title: "LAB 10"

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output: html_document

T1_04_REDES COMPLEJAS(1) - Visión de redes complejas - parte 1

Objetivo: Estimar el Maximum Spanning Tree -árbol de expansión máxima- (asegurar una visión clara del espacio-producto).Red troncal: Estructura general de la red: vamos a poder v. redes complejas Regla 1: mantener n-1 conexiones como máximo Regla 2: Quitar las conexiones con el peso más bajo, nos vamos quedar con las del peso máximo (menos conexiones) Regla 3: No crear nodos aislados ——— En este ejercicio vamos a: 1. Usar un matriz hipotetica de datos 2. Graficar sus próximos adyacentes

practica 3: Visión clara del espacio-producto: CASO HIPOTÉTICO
##

1)la visualización del espacio - producto sea una red conectada: evitar islas de productos aislados. 2)PROBLEMA: tratar de visualizar demasiados enlaces puede crear una complejidad visual innecesaria donde se obstruirán las conexiones más relevantes. calculamos el árbol de expansión máxima (MST) de la matriz de proximidad. MST es el conjunto de enlaces que conecta todos los nodos de la red utilizando un número mínimo de conexiones y la suma máxima posible de proximidades. Calculamos el MST usando el algoritmo de Kruskal: Básicamente, el algoritmo clasifica los valores de la matriz de proximidad en orden descendente y luego incluye enlaces en el MST si y solo si conectan un producto aislado. Por definición, el MST incluye todos los productos, pero el número de enlaces es el mínimo posible. Después de seleccionar los enlaces utilizando los criterios mencionados anteriormente, construimos una visualización utilizando un algoritmo de diseño dirigido por la fuerza.

Crear una matriz aleatoria de 200*200

```
M <- matrix(runif(200*200, min=0, max=100), ncol=200)
        diag(M) <- 0
        head(M[,1:6])
```

```
##              [,1]     [,2]      [,3]     [,4]     [,5]      [,6]
## [1,]   0.000000 33.36635 86.935517  8.375608 45.83037 47.292127
## [2,]   8.086913  0.00000 11.605955 39.091410 82.15133 61.126050
## [3,]  52.845448 10.63509  0.000000 22.700600 10.02156  5.516215
## [4,]  28.219008 90.94124 60.428810  0.000000 89.40508 11.161483
## [5,]  90.941054 92.43655  5.217044 13.384132  0.00000 89.480654
## [6,]  70.604329 25.67740 48.587643 13.243930 54.94695  0.000000
```

```
        dim(M)
```

```
## [1] 200 200
```

Cargar libreria
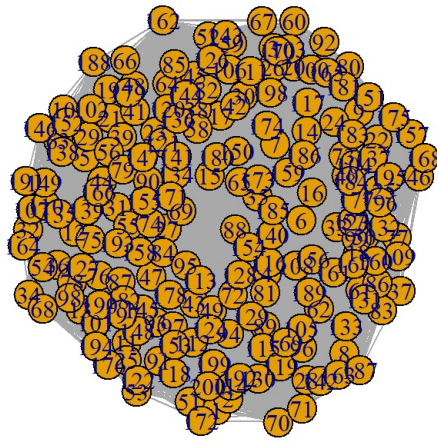
```
library (igraph)
```

```
##
## Attaching package: 'igraph'
```

```
## The following objects are masked from 'package:stats':
##
##     decompose, spectrum
```

```
## The following object is masked from 'package:base':
##
##     union
```

Graficar la matriz obteniendo un gráfico saturado MST igraph calculando el arbol de expansión minima

```
g <-graph.adjacency(M, mode="undirected", weighted = TRUE)
plot (g)
```

