

Uebung 11

Multivariate Statistik

SoSe 2019

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Aufgabe 1 a)

```
clust <- read.csv("Ex11.csv")  
library('VIM')
```

```
clust <- format(clust, scientific = FALSE)
```

```
clust[c(1:40)] <- lapply(clust[c(1:40)], as.numeric)
```

Skalieren der Daten

```
scaled_data = t(as.matrix(scale(clust)))
```

```
kmm = kmeans(scaled_data, 5, nstart = 60)
```

```
kmm
```

```
#> K-means clustering with 5 clusters of sizes 6, 20, 6, 4, 4
```

```
#>
```

```
#> Cluster means:
```

```
#>      1      2      3      4      5      6  
#> 1 -0.65293257 -0.03768118  0.3201111 -0.04555148 -0.32949186 -0.38874956  
#> 2 -0.37161784 -0.13035899 -0.1191583 -0.27118251  0.09177602 -0.28814260  
#> 3  0.52131197 -0.18331527 -0.1358904 -0.83481512  0.04058154 -0.18226590  
#> 4 -0.78319049 -0.49090586 -1.0648990  0.51260323 -0.54926363  0.05930680  
#> 5  0.08856917 -0.01887152 -0.7968997 -0.49724329  0.57702354 -0.04973452  
#>      7      8      9     10     11     12  
#> 1  0.2693997 -0.61242370  0.4129149 -0.12586306 -0.11344398 -0.009829228  
#> 2 -0.1211400 -0.37586416 -0.3708198  1.62663688  1.72059797  1.664074561  
#> 3  0.3908269  0.02740118  0.7588462  0.03165377  0.01290324  0.446714976  
#> 4 -0.3948767 -0.13357774 -0.2372000  0.27359662  0.68705922  0.277998806  
#> 5  0.3126914  0.29568956  0.5338776  0.26831779 -0.70752839 -0.010429615  
#>     13     14     15     16     17     18  
#> 1 -0.1792515 -0.4603594  0.39529678 -1.1720572 -0.3334882 -0.2269517  
#> 2  1.5375534  1.3451297  1.39421046  1.2634387  1.4395779  1.3612312  
#> 3  0.8304547 -0.2553001 -0.28482853  0.3531113  0.1755410  0.1823990  
#> 4 -0.4819270 -0.2432016 -0.52716355  0.3573333  0.2218558  0.9887323  
#> 5  0.7647604 -0.1114630 -0.05920584  0.5384011  0.4240889  0.1055045  
#>     19     20     21     22     23     24  
#> 1  0.5677292 -0.4456284  0.411038224 -0.58944506  0.80640302 -0.3782759  
#> 2  1.4899759 -0.1229951 -0.271069658 -0.09074504 -0.09921251 -0.2118606  
#> 3 -0.4180680  0.2222333 -0.363746912 -0.22473144  1.02112655 -0.3742816  
#> 4 -0.6681783  1.1072158  0.227614221  0.94218789 -0.06738606 -0.4950885  
#> 5  0.7103414 -0.1542571 -0.003805002  0.49595437 -0.49355629 -0.2892790  
#>     25     26     27     28     29     30  
#> 1 -0.07632688  0.2750312  0.38139605  0.089003126  0.08355035  0.1550209  
#> 2 -0.06460533 -0.1320811 -0.36691247  0.025430789 -0.21630879 -0.3471511  
#> 3  0.46540148  0.2379101  0.06653013 -0.006218144  0.24992445  0.0193832
```

```

#> 4 -0.52013622 -0.4439729 -0.45176058 -0.360283240 -0.57687231 0.5015907
#> 5 -0.66567915 0.3167454 -0.08532716 0.188448744 -0.64063374 0.2978999
#>      31      32      33      34      35      36
#> 1 0.43896819 -0.4709800 0.083331800 -0.89495651 0.5262321 0.7807821
#> 2 -0.26477050 -0.3687968 -0.105633410 0.07017628 -0.3253538 -0.2707660
#> 3 -0.04900111 0.5871501 0.038285929 0.20793615 0.6569464 -0.9284529
#> 4 0.25472249 -0.7221197 0.004067165 0.87426310 0.3446951 0.3958152
#> 5 0.35846280 0.9947445 0.998880781 -0.58949291 -0.1399450 -0.2028861
#>      37      38      39      40      41      42
#> 1 0.2445228 0.26612829 -0.48353931 0.4160063 0.05241789 -0.8641055
#> 2 -0.4575193 0.10645029 -0.14171386 -0.2189515 -0.55962325 -0.2133864
#> 3 0.5313674 0.16014437 0.90443488 -0.1930511 -0.28692377 -0.2970924
#> 4 0.2704832 0.07022468 -0.06312819 -0.8372542 0.02474842 -0.7335332
#> 5 -0.2417528 -0.32482099 0.42163902 0.1685215 0.36940873 0.5768088
#>      43      44      45      46      47      48
#> 1 -0.2284412 -0.410040330 0.2523642 0.02555843 0.12024182 0.1167303
#> 2 -0.2884094 0.271538367 0.1678662 -0.46828699 -0.03957990 0.3734940
#> 3 0.4642647 -0.114793503 0.5208168 -0.33404405 -0.56532028 -0.3274485
#> 4 0.6094372 0.878730844 -0.3116950 0.27882881 -0.09055204 0.7938531
#> 5 -0.3968998 -0.007011356 -1.0630995 -0.31146595 0.45057031 -0.7733195
#>      49      50      51      52      53      54
#> 1 0.2519002 -0.47625745 -0.1803616 -0.03397894 0.07006807 0.1521231
#> 2 0.1689789 -0.19732275 -0.1096104 -0.39064545 0.06101166 0.1015477
#> 3 -0.4747610 -0.03860082 -0.8738160 -0.11553991 -1.15857969 0.4848286
#> 4 0.6779938 -0.27268341 0.4434038 0.28183570 -0.58060013 0.7697884
#> 5 -0.5052395 0.05335149 -0.8816434 0.23382834 -0.09307375 0.3510067
#>      55      56      57      58      59      60
#> 1 0.2936580 0.83660972 0.96389754 -0.8151255 0.25198474 -0.43293809
#> 2 -0.2237806 -0.19949061 -0.28284603 -0.3253625 -0.02415848 -0.07723587
#> 3 0.8711945 0.09202742 -0.24991871 -0.3213844 -0.25011593 -0.06793408
#> 4 0.7143900 -0.06877729 0.03029892 0.5050880 1.33557834 -0.73307169
#> 5 -0.4365878 -1.00325012 -0.22282049 0.5770650 -0.65320219 -1.00676458
#>      61      62      63      64      65      66
#> 1 -0.2994688 -0.02661648 0.2933676 -0.8687416 0.308321333 0.5603507
#> 2 -0.1716111 0.05565590 -0.1743188 -0.2410408 0.003959843 -0.5425985
#> 3 -0.4378094 -0.20058601 0.3553418 0.4685499 0.300199623 -0.0723357
#> 4 -0.7439120 -0.52931438 -1.0429400 0.5393907 0.007869601 -0.2978932
#> 5 0.2951959 -0.01588713 -0.5110950 0.6862824 0.501922499 0.1425356
#>      67      68      69      70      71      72
#> 1 0.591758331 0.40415873 -0.24588737 0.40456349 -0.45941591 -0.07123055
#> 2 0.069128344 -0.05795774 -0.20241258 -0.17327019 -0.39225824 -0.27524147
#> 3 -1.209582198 0.16506374 -0.52397312 -0.23116589 -0.03524418 -0.75716969
#> 4 -0.076671288 0.42463312 0.07883907 -0.09155771 -0.07671349 -0.31775849
#> 5 0.008976087 -1.32839945 -0.29399634 0.10112407 0.50824908 0.20272775
