148.189068	139.140217	150.880748	101.111325	152.174242
28	16.109004	128.327706	14.177447	14.177447	111.085553	85.717559	92.336342
29	107.491860	158.993711	120.266371	111.642286	180.718012	132.070057	170.666341
30	33.533565	120.058319	21.236761	29.171904	90.697299	78.844784	71.217975
31	78.882824	80.541915	90.862534	82.800966	108.531102	59.181923	103.087342
32	32.054641	122.641755	43.543082	36.000000	120.818045	83.123402	104.980951
33	143.071660	68.022055	141.315250	142.372750	42.035699	84.542889	61.065539
34	173.004335	157.714933	187.773800	177.929761	207.518674	155.635793	206.775240
35	116.243279	70.377553	112.703150	114.899956	16.941074	69.198988	30.446675
36	114.142455	230.006522	111.085553	112.871608	210.235582	186.902381	190.759010
37	53.146025	78.166489	51.410116	52.373658	51.613952	41.285591	34.176015
38	54.171025	100.374299	45.847574	51.009803	61.798058	63.533456	43.462628
39	48.264894	93.546780	42.497059	45.891176	60.950800	55.059059	43.278170
40	40.589407	140.904223	51.604263	44.305756	139.756932	100.714944	123.790145
41	197.834527	309.596512	194.347627	196.649434	288.072907	268.019589	268.141754
42	191.061508	301.323746	190.265604	190.790461	286.590300	260.392972	267.267656
43	185.153153	290.658717	189.246638	186.585878	288.113328	251.391507	270.224518
	8	9	10	11	12	13	14
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9	54.534393						
10	68.814969	65.730510					
11	94.612367	94.480157	47.053161				
12	31.016125	59.782941	92.922010	121.936459			
13	177.918521	148.892579	112.363250	110.722626	197.987373		
14	60.266077	28.495614	44.254943	67.501852	75.894664	127.369541	
15	50.019996	103.778611	101.668579	115.578977	62.016127	213.197092	105.014285
16	60.340699	28.548205	44.322680	67.590680	75.835348	127.381317	1.000000
17	21.400935	37.496667	70.089229	100.670254	26.000000	173.052015	51.283526
18	279.971427	235.622580	227.652147	218.553197	294.465618	134.428420	220.730605

19	60.473135	113.168017	102.725362	111.662438	76.635501	212.490000	110.801625
20	113.061930	89.325248	150.500831	183.517029	90.570415	223.194982	117.290238
21	96.586749	148.131698	129.663025	130.508620	111.682586	234.567687	142.825068
22	112.583302	106.934559	54.115617	22.461077	139.222843	91.531415	79.101201
23	48.877398	61.212744	105.406357	136.903251	20.663978	204.860928	83.252628
24	60.440053	113.097303	102.676677	111.599731	76.491830	212.490000	110.702303
25	36.166283	68.949257	101.658743	130.217126	14.696938	207.482529	86.034877
26	185.916648	220.238507	173.826062	145.662281	210.715448	233.777672	200.302272
27	148.175572	104.153733	99.601707	113.747527	160.878836	67.134194	92.141196
28	13.674794	59.203040	63.486219	86.316279	39.382737	174.005747	59.287435
29	120.258056	116.000000	54.069400	64.556177	144.055545	83.108363	93.284511
30	21.047565	61.749494	83.111371	113.707959	17.233688	191.159619	73.803794
31	90.785461	56.920998	52.607034	90.617327	101.744779	104.818891	49.416596
32	43.266615	51.264022	50.896955	59.970826	65.924199	150.515780	37.496667
33	141.237389	109.827137	170.647297	203.829586	120.847011	229.958692	136.550357
34	187.763149	151.812384	126.954716	123.836586	205.866462	30.099834	132.245983
35	112.614386	89.933309	148.840519	183.830085	90.011110	221.614530	117.779455
36	111.103555	158.801763	129.797920	122.700856	131.202134	226.819311	148.653961
37	51.137071	38.118237	91.068655	124.480922	36.646964	182.389693	63.553127
38	45.847574	58.957612	99.184172	133.616990	25.768197	198.391028	80.845532
39	42.473521	49.618545	90.733125	125.866993	27.349589	188.565638	71.512237
40	51.429563	70.278019	44.096485	46.179000	79.366240	146.642422	52.469038
41	194.285872	237.846589	215.488979	194.446651	209.940468	301.074742	227.061666
42	190.197266	229.266221	200.792181	173.987068	209.659247	277.185858	214.827838
43	189.167360	221.430553	173.616503	143.677730	214.816876	229.066999	200.584371
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16	105.047608						
17	69.656299	51.293274					
18	321.247568	220.773640	270.107386				