Hacer la matariz en negariva para identificar valores maximos

```
M <- -M
head(M[,1:6])
```

```
##              [,1]      [,2]       [,3]       [,4]      [,5]       [,6]
## [1,]    0.000000 -33.36635 -86.935517  -8.375608 -45.83037 -47.292127
## [2,]   -8.086913   0.00000 -11.605955 -39.091410 -82.15133 -61.126050
## [3,]  -52.845448 -10.63509   0.000000 -22.700600 -10.02156  -5.516215
## [4,]  -28.219008 -90.94124 -60.428810   0.000000 -89.40508 -11.161483
## [5,]  -90.941054 -92.43655  -5.217044 -13.384132   0.00000 -89.480654
## [6,]  -70.604329 -25.67740 -48.587643 -13.243930 -54.94695   0.000000
```

Visualizar matiz

```
M
```

```
##               [,1]        [,2]         [,3]        [,4]        [,5]        [,6]
##  [1,]   0.0000000 -33.3663499 -86.93551661  -8.3756082 -45.8303744 -47.2921273
##  [2,]  -8.0869133   0.0000000 -11.60595545 -39.0914102 -82.1513288 -61.1260498
##  [3,] -52.8454475 -10.6350906   0.00000000 -22.7006004 -10.0215567  -5.5162151
##  [4,] -28.2190080 -90.9412442 -60.42881038   0.0000000 -89.4050754 -11.1614831
##  [5,] -90.9410538 -92.4365456  -5.21704403 -13.3841320   0.0000000 -89.4806537
##  [6,] -70.6043286 -25.6773960 -48.58764296 -13.2439298 -54.9469479   0.0000000
##  [7,] -58.8667507 -89.7843217 -64.04472871  -8.3795377 -99.5397505 -46.8726109
##  [8,] -92.7364546  -7.3899243  -4.98615555 -82.2271980 -92.8864752 -89.3984382
##  [9,] -16.6293650 -44.6755393 -81.03832214 -69.3327658 -15.4391884 -68.8781991
## [10,]  -4.9029500 -63.8689479 -72.26930493 -21.2531326 -78.3944782 -85.6898918
## [11,] -72.1709874 -80.1428644 -36.59557987  -5.9866018 -57.7149704 -67.8838807
## [12,] -45.1139078 -57.6865343 -27.06271138 -55.8851540 -70.1652735 -41.9795640
## [13,]  -4.5792306 -42.3332226 -93.74152718 -43.3754015 -49.7198252 -92.8503151
## [14,] -80.2645965 -28.6044226 -91.23760541  -6.9386352 -66.1648983 -74.4089460
## [15,] -95.7111008 -33.9745684 -48.30843774 -70.6722100 -42.8790587  -4.7773048
## [16,] -58.3001304 -46.6494081 -50.77218313 -30.2867161 -29.7264798 -16.1703529
## [17,] -86.9082828 -54.1100889 -45.19056217 -21.6203491 -15.3993854 -21.5379254
## [18,] -57.7321017 -97.6045558 -65.80046806 -78.6487806 -70.1349616 -93.9496359
## [19,] -43.6108948 -14.4008920 -33.53405478 -31.9471495 -52.4262684 -59.9226453
## [20,] -91.4121115 -33.6347960 -45.10377767 -32.0536527 -89.4988637 -12.0732545
## [21,] -79.8308093 -12.6267733 -38.42791275 -45.7777132 -70.7341234 -19.2246614
## [22,] -81.6502066  -3.3888990 -78.08490160 -56.5723555  -1.8071423 -69.0299083
## [23,] -32.7926213 -46.7055342 -72.98912751 -75.6674753 -57.6491168 -87.1394924
## [24,] -75.6646963 -47.6767085 -21.47903994 -66.2960852 -42.8257814 -28.9541217