#>      73      74      75      76      77      78
#> 1 -0.4478968 0.60794454 1.22737287 0.1493384 -0.52497349 -0.3738813
#> 2 -0.4379984 -0.18168741 -0.37088891 -0.4889365 -0.76899089 -0.1778989
#> 3 0.7542423 0.68223383 0.04309302 0.4575848 -0.02283312 0.3108973
#> 4 0.3626320 -0.02847437 -0.29489093 0.9037426 0.18491478 -0.8488177
#> 5 -0.3114641 0.16943600 -0.03061183 0.2402980 -0.43115134 0.1169313
#>      79      80      81      82      83      84
#> 1 -0.1338984 -0.4984065 0.51911339 0.408749981 -0.3139950 0.33587365
#> 2 -0.3008811 -0.1391844 0.08066834 -0.240625654 -0.2733893 -0.07868906

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#> 3 -1.0663669 0.2519644 -0.14365149 0.675278039 0.5017206 -0.77865210
#> 4 -0.1208858 0.7353870 -0.06788379 -0.834523728 0.3003228 1.47121663
#> 5 -0.6224291 0.3248554 0.11224238 0.004672226 1.0036056 -0.27527680
#>      85      86      87      88      89      90
#> 1 -0.2965258 0.27807134 0.1388487 -0.21848379 -0.30532421 -0.2725529
#> 2 -0.2850831 -0.02402128 -0.3858371 -0.03740294 -0.08604632 -0.4574942
#> 3 -0.1504066 -0.24173598 0.1500079 1.13711974 -0.26136841 0.4605060
#> 4 -0.1639529 -0.85655827 -1.0991932 0.28350738 0.38691686 -0.1134014
#> 5 0.3181019 -0.49205025 0.6634653 0.08270619 -0.20351583 -0.1439250
#>      91      92      93      94      95      96
#> 1 0.4955692 -0.4213072 -0.4634990 0.08936219 0.37162897 -0.65775772
#> 2 -0.1111301 -0.2107736 -0.2856978 0.22069225 -0.38174396 -0.52005547
#> 3 -0.3800253 0.1450556 -0.6683688 0.49951013 0.27979346 0.03597746
#> 4 -0.4460123 -0.3565933 -0.2100048 0.15435173 -0.19036045 0.22589694
#> 5 -0.3581352 0.1719809 -0.3005216 0.37242527 -0.02043969 0.31218035
#>      97      98      99      100      101      102
#> 1 0.82976307 0.2571233 -0.51284064 -0.4281201 0.08908484 -0.05085597
#> 2 -0.38868732 -0.1842695 -0.04823037 -0.2101826 -0.60903738 0.06862975
#> 3 -0.01727092 -0.5095228 0.02943630 -0.3162786 0.26162368 -0.10512164
#> 4 0.06090514 0.1679564 0.33668665 0.1987313 -0.31713962 0.11908894
#> 5 0.40529435 0.9261345 -0.76126211 0.1427432 0.01598073 0.07301713
#>      103      104      105      106      107      108
#> 1 0.03268454 -0.11937055 -0.02676059 -0.24927610 0.15059039 0.3199368
#> 2 -0.41996995 0.03628597 -0.33782185 -0.09043603 -0.39731476 -0.3198139
#> 3 0.62912917 0.80418476 0.29707154 0.45139701 -0.05259747 0.6556487
#> 4 -0.34209980 0.57121002 0.56128863 0.32416558 0.46074442 0.1774898
#> 5 1.34547615 0.60211206 0.23267875 -0.05393762 -0.63221150 -0.9519872
#>      109      110      111      112      113      114
#> 1 0.33426883 0.2592015 0.22660049 0.1795284 -0.32101651 -0.7876200
#> 2 -0.18713798 -0.1828621 -0.41536508 -0.2857062 -0.15815029 -0.6940744
#> 3 0.03174276 0.1344284 0.10181235 -0.2478251 -0.03864506 -0.9254685
#> 4 0.46605682 -0.0575877 0.07936352 -0.3900128 -0.44369862 0.5067358
#> 5 0.26624720 -0.4818963 -0.47025473 -0.3792165 0.25472147 -0.5283800
#>      115      116      117      118      119      120
#> 1 0.2056763 -0.80179364 -0.4589792 -0.01287077 -0.65299428 -0.6626545
#> 2 -0.6548391 -0.28193948 -0.0248672 -0.16917252 -0.46087125 -0.1799984
#> 3 0.7368935 0.72280826 -0.7697384 -0.20577044 -0.38970124 0.1582693
#> 4 -0.4311119 0.04180792 0.1682408 -0.02377467 -0.65666646 0.6590055
#> 5 0.1483241 0.94228010 0.2461943 0.39872116 0.05468702 -1.2793512
#>      121      122      123      124      125      126
#> 1 -0.26278902 0.4050097 0.2779652 -0.06806864 0.2645823 0.4075911
#> 2 -0.28478555 -0.1280213 -0.6209063 0.14749476 -0.2707339 -0.3693148
#> 3 0.08803798 0.2554742 -0.5178308 -0.28643547 -0.5714683 0.1137160
#> 4 -0.99588094 0.6526278 0.1431587 0.34448214 -0.4285678 -0.1140092
#> 5 0.30292271 -0.1560288 0.2000287 0.32729822 0.4387156 0.1027881
#>      127      128      129      130      131      132
#> 1 -0.12176186 -0.12293418 0.06816794 -0.1557446 -0.1400442 0.04460554
#> 2 -0.01486872 -0.04566675 -0.37258822 -0.5944401 0.0184310 -0.12154245
#> 3 -0.03902597 0.14833305 0.17183569 -0.6140748 -0.0700036 -0.20698630
#> 4 -1.07589491 -0.46488600 1.14166708 -0.2481689 0.9262626 -0.17280460
#> 5 -0.19670479 0.75811423 0.77504594 0.9776132 -0.4619706 0.53296528
#>      133      134      135      136      137      138
#> 1 0.381552276 0.6330100 0.30126000 -0.2171590 0.1744577 -0.7805140

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#> 2 -0.310826285 -0.5052728 0.09234226 -0.3554007 -0.2423965 -0.4599217
#> 3 0.009754401 0.4819932 0.89140450 0.4213859 -0.4123370 -0.3113772
#> 4 1.641199591 0.6320004 0.10916596 -0.3845967 -0.7995270 -0.1899867
#> 5 -1.036601722 0.6264947 -0.51980031 1.2790199 0.3345854 -0.3965024
#>      139      140      141      142      143      144
#> 1 -0.01086746 -0.25523403 -0.1765432 -0.8543973 0.3045971 -0.6387030
#> 2 0.03507214 -0.59107106 0.1049791 -0.1844108 -0.1877522 -0.1874742
#> 3 0.58590352 0.08246624 0.2591798 -0.1250495 0.9733864 0.3634333
#> 4 0.74610899 -0.09379896 -0.5642678 -0.4731945 -0.1859028 -0.6810929
#> 5 0.09309054 -0.45931965 -1.3686985 0.9031501 0.3620551 -0.4161519
#>      145      146      147      148      149      150
#> 1 0.1577444 -0.05890027 -0.1452037 0.03267094 0.65830566 0.5704079
#> 2 0.0273816 -0.20573727 -0.4051609 -0.52708075 -0.04983021 -0.1545578
#> 3 -0.2318873 -0.25426588 -1.0078834 -0.53900374 -0.20035935 0.3988125
#> 4 -0.1638914 0.06551669 0.3956722 0.06161988 -0.03001500 0.2994339
#> 5 1.0048672 -0.15939108 -0.2091676 0.40316442 -0.10935245 -0.8132031
#>      151      152      153      154      155      156
#> 1 0.2970520 -0.8772445 0.18926348 -0.66872364 0.04754606 -0.1419597