19	16.155494	110.851252	81.160335	322.631369				
20	151.218385	117.251866	94.270886	288.615661	166.114418			
21	50.269275	142.849571	117.162281	347.360044	36.523965	201.221271		
22	135.214644	79.183332	116.837494	204.066166	131.125894	195.933662	148.848917	
23	81.074040	83.198558	36.755952	295.920597	96.156123	70.894287	130.942736	
24	16.031220	110.751975	81.086374	322.603472	1.414214	166.048186	36.496575	
25	60.033324	86.063930	35.213634	303.947364	75.292762	91.820477	110.122659	
26	159.263932	200.314752	204.232710	342.039471	143.833237	297.328102	120.971071	
27	193.277003	92.168324	136.521061	141.124059	197.370211	164.593439	226.982378	
28	46.679760	59.279001	30.083218	278.332535	55.009090	123.117830	89.744081	
29	144.416066	93.279151	122.605057	214.480768	141.672157	197.410739	160.402618	
30	53.282267	73.824115	24.556058	293.197885	66.843100	102.528045	102.547550	
31	135.749770	49.325450	78.943017	206.973428	141.714502	124.735721	173.207967	
32	75.259551	37.456642	47.391982	248.128999	78.885994	132.434890	108.779594	
33	181.758081	136.524723	121.523660	283.485449	196.349179	31.670175	231.859871	
34	226.395671	132.264886	180.657134	107.307968	226.839150	221.341365	250.842580	
35	150.877434	117.732748	93.744333	289.896533	165.810132	10.148892	200.970147	
36	71.777434	148.704405	131.901478	340.986803	55.955339	220.995475	28.757608	
37	95.482983	63.560994	31.096624	269.961108	108.683025	64.358372	144.706600	
38	81.252692	80.901174	34.058773	292.386730	95.713113	74.074287	131.266904	
39	83.090312	71.575135	27.422618	282.595117	96.772930	74.612331	132.781776	
40	71.770467	52.554733	62.056426	252.390570	70.880181	152.663028	96.829747	
41	153.117602	227.077079	213.777922	401.468554	140.185591	295.076261	108.949530	
42	154.857999	214.858093	209.286884	375.503662	140.790625	294.872854	112.933609	
43	164.967542	200.661631	207.091502	335.698808	149.699332	300.236390	128.793983	
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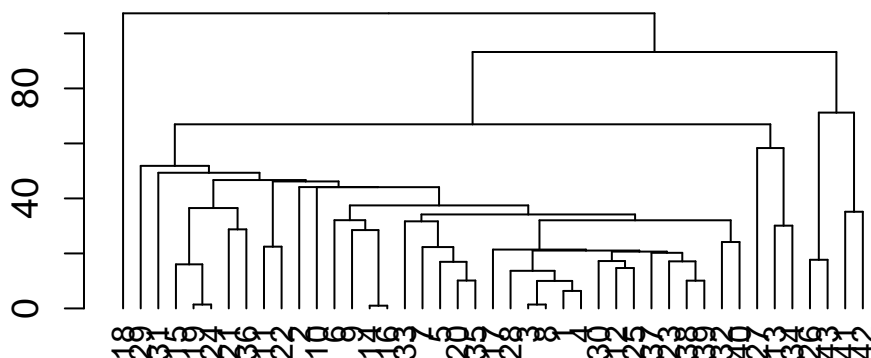
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 27 105.123737 162.009259 197.365144 170.135240 257.155595
 28 104.709121 58.532043 54.863467 46.486557 174.974284 148.199190
 29 51.836281 156.284996 141.658039 152.479507 172.478984 103.043680 113.820033
 30 130.575649 34.263683 66.768256 20.808652 200.289790 158.230844 30.232433
 31 91.230477 104.522725 141.658039 111.364267 225.727712 66.947741 91.230477
 32 79.366240 80.715550 78.746428 75.033326 170.707352 126.174482 36.373067
 33 214.147146 101.621848 196.298242 122.490816 324.778386 167.206459 151.145625
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 35 195.731960 70.192592 165.749811 91.268834 297.514706 163.694838 122.723266
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 41 210.504157 228.691933 140.092826 209.339437 98.934322 305.448850 185.956984
 42 188.063819 229.194241 140.698259 210.625260 71.203932 286.839676 180.792699
 43 149.411144 235.201807 149.605782 218.212946 17.694349 254.368414 178.308413
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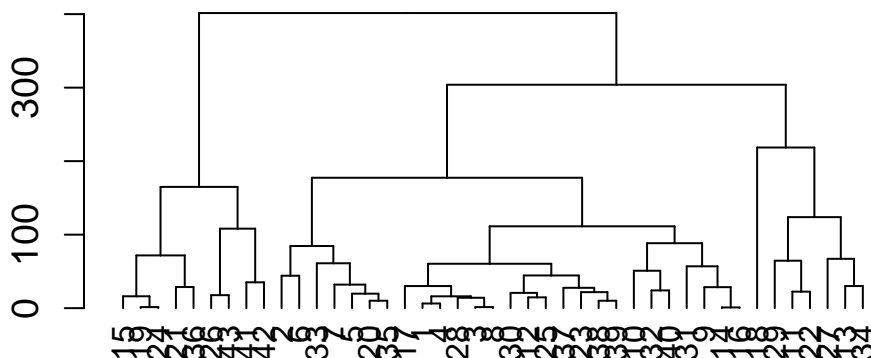
Item B

Dendograma



Ligação Simples

Dendograma



Ligação Completa

Exercício 12.15