## [25,] -54.6410375 -89.2384361 -30.79157851 -71.5909060 -69.3418457 -85.5718607
## [26,] -22.6809622 -72.4145944 -27.81541659  -1.3767634 -54.6978949 -23.9312157
## [27,] -29.8237282 -79.6474122 -52.51743009  -3.8186394 -37.8027114 -11.7734414
## [28,] -29.0846348 -87.0811579 -45.25420354 -64.6974904 -89.1925260 -60.6758348
## [29,] -81.0268431 -91.6230346  -5.56408369 -41.4304470 -31.8269381 -74.0242167
## [30,] -41.0735887 -65.5593747 -35.71932267 -21.0262364 -79.1039352 -34.1746435
## [31,] -61.6816908 -62.4697428 -37.75584092 -35.2441559 -42.9634885 -60.6964614
```

```
##  [32,] -58.9189603 -67.6561720 -22.62523451 -69.9979603 -34.0128225 -61.4224936
##  [33,] -88.2288678  -1.1902314 -77.82765969  -0.3977419  -0.1364322 -13.5532927
##  [34,] -15.3335713 -54.0410187 -52.18644724 -19.5261246 -14.8934494 -26.3944487
##  [35,] -87.8263711  -0.5393288 -68.04359702 -18.5909302 -89.0323505 -33.4685229
##  [36,] -82.5155428 -50.5119549  -6.99917658  -2.8768784 -29.4901191 -38.9790322
##  [37,] -84.9081993 -26.1970754 -26.87804343 -96.5927214 -16.1562248 -37.5503627
##  [38,]  -6.0370595 -55.7701948 -64.63582199  -3.6628986 -82.0662770 -44.3383447
##  [39,] -28.1049767 -38.4495753 -44.04427425 -53.3562479  -8.3650827 -98.2430395
##  [40,] -80.3336188 -85.1309530  -9.28920016 -82.8918092  -1.8594749 -35.1308538
##  [41,] -56.3009135 -32.8344453 -12.27449945 -36.6266712 -86.2062120 -42.1350722
##  [42,] -33.7921173 -96.1347698 -50.59181054 -88.2583887 -61.1725626 -72.7128710
##  [43,] -41.2533253 -78.3942208 -42.12191384 -17.9555844 -22.9789446 -46.0937979
##  [44,] -72.6224726 -79.5396176 -58.54141209 -87.5720976 -92.2746029 -68.0686569
##  [45,] -42.3688073  -9.2941610  -8.33532780 -65.2352651 -79.8235547 -18.0101315
##  [46,] -65.8621291  -3.2325966 -23.93115598 -21.8239532 -77.4656115 -91.6279044
##  [47,] -87.5122282 -98.2857253 -24.24537994 -10.4285642 -34.2696473 -77.3527346
##  [48,] -40.8651422 -76.5496928  -2.04969367 -52.9068123 -18.7737868 -25.2083363
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##  [50,] -63.4902322 -43.4996995 -18.75404723 -84.3561392 -13.7841669 -47.9618302
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##  [62,] -35.1345285 -51.3005448 -15.34754026 -67.2424426 -52.3801554 -99.9652183
##  [63,]  -3.4560317 -40.5953029 -97.74618817 -63.3969736 -84.8902973 -60.1932871
##  [64,] -87.9234882 -15.4845644 -86.24100315 -34.1780866 -62.0059331 -66.2570492
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##  [76,] -41.5992036 -86.1785867 -60.89840929 -41.1042136 -34.7055170 -95.4969837