#> 2 -0.1998927 -0.0248404 -0.33435454 -0.10711989 0.18935530 -0.3908296
#> 3 -0.5194580 -1.2221056 0.06317895 0.15067122 -0.75943440 -0.7584065
#> 4 0.1634228 -0.1315224 -0.52381821 0.07497978 -1.45190328 0.4451738
#> 5 0.9203701 0.8353240 -0.10866181 -0.08976758 -0.52698935 0.3716755
#>      157      158      159      160      161      162
#> 1 0.051001559 0.4579355 0.57053811 0.1175550 -0.1962088 0.15791366
#> 2 -0.149268758 -0.4070264 -0.04287047 -0.1365019 -0.1981188 -0.36367445
#> 3 -0.284328316 0.2598854 0.06729398 0.1153083 0.7159439 -0.44049100
#> 4 -0.003566287 0.4984736 0.68412281 -0.4389722 0.6604856 -0.65915138
#> 5 -0.705715128 -0.1213432 -0.05671325 -0.9358367 0.2909226 -0.02494178
#>      163      164      165      166      167      168
#> 1 0.4640424 0.61339821 0.33631649 0.50906346 -0.02988715 0.6917919
#> 2 -0.2143637 -0.08253502 -0.01422696 0.01501698 -0.24345103 -0.3325655
#> 3 -0.2143666 0.29607272 -0.11226322 0.04743149 -0.51400189 0.2658628
#> 4 -0.9449133 0.04471201 -0.01262969 0.50623115 -0.29404154 -0.3246160
#> 5 0.6974189 0.53376175 0.01289270 -0.67337411 0.03596347 -0.2083181
#>      169      170      171      172      173      174
#> 1 -0.21593291 0.64754765 0.58229769 -0.04806168 -0.01385538 -0.42939340
#> 2 -0.09039814 -0.33426566 -0.69031693 -0.47621529 -0.31287627 -0.17482762
#> 3 -0.77504362 -0.06472232 0.09536432 -0.38732010 -0.29522876 -0.10837164
#> 4 0.02904725 0.12550014 -0.18923539 0.02570236 0.01872816 0.28399307
#> 5 1.00738750 -0.01851372 0.41373973 -0.30703778 -0.20341825 -0.08356962
#>      175      176      177      178      179      180
#> 1 -0.02835222 0.12368835 0.12692342 -0.10340293 -0.14313579 0.02207836
#> 2 0.03311640 0.01718515 0.06853988 -0.44442226 -0.06689367 -0.34657703
#> 3 -0.27376516 -0.29174453 0.09411501 0.93851945 0.19843762 0.36399061
#> 4 -0.12412693 0.55564689 0.16528210 0.06335519 -0.42210989 0.33945918
#> 5 1.02518727 0.09513698 -0.74704077 -0.68471190 -0.77551825 0.12849632
#>      181      182      183      184      185      186
#> 1 0.29262780 -0.314645559 0.13251735 0.59204370 -0.3674472 0.4439589
#> 2 -0.20360180 -0.055260829 0.04141384 -0.04641734 -0.3724033 -0.1648925
#> 3 0.25994555 -0.479878691 0.55024326 -0.01169700 -0.3764713 -0.1962039
#> 4 -0.05306831 -0.009699505 -0.05494839 -0.11863998 -0.6723188 -0.1308761
#> 5 0.21571441 -0.506614383 0.33005762 -0.21335144 -0.8495445 -0.5453443
#>      187      188      189      190      191      192

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#> 1 -0.19458408 -0.3919685 -0.5392328 0.210025585 -0.15642377 -0.1121745
#> 2 -0.46623352 -0.1945033 -0.2765365 -0.437107682 -0.02824591 -0.0137198
#> 3 -0.15459726 0.4074572 -0.2700543 0.062493443 -0.05720502 -0.5768854
#> 4 0.18205663 -1.4367227 -0.7931617 -0.009340915 0.50418100 0.2962404
#> 5 0.01005885 0.2603170 0.6625878 0.023276500 -1.24224639 0.6568225
#>      193      194      195      196      197
#> 1 -0.42012725 -1.15310695 0.572721202 0.007686597 0.03384184
#> 2 -0.22959928 0.03871662 -0.008145671 -0.058586788 -0.22633581
#> 3 0.03493856 -0.43660797 0.104683459 -0.016863695 -0.58954363
#> 4 -0.13164775 -0.48136477 -0.186579852 -0.377846946 -0.29811528
#> 5 1.36755593 1.37581409 -0.298102574 -0.422326529 -0.73703229
#>      198      199      200      201      202      203
#> 1 -0.03961779 -0.4600117 -0.09576678 -0.098012810 -0.1945209 0.45427144
#> 2 -0.05257738 -0.2073000 -0.05471169 -0.298138118 -0.4792068 -0.11496417
#> 3 -0.22659592 0.1144711 -0.02852588 0.001429395 -0.1838964 0.28945311
#> 4 0.17481905 0.4678694 -0.74620114 0.400773257 0.2804912 0.06989101
#> 5 0.01157722 -0.7865783 -0.48331183 -0.595371875 0.2841724 -0.08655131
#>      204      205      206      207      208      209
#> 1 0.1191151 0.04870360 0.82670327 0.4946159 -0.2498191 0.79174749
#> 2 -0.1588761 -0.02950543 -0.29732272 -0.1016534 -0.1573904 -0.35680929
#> 3 -0.4247872 0.20405086 0.09119122 -0.1336539 0.7015868 -0.00363324
#> 4 1.1189000 -0.19947071 0.35767464 -0.7963723 -0.2264914 -0.45952646
#> 5 -0.2002485 -0.59435678 -0.71773896 0.5945637 -0.3591834 -0.25090850
#>      210      211      212      213      214      215
#> 1 -0.16636116 -0.09504943 0.09731115 -0.81835864 0.22841629 0.67470185
#> 2 -0.28051747 -0.08381073 -0.10372380 0.11129123 -0.09024021 -0.04638255
#> 3 -0.18388737 -0.56022355 0.32635002 -0.08660871 0.39037864 -1.04303450
#> 4 0.03204052 0.23877756 -0.77338759 -0.60879876 -0.17067634 0.02476100
#> 5 -0.14316521 -0.68896910 0.05954856 -0.04942479 0.68244976 -0.17353753
#>      216      217      218      219      220      221
#> 1 0.8054967 0.02464152 0.8158847 0.3803715 0.1182419 -0.07002739
#> 2 -0.2515823 -0.07630523 -0.2811819 -0.4373923 -0.1759834 -0.39606320
#> 3 -0.2215647 -0.47148349 -0.6190156 0.3161815 -0.1947727 0.06106580
#> 4 0.2221446 0.44570752 0.8641705 -0.5112934 -0.9541388 1.06227736
#> 5 0.1581896 0.87497295 0.7400291 -0.9960164 -0.7156804 0.30505963
#>      222      223      224      225      226      227
#> 1 -0.02374483 0.6492953 -0.34913675 0.03003728 -0.2191031 0.3885697
#> 2 -0.07066302 -0.6015252 -0.20323856 -0.22987130 0.2212300 -0.3419037
#> 3 0.45953492 -0.6131163 0.09676732 -0.16860680 0.2534536 0.3203354
#> 4 -0.71897773 0.5455919 0.41704862 -0.12037647 0.3542746 -0.8212967
#> 5 -0.76860271 -0.4003603 -0.22659122 1.08562603 -0.2782425 -0.2397290
#>      228      229      230      231      232      233
#> 1 0.06173504 -0.99654239 0.9812396 0.50755148 -0.4950941 -0.677181856
#> 2 -0.06864663 -0.09308773 -0.3247298 -0.04280057 -0.3929308 -0.324002544