##  [77,] -90.3856052 -44.7036457 -11.28264905 -46.2372284 -13.4869304 -45.3317976
##  [78,]  -6.6738128 -54.4468804 -10.51688208 -55.8040103 -38.6583811 -47.4660937
##  [79,] -58.6034636 -32.2917989  -7.56579097 -35.1312600 -90.2603984 -30.5418605
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##  [81,]  -5.6673967 -52.1631661 -48.18709418 -20.8000302 -51.1674154 -50.1258716
##  [82,]  -1.4455605 -23.8839290 -54.66480611 -70.9184577 -80.7826736 -74.0543344
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##  [84,] -62.7055105 -83.0884690 -86.56220941 -68.5188462 -50.9749022 -51.8185237
##  [85,] -28.1715932 -44.5794228 -29.18156993 -19.3112224 -85.5796383 -85.5287465
##  [86,] -11.2170177 -87.9551504 -40.99798307 -45.0375874  -6.4155637 -73.4857365
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##  [94,] -87.1705138 -40.2051133 -51.99759880 -16.1751533  -0.4271033 -23.2259290
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##  [96,] -50.5782916 -80.3723538 -74.35254764 -43.9101223 -60.9125667 -73.2892480
##  [97,] -43.0556377 -57.8472706 -92.10649771 -57.1432462 -84.2465280 -26.1902142
##  [98,] -87.8009149 -25.1165881 -85.51913032 -52.1177372 -68.7682481 -17.4725719
##  [99,] -53.0666750 -94.8111722 -39.71792764 -92.9643466 -20.5144919 -65.8586922
## [100,] -42.3657632 -26.6496239 -43.31157566  -3.2636374 -52.9246301 -35.6099947
## [101,] -44.0454058 -31.2557860 -20.99031711 -35.7121619 -85.8326175 -98.7063272
## [102,] -82.0764012 -63.9727882 -24.60090267 -99.5691259 -26.9281760 -94.3948945
## [103,] -64.7804249 -13.4499416 -61.27034908 -44.4397579 -46.5460413  -1.6524551
## [104,] -96.8400174 -54.2251677 -15.31538700 -44.0780312 -24.1024934 -57.3548793
## [105,]  -3.0115730 -66.8175429 -72.61285484 -55.8471430 -95.4933299 -47.3122988
## [106,] -23.4460682 -88.8651368 -22.84855247 -23.0754754 -84.5776994 -79.0295511
## [107,] -34.4022732 -15.3891095 -37.04744331 -18.9467733 -46.2085032 -62.4978127
## [108,] -42.0173883 -43.0654097 -24.24732188 -51.6235497 -62.3570210 -80.6722046
## [109,] -67.6027067 -61.7067305 -34.63253260 -51.3451534 -88.1490856 -95.5589545
## [110,] -26.9094261 -49.2809556 -52.54430857 -22.9184511 -65.0029590  -8.9819732
```

```
## [111,]  -0.8734224 -85.8539637 -43.10294457  -1.4242727  -8.0870893 -77.1333503
## [112,] -71.5111076 -27.8610743  -3.80469253 -42.5442176 -68.0537519 -32.3811967
## [113,] -60.9807800 -74.1130912 -33.25692366 -50.6559079 -30.7771936 -57.3591158
## [114,]  -1.2143685 -21.3050792  -6.45709899 -45.4989586 -16.0857936 -33.9426154
## [115,] -92.8901701 -53.1579544 -12.67533631  -4.2374535 -43.8031196 -90.1172572
## [116,] -62.7754610 -58.8570035 -76.97729133 -37.1119206 -20.4808784 -39.6265364
## [117,] -53.3885957 -88.8580535 -61.91398436 -93.3445902 -88.2331699 -42.9548393
## [118,] -82.8216839 -40.7856080 -77.07308645 -15.5175893 -27.9075897 -57.2039108
## [119,] -73.8702658 -86.2316780 -17.33865421 -68.3352058 -18.6252919 -14.4711859
## [120,] -36.0165729 -86.9154358 -49.88534485  -1.8620564 -21.7295456  -7.9197079
## [121,] -30.7794869 -51.9908112  -3.11719098 -52.9188537 -25.9226006 -57.1782952
## [122,] -21.6643062 -83.5665615 -25.65427576 -98.4314881  -0.6458999 -77.2131636
## [123,] -67.5599382 -21.5270451 -95.36948747 -65.2240374 -67.5830733 -18.1156388
## [124,] -29.8757448 -14.1693344 -36.82902532 -15.0220365 -48.7542877 -70.4157166
## [125,] -82.9294571 -72.4191969 -75.99488562  -6.2125324 -77.2513860  -2.2044120
## [126,] -44.4759207 -68.1772737 -74.76614011 -14.7134624  -1.6572066 -68.6810359
## [127,] -66.5994145 -57.3359097 -81.74357580 -34.3086589 -69.2108632 -14.1537531
## [128,] -54.5127189 -66.9077031 -36.84996522 -97.1532399 -45.6783591 -40.1836395
## [129,] -27.9357399 -49.1809711 -40.41415940 -45.2036397 -98.7084975 -96.9601182
## [130,]  -2.1675561 -35.7870168 -92.67323336 -82.2643104 -33.7338340 -43.0025887
## [131,] -38.0495239  -9.9635834 -48.84369762  -4.7069551 -48.5733509 -58.0326924
## [132,] -18.4376411 -66.1343531 -39.27570086 -68.9944741 -85.9526838  -8.7704363
## [133,] -82.2189642 -84.0606174 -54.92424842 -16.2870968 -18.3618766 -49.0174751
## [134,] -13.4631736 -65.0582877 -19.10542420 -42.9154092 -82.1797603 -77.5350206
## [135,] -46.3370271  -8.1131190 -93.70206269 -46.6368115 -61.4316466 -10.4238830
## [136,] -84.8450745 -73.7518437  -2.44732425 -94.9753549 -76.2920886 -81.1657635
## [137,] -45.4399061 -40.3945316 -26.49180661 -42.1048762 -67.7242992 -54.2449451
## [138,] -21.4902763 -75.7145302 -69.99630011 -39.6788443 -57.8012805 -39.2719820
## [139,]  -8.5441063 -70.2948967 -21.61811225 -23.1246894 -78.3507574 -30.3890592
## [140,] -96.6172941 -42.0978663 -31.04119005 -21.6855339  -1.7878949 -92.6049870
## [141,] -32.6264270 -85.2175451 -50.15147363 -28.2926943 -95.1080070 -48.2069490
## [142,] -82.1939547 -93.1856764 -48.29587690 -60.6923037 -83.5557184 -77.3508850
## [143,] -51.1503950 -99.0019714 -66.17712863 -89.6187095 -11.8538074 -35.3081617
## [144,] -97.4211700 -63.7653001 -50.95829994 -79.3974249 -31.3468221 -93.3428193
## [145,] -83.4595268 -11.9136471 -51.03560733 -26.8392837 -14.4070331 -33.0284399
## [146,] -30.4721539  -8.4407364 -98.72703496  -9.9582672  -6.1807249 -28.1421849
## [147,] -88.3409018  -8.8700800 -13.50104958  -1.0221116 -36.7253492 -46.2635781
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## [113,]  -9.378405 -36.2368726