#> 3 0.11517102 -0.54427639 0.6866133 -0.35818162 -0.5073734 -0.004149914
#> 4 0.26843993 1.14341767 -0.1324919 0.44256694 0.1858946 0.369593146
#> 5 -0.57705045 0.49034857 -0.2653312 -1.05709535 0.7420107 -0.315045120
#>      234      235      236      237      238      239
#> 1 0.17705121 -0.3706623 -0.32322869 -0.3882897 0.06898226 -0.06362893
#> 2 -0.12082307 -0.2634332 -0.11857208 -0.4379556 -0.14593985 -0.21615998
#> 3 0.53936179 0.3891229 -0.07269506 -0.4770216 0.64106217 0.02814720
#> 4 0.61467929 -0.2482206 -0.16427799 -0.7446304 1.03780087 0.41616267
#> 5 0.06921086 0.6236115 -0.25179229 0.3562062 -0.30198756 -1.21257068

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#>	240	241	242	243	244	245
#> 1	-0.2036582	0.1108783	-0.5698648	0.307640986	-0.15816255	0.42990429
#> 2	-0.2013050	-0.3089057	0.1601684	0.039204756	-0.44501823	-0.16336883
#> 3	0.2337291	-0.3803719	-0.4444535	0.007129374	-0.07917051	0.29673414
#> 4	-0.5380722	-0.7436213	-0.4805238	0.027997142	0.27710936	0.07369758
#> 5	-0.3535575	0.1082523	-0.1014300	-0.009797501	0.13519220	0.21152877
#>	246	247	248	249	250	251
#> 1	-0.1571760	-0.11054146	0.3945439	-0.10207419	-0.005762165	-0.3920155
#> 2	-0.2708567	0.10481967	-0.1420319	0.03639378	-0.541031748	-0.3240877
#> 3	-0.3122277	0.48809258	-0.2105843	0.51630974	0.086991568	-0.5664398
#> 4	-0.7705080	0.08363008	-0.2224351	0.17973221	0.248710799	-1.0419485
#> 5	-0.2933394	-0.52686148	0.5514007	0.98256871	-0.071684350	0.6363105
#>	252	253	254	255	256	257
#> 1	-0.79349522	0.2667845	0.4130458	0.44320388	-0.11253834	-0.15464964
#> 2	-0.04088518	-0.1988928	-0.1105994	-0.24760256	-0.33944795	0.05478381
#> 3	0.24441960	0.5733056	-0.3528748	-0.25998261	-0.38844785	-0.41261352
#> 4	0.93602017	-0.2894260	0.1794442	0.04932595	0.03477383	-0.87984830
#> 5	-0.36582836	0.3265524	0.2328803	-0.05398845	0.95752932	0.12836319
#>	258	259	260	261	262	263
#> 1	0.19821541	-0.2575350	0.511767769	-0.1613375	0.8490005	0.4963020
#> 2	-0.07562479	-0.4515204	-0.115031076	-0.2506233	-0.4279321	-0.0402355
#> 3	0.68704161	-0.8636847	-0.537109874	-0.5548416	0.3045462	0.7434198
#> 4	0.40434173	1.5239140	-0.002196145	-0.3608666	0.2339480	1.1881637
#> 5	0.05508310	-1.0486459	0.673314995	0.6759816	0.1584211	-0.2224855
#>	264	265	266	267	268	269
#> 1	-0.52733508	-0.41030291	-0.56512817	0.41626359	-0.03622207	0.454498324
#> 2	0.04769223	0.06554644	-0.09646024	-0.34968273	0.06494382	0.002909401
#> 3	0.05416319	-0.01814869	0.54806678	-0.65226542	-0.58154084	0.957038183
#> 4	-0.41690605	0.14355225	-0.38514991	-0.54587703	-0.16788794	-0.677954245
#> 5	-0.05862514	-0.65918720	-0.67689574	-0.07990385	0.52418140	0.083492222
#>	270	271	272	273	274	275
#> 1	-0.2283377	-0.2542903	0.51702411	0.7884834	0.0444483820	0.09288147
#> 2	-0.2027082	-0.2507513	-0.23143191	0.3381160	-0.3367401840	-0.05484301
#> 3	-0.9429862	0.1056658	-0.13248456	-0.1043087	0.1805338211	0.49600479
#> 4	-0.3253811	0.1191698	0.26049325	-0.6204638	0.2422610672	-0.38123253
#> 5	0.2691276	-0.6076512	0.05286721	0.1040432	-0.0009331142	0.15110767
#>	276	277	278	279	280	281
#> 1	-0.55632059	0.11054018	0.1002715	0.10874364	0.1599731	0.1760556
#> 2	-0.15554869	0.04224552	0.0387671	0.04702720	-0.4101152	-0.2832606
#> 3	-0.21325753	0.23928910	-0.2070372	-0.07645852	0.3674222	-0.2250821
#> 4	-0.84288409	-0.34060213	-0.5145170	-0.39517984	-0.9749672	-0.7847612
#> 5	0.05641763	-0.47787549	0.6365669	-0.74699442	0.5173123	0.4172713
#>	282	283	284	285	286	287
#> 1	-0.50361648	0.1957443	0.23082132	-0.36572792	0.3781894	0.34587981
#> 2	-0.06664182	0.1157681	-0.15034506	0.04149202	-0.2472589	-0.36420949
#> 3	-0.25282832	-0.8769229	-0.11155346	0.41793594	-0.3938511	-0.56889572
#> 4	-0.01579165	-0.2225745	-0.13406296	-0.10324950	-0.2624028	0.59785071
#> 5	0.28414115	0.5088796	-0.08588344	-0.77022865	0.5850160	-0.01588048
#>	288	289	290	291	292	293
#> 1	-0.929298832	-0.05058438	-0.1321362	-0.06548937	0.07971995	-0.6095113
#> 2	-0.265870988	-0.01491961	-0.2421760	-0.14735920	-0.58905953	-0.2297312
#> 3	-0.619853379	0.84274040	0.6906785	-0.29209146	0.27337911	0.2659665
#> 4	0.006875303	0.04214186	-1.0595060	-0.52682246	0.33252897	-0.2525349


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#> 5 0.951011714 -0.83955245 -0.2425269 -0.02963904 0.46328495 0.6193254
#>      294      295      296      297      298      299
#> 1 -0.2588170 0.14327089 0.1367911 0.1541647 -0.6451365 -0.2454932
#> 2 -0.2571485 -0.23782320 -0.3171164 -0.3028338 -0.1451964 -0.1840770
#> 3 -0.1865789 0.07949498 0.2683446 -0.4361987 0.7867093 0.7933921
#> 4 -0.3315445 0.15130182 0.4674131 0.1813776 -0.4701671 -0.3956435
#> 5 0.7495209 -0.43799669 -0.6382841 0.2883908 0.2301080 0.5875673
#>      300      301      302      303      304      305
#> 1 0.06589858 0.1580467 0.6315297 -0.05893037 0.32135394 -0.37649820
#> 2 -0.03907029 -0.1778240 -0.2214404 -0.03069261 -0.39330553 -0.12847727
#> 3 -0.58056743 0.5871597 -0.1705773 0.09543652 -0.07715192 -0.06707516
#> 4 0.23185385 -0.3110922 0.7439579 -0.53397962 -0.05304700 -0.34154118
#> 5 0.48134714 0.9303331 0.1882104 -0.69544073 0.58104539 1.91025547
#>      306      307      308      309      310      311
#> 1 0.3083191 -0.09730933 0.02979209 0.06358576 0.8254488 -0.1512513
#> 2 -0.2383749 -0.25225570 -0.12461752 -0.32541250 -0.1894473 -0.1687640
#> 3 0.7129227 0.49778897 -0.26864604 0.54626360 -0.1068121 0.3525442
#> 4 -0.6394345 -0.85220806 -0.32272989 0.14425971 -0.7082144 0.3000587
#> 5 -0.4669108 -0.16318052 -0.45638737 0.50075893 -0.1567762 -0.1940442
#>      312      313      314      315      316      317