## [114,] -30.420587 -39.2601977
## [115,] -20.064226 -92.8089708
## [116,] -95.285978 -97.7080183
## [117,] -62.553090 -51.5277155
## [118,]  -8.582957 -40.0662582
## [119,] -76.455039 -95.4454557
## [120,] -25.300339 -99.3533624
## [121,] -24.238448 -15.7033959
## [122,]  -8.207299 -73.1464995
## [123,] -96.650073 -96.9351973
## [124,] -98.233267 -81.6382048
## [125,] -62.564575 -59.9462623
## [126,] -49.041155 -16.9271408
## [127,] -85.884857 -97.2193776
## [128,] -36.301288 -46.7993545
## [129,] -11.739077 -28.2874703
## [130,] -70.962919 -81.5638346
## [131,] -93.912865 -83.7456212
## [132,] -87.710119 -37.1198160
## [133,] -28.334376 -57.5082214
## [134,] -73.098714 -66.1116943
## [135,] -97.705492 -19.8781101
## [136,] -80.355848 -61.6813137
## [137,] -53.146398 -17.9922523
## [138,] -31.710485 -91.8665087
## [139,] -24.752969 -92.7297310
## [140,] -30.229933 -45.5999877
## [141,] -58.641987 -65.1651494
## [142,] -60.636877 -62.3224832
## [143,] -84.124345 -87.8763895
## [144,] -91.113344 -32.7836183
## [145,] -31.823243 -29.5682114
## [146,] -12.267486 -85.4262511
## [147,] -32.597403 -58.7534744
## [148,] -40.935842 -77.5572063
## [149,] -89.628565 -24.4841969
```

```
## [150,] -77.056227 -64.2485494
## [151,] -39.077191 -34.7156050
## [152,] -35.248777 -41.4494668
## [153,] -26.586235 -96.5272037
## [154,] -40.978563 -39.3761898
## [155,] -91.835871 -44.5940744
## [156,] -17.375197 -75.9293577
## [157,] -42.477191 -27.7559747
## [158,]  -2.352319 -30.4888415
## [159,] -56.266304 -45.3145581
## [160,] -80.124492 -45.3916366
## [161,] -94.435213 -92.7384397
## [162,] -69.394227 -99.2115527
## [163,] -65.377865 -16.8631806
## [164,] -55.533208 -49.5132195
## [165,] -28.192603 -65.7987560
## [166,] -53.567832 -80.3018885
## [167,] -67.412904 -51.0759267
## [168,] -79.485415 -16.4609660
## [169,] -95.187276 -90.8863519
## [170,] -63.830051 -94.2293830
## [171,] -91.194314 -10.0194546
## [172,] -24.354794 -48.3468558
## [173,] -29.369175 -84.5087620
## [174,] -51.009005 -15.7071761
## [175,]  -4.055670  -0.7524989
## [176,] -64.622680 -51.4517117
## [177,] -86.674470 -62.5931229
## [178,] -74.929416 -83.6176618
## [179,] -65.494442 -98.3976682
## [180,] -79.723477 -16.3831948
## [181,] -37.555707 -47.3941487
## [182,] -61.200312 -81.6690973
## [183,] -37.116419  -7.5314351
## [184,] -35.947086 -83.2150112
## [185,] -23.579145 -87.3682620
## [186,] -35.212807 -76.5408365
## [187,]  -2.756806 -83.7108924
## [188,] -96.654821 -61.3140091
## [189,] -11.547174 -23.2297626
## [190,] -45.700683  -5.4531191
## [191,]  -8.138595 -35.5034374
## [192,] -69.439314 -74.9604085
## [193,] -93.853592 -43.4934990
## [194,] -15.614944 -29.3939764
## [195,] -14.042259 -37.5049410
## [196,] -28.037010 -26.3817671
## [197,] -65.659767 -63.8691747
## [198,] -21.178610 -22.4754119
## [199,]   0.000000 -76.2222024
## [200,] -52.335262   0.0000000
```