#> 1 0.82039354 -0.18498430 -0.2207377 -0.5183145 -0.3286650 0.43188767
#> 2 -0.16534664 -0.04097014 -0.2481535 -0.2592501 -0.3146802 -0.18400773
#> 3 -0.03899257 0.18630660 0.4006508 -0.5868041 0.4713211 -0.29585804
#> 4 -0.24933172 0.13675384 -0.3639423 0.6374543 0.2223656 -0.34211941
#> 5 0.61588300 -1.09370979 0.1131162 0.1135318 0.7956170 0.06590423
#>      318      319      320      321      322
#> 1 0.83850501 0.62182673 0.095160530 -0.215327762 0.446211293
#> 2 -0.13791648 0.04775353 0.006345852 0.001958132 0.003370876
#> 3 -0.01278158 -0.35673901 0.424946864 0.139123996 0.193549558
#> 4 -0.82892703 -0.14062336 0.575562860 0.119711621 -0.709501690
#> 5 0.37749307 0.29525040 0.160484219 0.102060255 0.524861910
#>      323      324      325      326      327      328
#> 1 -0.28685487 -0.8683734 -0.076815683 0.20896275 0.43417719 0.53585343
#> 2 -0.14369827 -0.1064390 -0.001195293 0.04353154 -0.01745769 -0.19870906
#> 3 -0.36171732 0.2422718 -0.967412014 -0.28071764 0.42658939 0.02646455
#> 4 0.04548457 0.4026670 -0.587450186 0.09924276 -0.04531448 -0.26472306
#> 5 -0.29845285 0.4652770 0.450920988 -1.41288410 -0.37748821 -0.22127076
#>      329      330      331      332      333      334
#> 1 -0.23441534 -0.53118982 0.520622405 -0.6132434 0.19768501 -0.21080819
#> 2 -0.27051534 0.05846314 -0.493619047 -0.1503602 -0.07860417 -0.06975969
#> 3 0.09119682 -0.61855243 -0.005058847 -0.1257836 -0.31001308 -0.22061631
#> 4 0.25104815 -0.41389479 -0.176966046 -0.2920346 -0.88586877 0.41449245
#> 5 -0.08812282 -0.51944909 -1.039002494 0.8155734 -0.07917443 0.95293279
#>      335      336      337      338      339      340
#> 1 -0.15390064 0.07843821 0.12525820 0.1090802 0.77241619 -0.06050214
#> 2 -0.10062988 -0.40539145 -0.27236425 -0.1123775 -0.29111986 -0.27427107
#> 3 0.68811756 0.69457118 -0.20205908 0.5396668 -0.37552456 1.00356422
#> 4 -0.09969756 1.42235326 -0.04107408 0.8077345 -0.59969866 0.25268863
#> 5 -0.59934990 -0.36072737 -0.43455623 -0.1352037 -0.02741347 0.24854054
#>      341      342      343      344      345      346
#> 1 -0.2466827 0.35356303 0.147641896 -0.20056635 -0.4689421 0.20471211
#> 2 0.2414119 -0.01759022 0.095838964 -0.09698348 -0.1572625 -0.06172079
#> 3 0.1175750 0.89089975 0.004673002 0.18611971 -0.5273666 0.03498710

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#> 4 0.1476692 -1.03644678 0.160913647 -0.37176652 -0.4228240 -0.23409827
#> 5 0.5403636 0.36046156 0.018545881 0.54190793 -0.5263953 -0.64043006
#>      347      348      349      350      351      352
#> 1 -0.69781539 0.04753899 0.12307473 -0.6692644 0.11915952 0.33061022
#> 2 -0.26239661 -0.09999711 -0.19624252 -0.3284257 -0.05405561 -0.31294779
#> 3 0.49769881 0.23555774 -0.04512022 -0.4024571 0.94057549 0.19265825
#> 4 -0.17103621 0.46529874 0.09994455 0.1855504 -0.54945308 0.03860849
#> 5 0.07753823 0.52070363 0.22506367 -0.3691400 -0.16634937 0.24843670
#>      353      354      355      356      357      358
#> 1 -0.3888338 -0.2813940 0.27468380 0.1284673 -0.1624097 0.19564086
#> 2 -0.4502637 -0.1579265 -0.29107030 -0.1670859 -0.1301331 -0.33794069
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#> 4 0.1298864 -0.2008702 -0.02056044 0.9951753 -0.5605762 -0.06962256
#> 5 0.2546045 0.1577496 -0.04719554 -0.2034554 0.3503378 0.19422055
#>      359      360      361      362      363      364
#> 1 0.50017574 -0.1820760 -0.5484316 -0.24081350 -0.49882223 0.1724026
#> 2 -0.30910520 -0.4590409 -0.2087517 -0.07006777 -0.13937048 -0.1542747
#> 3 0.05835138 -0.7383609 0.1376705 0.58690072 1.20427122 -0.1328204
#> 4 0.35159259 0.1607749 -0.3246602 -0.05922967 -0.46460893 -0.1785681
#> 5 -0.44964022 -0.2823780 0.2642874 -0.37683729 -0.06836475 -0.0462751
#>      365      366      367      368      369      370
#> 1 -0.1498326 0.55679679 -0.2364389 -0.3829215 -0.08598474 -0.7527183
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#> 4 0.4602788 -0.65281112 0.3608253 0.1831794 -0.13160696 0.6927421
#> 5 0.5169515 0.53671429 0.4963392 0.0443364 -0.54841335 0.6853309
#>      371      372      373      374      375      376
#> 1 -0.1209429 -0.28891093 0.15950372 0.4554504 -0.1520976 -0.5188342
#> 2 -0.2708552 -0.67375535 -0.33842763 -0.5355013 -0.3158391 -0.5327149
#> 3 0.6054707 -0.02506602 0.19409041 0.3461508 0.5663617 -0.4770541
#> 4 0.1806447 0.57735518 -0.75429855 -0.4069402 -0.8763866 0.6704236
#> 5 -0.7356287 0.19736287 0.06238895 -0.3826309 0.1558776 0.3829988
#>      377      378      379      380      381      382
#> 1 0.1484546 0.12712899 0.12132627 -0.2520345 1.1414907 0.8261817
#> 2 -0.2215367 -0.36368870 -0.18138888 -0.2564696 -0.3060971 -0.4081535
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#> 5 -1.0355968 0.41379778 -0.04281664 -0.2976979 -1.0793374 -0.7233423
#>      383      384      385      386      387      388
#> 1 0.06401572 0.63291082 0.4865032 -0.50210425 0.4498780 0.7655372
#> 2 -0.37485496 -0.27366350 -0.1785327 -0.58325064 -0.3321113 -0.2824488
#> 3 0.21937988 0.03114518 -0.4103414 0.53812891 0.8232184 0.1508628
#> 4 0.59242461 -0.82032695 0.3141775 -0.67697985 -0.1278803 0.8919974
#> 5 -0.46521759 0.50459162 -0.4333917 -0.02601396 -1.3814482 0.3440361
#>      389      390      391      392      393      394
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#> 2 -0.2438087 -0.3678750 -0.3123191 -0.2975324 -0.30668070 0.06409153
#> 3 0.1969103 0.7727097 0.2369906 0.7113937 0.47589433 -0.26394512
#> 4 0.2949708 -0.1804217 -0.3924494 0.9753885 0.21187423 1.20023173
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#>      395      396      397      398      399      400
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#> 3 -0.29552526 0.11597698 -0.15616689 0.2538140 0.008404814 -0.7710264
#> 4 -0.24241972 0.26477857 0.54819208 0.1158466 0.428822792 -0.5596434
#> 5 -0.06343294 0.08951891 0.09088126 -0.4639714 0.805494759 0.4299139
#>      401      402      403      404      405      406
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#> 5 0.69137727 -0.17222267 0.6590490 -0.21602911 0.006492096 -0.41945403
#>      413      414      415      416      417      418
#> 1 -0.29413855 -0.97705288 -0.7777529 0.004161935 0.37405994 -0.38359263
#> 2 -0.34680987 -0.44714677 -0.3755223 -0.262407834 -0.14132512 -0.09062592
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#> 4 0.25945030 1.27439211 -1.0236223 0.379622439 0.53861227 0.17522030
#> 5 -0.12052633 -0.37049120 -0.1503765 0.088421071 0.24129264 0.02149397
#>      419      420      421      422      423      424
#> 1 0.03524693 0.15161497 -0.09440421 0.430803372 -0.53643227 -0.27066567
#> 2 -0.17284778 -0.07375267 -0.33212074 -0.267680985 -0.02191643 -0.09298312
#> 3 -0.30009795 0.08125442 -0.48205114 0.196783263 0.01989802 0.16698895
#> 4 -0.52949880 0.07827378 0.24159622 -0.005229472 -0.29982005 -0.28578761
#> 5 -0.24167398 -0.48547933 0.25693878 -0.614844552 -0.87031962 -0.31510563
#>      425      426      427      428      429      430
#> 1 0.8026869 0.3164025 -0.1641314 -0.086460900 0.26262828 -0.3525628
#> 2 -0.4486130 -0.2467827 -0.1111693 0.088726185 -0.38322810 -0.1048749
#> 3 -0.8774190 0.6847616 0.4422757 -0.282304407 0.02853325 -0.3477355
#> 4 -0.7087375 0.7297806 -0.2823974 0.155373169 -0.13018269 -0.1457920
#> 5 -0.2125312 0.4836965 1.1562290 -0.005983318 -0.00788391 -0.1165339
#>      431      432      433      434      435      436
#> 1 -0.19874456 -0.2727443 -0.3506332525 -0.49005069 -0.24853741 -0.05644166
#> 2 -0.25935962 -0.4259408 -0.0002521077 -0.09250613 -0.11746306 0.01878174
#> 3 0.04839775 -0.1886849 -0.0671208380 -0.15132139 0.06657756 -0.31447916
#> 4 -0.10526132 0.1909620 0.8565839189 0.52445277 -0.17676614 0.51675535
#> 5 0.07475121 -0.5538708 -0.1322598746 0.337777992 0.19364382 -1.00005924
#>      437      438      439      440      441      442
#> 1 0.1835175 -0.30180669 -0.24911217 -0.05811262 -0.07713184 0.42640965
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#> 3 -0.4049748 -0.09792776 -0.02549258 -0.03588785 0.61112844 0.31187710
#> 4 -0.7231504 -0.53369534 -0.05715560 -0.93596861 -0.30199466 -0.50382351
#> 5 0.6386129 0.26067497 0.06410597 0.36753826 0.68695199 -0.68572523
#>      443      444      445      446      447      448
#> 1 0.7022157 -0.25906953 0.572962910 -0.4662536 -0.62820718 -0.01895617
#> 2 -0.3664160 -0.04114866 -0.001734693 -0.4392924 0.29863822 -0.34385216
#> 3 0.3397178 -0.92561965 0.036848098 0.5040643 0.09991138 0.14886483
#> 4 0.1495253 0.05660391 -0.422254154 -0.2646816 -0.21659811 -0.40413175
#> 5 -0.2909948 1.30546253 -0.094923125 -0.5119083 -0.83815487 -0.38495514
#>      449      450      451      452      453      454
#> 1 0.2578389 0.1945983 0.6321590 0.5797976 -0.27790523 -0.08297132

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#> 2 -0.2473177 -0.3679577 -0.4643532 -0.3151017 -0.01194468 -0.59435062
#> 3 -0.9105052 -0.3597989 -0.6184625 0.5103723 0.33875557 0.46631715
#> 4 -0.1192693 0.5173956 -0.1529362 0.4177025 0.21341059 -0.11039574
#> 5 0.9099006 0.2871439 -0.3464939 0.5783902 -0.79162640 -0.59745094
#>      455      456      457      458      459      460
#> 1 -0.07111313 -0.834788998 -0.26963736 0.96477244 -0.03931857 0.23002682
#> 2 -0.36231867 0.115311899 -0.04620186 -0.21706486 0.21037835 0.04166292
#> 3 0.38008466 0.140877275 0.46045419 0.07123362 -0.14853114 0.16021951
#> 4 -0.46175508 -0.602267991 0.20616634 0.78591902 0.15082357 0.01462283
#> 5 -0.10484507 -0.007321142 -0.11155687 0.79469567 -0.36890990 0.01763332
#>      461      462      463      464      465      466
#> 1 0.08893506 0.118060365 -0.62328154 -0.2324360 -0.3174536 -0.58091079
#> 2 -0.83647883 -0.058368679 -0.38873229 -0.3228051 0.1010995 -0.13361619
#> 3 -0.41593464 0.003847981 0.70767345 -0.1845370 1.2676402 0.36831735
#> 4 0.17852302 1.408774749 0.07717735 -0.8440678 -0.4983956 0.04729106
#> 5 0.62813666 -0.278884143 -0.20728286 -0.1159230 0.3958841 -0.22159892
#>      467      468      469      470      471      472
#> 1 -1.0214872 0.4699514 -0.05173825 -0.23713905 -0.1364211 0.4456317
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#> 3 -0.3317403 0.8148170 0.06418447 -0.29942490 -0.6379180 -0.1450814
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#> 5 -0.3059604 1.4907296 0.21867661 -0.31945060 0.5114582 0.6322259
#>      473      474      475      476      477      478
#> 1 -0.64321224 0.02728395 0.10078344 -0.7315166 0.2636861 0.5628129
#> 2 -0.31688715 -0.10136342 -0.05327698 -0.1950564 -0.2399486 -0.1893485
#> 3 0.74821374 0.24636068 -0.32576640 -0.3476198 -0.2206935 0.4571763
#> 4 0.76225968 0.37242666 0.10047930 -0.5717795 0.8439305 0.4964697
#> 5 -0.02393511 0.55813442 0.17036200 0.9586264 -0.1977060 -1.5429231
#>      479      480      481      482      483      484
#> 1 0.5235803 -0.4745194 -0.07792447 0.2255679 0.3183399 -0.243218856
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#> 3 -0.2324497 0.3974477 -0.46463525 -0.3104915 -0.2311004 -0.284613147
#> 4 0.4508960 0.6321876 -0.32026513 -0.1867254 0.7950097 0.497964799
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#>      485      486      487      488      489      490