Grafica nueva con matriz negativa, ver el espacio-producto, tecnológico

```
g <-graph.adjacency(M, mode="undirected", weighted = TRUE)
MST<- minimum.spanning.tree(g)
plot(MST, vertex.shape="none", vertex.label.cex=.7)
```

```
## Warning in v(graph): Non-positive edge weight found, ignoring all weights
## during graph layout.
```
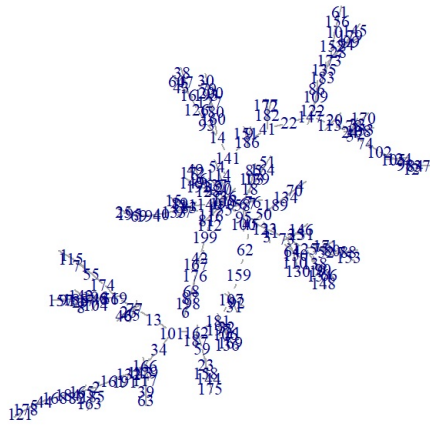
Matriz de adyacencias (nuevo relacionamiento) Ver las aristas que hay entre los nodos

```
A<- get.adjacency(MST, sparse = F)
```

VER LAS ARISTAS(PESOS)

```
head(A)
```

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13] [,14]
## [1,]    0    0    0    0    0    0    0    0    0     0     0     0     0     0
## [2,]    0    0    0    0    0    0    0    0    0     0     0     0     0     0
## [3,]    0    0    0    0    0    0    0    0    0     0     0     0     0     0
## [4,]    0    0    0    0    0    0    0    0    0     0     0     0     0     0
## [5,]    0    0    0    0    0    0    0    0    0     0     0     0     0     0
## [6,]    0    0    0    0    0    0    0    0    0     0     0     0     0     0
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25] [,26]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     0     0     0     0     0     0     0     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37] [,38]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     0     0     0     0     0     0     0     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49] [,50]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     0     0     0     0     0     0     1     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61] [,62]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     0     0     0     0     0     0     0     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73] [,74]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     1     0     0     0     0
## [5,]     0     0     0     0     0     0     0     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
```

```
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85] [,86]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     0     0     0     0     0     0     0     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97] [,98]
## [1,]     0     0     0     0     0     0     0     0     0     0     0     0
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     0     0     0     0     0     0     0     0     0     0     0     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     0     0     0     0     0     0     0     0     0     0     0     0
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]     0      0      0      0      0      0      0      0      0      0
## [2,]     0      0      0      0      0      0      0      0      0      0
## [3,]     0      0      0      0      0      0      0      0      0      0
## [4,]     0      0      0      0      0      0      0      0      0      0
## [5,]     0      0      0      0      0      0      0      0      0      0
## [6,]     0      0      0      0      0      0      0      0      0      0
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,]      0      0      0      0      0      0      1      0      0      0
## [2,]      0      0      0      0      0      0      0      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      0      0      0      0      0      0      0      0
## [3,]      0      0      0      0      1      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      0      0      0      0      0      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      0      0      0      0      0      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,149] [,150] [,151] [,152] [,153] [,154] [,155] [,156] [,157] [,158]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      0      0      0      0      0      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,159] [,160] [,161] [,162] [,163] [,164] [,165] [,166] [,167] [,168]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      1      0      0      0      1      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,169] [,170] [,171] [,172] [,173] [,174] [,175] [,176] [,177] [,178]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      0      0      0      0      0      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      1
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,179] [,180] [,181] [,182] [,183] [,184] [,185] [,186] [,187] [,188]
## [1,]      0      0      0      0      0      0      0      0      0      0
## [2,]      0      0      0      0      0      0      1      0      0      0
## [3,]      0      0      0      0      0      0      0      0      0      0
## [4,]      0      0      0      0      0      0      0      0      0      0
## [5,]      0      0      0      0      0      0      0      0      0      0
## [6,]      0      0      0      0      0      0      0      0      0      0
##      [,189] [,190] [,191] [,192] [,193] [,194] [,195] [,196] [,197] [,198]
## [1,]      0      0      0      0      0      0      0      0      0      0
```

```
## [2,]     0       0       0       0       0       0       0       0       0       0
## [3,]     0       0       0       0       0       0       0       0       0       0
## [4,]     0       0       0       0       0       0       0       0       0       0
## [5,]     0       0       0       0       0       0       0       0       0       0
## [6,]     0       0       0       0       0       0       0       0       0       1
##      [,199] [,200]
## [1,]     0       0
## [2,]     0       0
## [3,]     0       0
## [4,]     0       0
## [5,]     0       0
## [6,]     0       0
```

Exportar nodos n-1 en gráfico gml

```
write.graph(MST,file="g.gml", format = "gml")
```

Exportar resultados para cytoscape o gephi

```
write.csv(A, file= "Adyacentes.csv")
```