#> 1 -0.27802886 0.001145152 0.95519202 -0.29699492 -0.7233408 -0.61795214
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#> 5 -0.82142874 0.835475153 -0.35318004 -0.37621626 -1.2188814 0.59443371
#>      491      492      493      494      495      496
#> 1 0.43874007 -0.49375846 -0.12951962 0.2571141 -0.40973956 0.0483506
#> 2 -0.38761921 0.12294725 -0.73677635 -0.1277114 0.05164898 -0.4289807
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#> 4 -0.06330394 -0.49845968 -0.44783426 0.2786129 0.49606524 -0.9147054
#> 5 -0.60717139 -0.08614331 0.06445508 -0.2261252 0.47523865 -0.6544011
#>      497      498      499      500      501      502
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#> 2 -0.1578162 0.07362897 -0.0003274374 1.40456267 1.75189772 1.69711663
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#>      503      504      505      506      507      508

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#> 1 -0.2351657 -0.6020518 -0.02251395 0.03114512 0.1363008 -0.7039259
#> 2 1.2419118 1.6470960 1.54380721 1.28571572 1.8528533 1.8017876
#> 3 -0.6747142 0.1322356 0.31802594 0.04840475 0.8999062 0.1562820
#> 4 0.8632818 1.1182051 0.91472906 -0.46086625 -0.2787639 0.1910734
#> 5 -0.4267987 -0.1926383 -0.33913455 -0.44090648 0.4812527 0.7754977
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#> 1 0.4755866 -0.10633369 0.1049595 0.2895586 -0.16819591 0.3026810
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#> 1 -0.6326884 0.17790367 0.1529473 0.000949494 0.11361548 0.09812261
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#> 1 -0.1621031 -0.4124857 0.3829286 0.16393616 -0.10138938 0.7397632
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#> 4 -0.5095456 0.1330409 -0.1350190 0.09448719 0.05082684 0.4668918
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#>      527      528      529      530      531      532
#> 1 -0.5249672 -0.5074125 0.04227187 0.1436162 -0.1115161 0.1102102
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#>      533      534      535      536      537      538
#> 1 0.86559317 -0.1575004 -0.01888199 0.9029136 -0.24127670 0.43468781
#> 2 1.74672549 1.5174088 1.46839683 1.5041989 1.65671952 1.45860367
#> 3 0.02205584 0.4638567 -0.29390553 0.5102829 0.08757419 0.49246010
#> 4 -0.09297852 -1.3191741 -0.19512176 0.6817900 -0.02217292 -0.79391060
#> 5 0.59149827 -0.1334661 -0.76511816 -0.1468837 -0.63263733 -0.02140968
#>      539      540      541      542      543      544
#> 1 -1.2850673 0.42112720 0.1573996 0.2950914 -0.1580974 0.2461036
#> 2 1.7832946 1.58668899 1.4969298 1.4424795 1.4690633 1.6410311
#> 3 0.5886061 0.05077996 -0.4988030 -0.1344771 0.1495193 -0.3000748
#> 4 -0.3562951 0.42350082 0.6979044 -0.2095406 0.1505243 0.2251811
#> 5 0.4690894 -0.71372950 0.1653693 0.7815352 0.5732284 0.3096858
#>      545      546      547      548      549      550
#> 1 -0.7384893 -0.1755618 -0.08937795 -0.1952706 0.009170035 0.31506241
#> 2 1.5515175 1.3050625 1.81634975 1.6864728 1.625985598 1.94061734
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#> 2 1.22568109 1.31728614 1.6505580 1.5802521 1.5025665 1.2358365
#> 3 0.26531694 0.12462296 -0.2785247 0.5656419 0.2426602 -0.2353362
#> 4 0.05435737 0.55150901 0.3099623 0.8303239 0.2033122 0.3196292
#> 5 0.49312298 -0.02852972 -0.4870552 -0.6213101 0.5743329 0.2984626

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#>	557	558	559	560	561	562
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#> 2	1.73024094	1.57494048	1.5913168344	1.75745771	1.52481737	1.40580754
#> 3	0.27054341	0.08715501	0.5637357044	-0.04678057	-0.54460236	-0.18654890
#> 4	0.84938983	0.63833256	-0.0009207093	0.18022183	-0.04452153	0.49642564
#> 5	0.64687770	-0.34910396	0.0931666517	0.02057299	-1.08568126	0.06008485
#>	563	564	565	566	567	568
#> 1	0.54965779	-0.47827593	0.8373319	0.45250635	-1.0600953	-0.2131507
#> 2	1.51072908	1.78406743	1.7867569	1.44540937	1.7113705	1.4419683
#> 3	-0.82268262	0.14698253	-0.1242347	-0.22246799	-0.2320375	0.1771697
#> 4	-0.09497711	0.03097238	-0.0183718	-0.36001694	0.8083770	-0.2799513
#> 5	-0.12323700	-0.11755455	0.1213718	0.01761069	-0.1392129	0.1767065
#>	569	570	571	572	573	574
#> 1	0.2006595	-0.9476748	0.4369781	0.5825721	-0.87012088	0.3426916
#> 2	1.5824690	1.5467432	1.6619796	1.2223396	1.34587223	1.4971112
#> 3	-0.2234180	0.1306242	0.3209654	0.3230902	-0.01706252	-0.2589465
#> 4	-0.2625819	0.5448299	0.0507760	-0.1663153	-0.48409027	-0.1064669
#> 5	-0.4630460	0.3513185	-0.1892969	-0.8052954	0.06700105	-0.2283370
#>	575	576	577	578	579	580
#> 1	0.2618689	-0.40178125	0.6350788	0.3283936	0.34020312	0.7330385
#> 2	1.5421300	1.20447941	1.7034082	1.4527622	1.30751286	1.3765522
#> 3	-0.0827593	0.04115268	0.6929459	-0.1354014	0.04173469	-0.1378840
#> 4	0.5932185	0.06093792	0.1044598	-0.5070787	1.19130638	0.6586431
#> 5	-0.3899005	-0.20488563	1.4604145	0.1435288	-0.59556496	0.1749258
#>	581	582	583	584	585	586
#> 1	-0.05965867	0.3908880	0.2309135	0.04211508	0.16115137	0.47603748
#> 2	1.70179035	1.4281791	1.7395391	1.37440276	1.73234008	1.63504939
#> 3	0.49169990	-0.2392124	-0.5597592	0.42695234	0.05166746	-0.08704223
#> 4	-1.05102198	0.2864017	-1.0808397	0.10513547	0.27056508	0.31053594
#> 5	-0.79464425	-1.2823960	0.1174337	0.72159449	0.64529617	-0.28877397
#>	587	588	589	590	591	592
#> 1	-0.03789617	0.13006104	-0.0801083	1.0023614	-0.68498954	0.5760526
#> 2	1.40340087	1.89909129	1.5767421	1.5044341	1.38572474	1.7467402
#> 3	0.04619608	0.06025608	-0.1727694	-0.1603537	-0.09607106	-0.3927492
#> 4	0.01821627	-0.14845139	0.1732367	-0.8125931	-0.32982992	0.2576952
#> 5	-0.55594655	0.58605997	-0.2868340	-0.2760296	0.04270151	-1.0028636
#>	593	594	595	596	597	598
#> 1	0.44132310	0.1194174	0.4531873	0.1638653	0.59321997	-0.21059849
#> 2	1.45882776	1.4845304	1.5233950	1.5777387	1.29963694	1.48445969
#> 3	0.61813768	0.1002287	0.2942750	0.1941199	-0.14322248	0.06371485
#> 4	0.09696444	0.3070784	-0.5318341	0.8787738	-0.83291629	-1.35241480
#> 5	0.67856175	0.1359853	-0.3454087	0.2220714	-0.03934745	-0.47885565
#>	599	600	601	602	603	604
#> 1	-0.5656951	0.15742241	0.06300663	0.1084210	0.28973389	0.3740172
#> 2	1.5823443	-0.24354123	-0.19986019	-0.1975115	0.01489423	-0.1580870
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#>	605	606	607	608	609	610
#> 1	0.1760117	1.1130777	0.28562411	0.15268160	-0.1732629	0.47892041
#> 2	-0.2513529	-0.2392276	-0.03185414	-0.11779342	-0.2796918	-0.55803218
#> 3	0.2307637	0.8132690	0.36710420	0.42697062	0.3536543	0.46927534
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#> 5 -0.1585968 -0.7704702 0.33071645 0.04301411 0.1300726 -0.08880430
#>      611      612      613      614      615      616
#> 1 0.13539246 0.3986611 -0.02346974 -0.2061695 -0.08922817 -0.49059664
#> 2 -0.10676764 -0.5715339 -0.07543696 0.3928630 -0.24550061 -0.05202011
#> 3 0.13082606 -1.1284972 0.51060084 -1.0870190 0.05268219 0.76740112
#> 4 -0.49848413 -0.2099471 -0.53922053 0.5953518 0.19716902 -0.91917202
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#>      617      618      619      620      621      622
#> 1 0.5752269 0.42981817 -0.25922601 -0.6245834 0.622114813 -0.3307448
#> 2 -0.1874114 0.04295360 0.19820379 -0.1502433 -0.549928144 -0.3304632
#> 3 0.1969061 0.07251558 0.08034389 -0.1245708 0.126971711 -0.2086159
#> 4 0.0297619 -0.10048283 -0.41463397 -1.0193304 0.109662607 -0.3233167
#> 5 0.4073398 0.44156713 -0.27605558 0.4020587 -0.005316599 0.1157115
#>      623      624      625      626      627      628
#> 1 0.11154435 -0.25838114 -0.12855285 -0.6776227 -0.6347673 0.20544123
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#> 4 0.87841288 0.72336140 0.23651352 0.2538604 -0.4494797 -0.58803042
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#> 1 0.06179575 -0.01859085 0.65455953 1.11016857 -1.0078892 0.8033660
#> 2 0.07788059 -0.33295553 -0.21991411 -0.16095068 0.1365748 -0.2713199
#> 3 0.08911003 -0.85037935 -0.06270182 0.27418286 -0.6661079 0.1608581
#> 4 -0.03009723 -0.32441588 0.12786401 0.04749958 0.6751219 0.4743874
#> 5 -0.07512568 -0.38567111 -1.16128594 -0.59755354 0.7310797 -0.9844840
#>      635      636      637      638      639      640
#> 1 -0.02135316 0.07190710 -0.06205382 0.17443602 0.23456633 -0.4122220
#> 2 -0.11031296 -0.35805827 0.09684187 -0.24698414 0.14492497 -0.5332118
#> 3 0.43862396 0.03498444 -0.39340246 -0.02655699 -0.33905637 0.2323365
#> 4 -0.13130291 0.50155283 -0.56929412 -0.87236280 -0.27810451 0.1119182
#> 5 0.41999020 -0.09098791 0.54962477 0.36106413 0.06191631 0.6078878
#>      641      642      643      644      645      646
#> 1 -0.22983272 0.5253708 0.5732194 0.51949860 -0.1343351 0.004305671
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#> 1 -0.26284941 -0.64905216 0.63622848 0.06521180 0.44423387 -0.082239097
#> 2 -0.09845102 -0.09671321 -0.10082128 0.16571790 -0.02686991 -0.006628834
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#>      653      654      655      656      657      658
#> 1 0.08658630 0.3803976 -0.001111453 0.51104775 -0.2950923 -0.05458927
#> 2 -0.18802533 -0.1372751 -0.355722837 0.04991135 -0.5278061 -0.05520837
#> 3 -0.60245667 -0.2364558 -0.130244079 -0.12575581 -0.6055081 0.16586381
#> 4 0.44307761 -0.6273584 -0.901448861 0.03306812 -0.4019955 0.92256054
#> 5 -0.08439474 -0.3644118 -0.412044331 0.09246906 -0.1629141 0.44686772
#>      659      660      661      662      663      664
#> 1 0.8942686 0.5542121 -0.36853388 -0.15535432 -0.1371932 -0.32877702
#> 2 -0.4021425 -0.3750641 0.07549421 0.04004293 0.1354282 -0.12795306
#> 3 -0.1418927 -0.1147084 -0.11618652 0.82873853 0.2634256 -0.59762346

```



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#> 4 0.5161954 -0.7847251 -0.30146050 0.21637296 0.2284269 -0.77926696
#> 5 -0.4713316 -0.6561029 0.61990163 -1.04019476 0.3467328 0.03591614
#>      665      666      667      668      669      670
#> 1 0.33622974 -0.1338507 0.5014833 0.36111802 -0.30172664 -0.23181982
#> 2 0.17153444 -0.4175671 -0.3142672 -0.45618066 -0.36665408 -0.21684955
#> 3 0.04830504 0.1851324 0.4291430 0.22000322 0.47860513 -0.26035410
#> 4 1.14052675 0.4846370 -0.1690758 -0.03862069 0.06819288 0.21542127
#> 5 0.42100160 0.2867734 -0.7784346 -0.09889806 0.49350348 -0.07594976
#>      671      672      673      674      675      676
#> 1 0.03354542 -0.4590974 0.33198050 -0.42848163 0.009364633 0.24216430
#> 2 -0.32375570 -0.4983792 0.02875551 -0.08116334 -0.031971620 0.07921775
#> 3 -0.38003813 -0.2201886 0.10415155 -0.15669099 -0.152106165 -0.50670654
#> 4 0.39134700 0.5738671 0.26070481 -0.82890985 -0.072077944 0.59370354
#> 5 0.67929511 -0.4338478 -0.33151365 -0.41197514 0.769623165 0.05472683
#>      677      678      679      680      681      682
#> 1 0.7984521 -0.3284940 -0.28062864 0.1306584 0.15466945 0.38268024
#> 2 -0.3490365 -0.3251701 0.27136489 -0.1633882 -0.06302492 -0.05329993
#> 3 -0.3362317 -0.4766155 0.02891883 0.5596232 1.15832159 -0.61191569
#> 4 0.6765826 0.1825317 0.37296308 -0.7376649 0.26089873 0.42186943
#> 5 0.3012890 0.7508444 -0.22416765 -0.4072659 -1.03222949 -0.07940279
#>      683      684      685      686      687      688
#> 1 -0.70953363 -0.4557026 -0.83915949 0.31631873 0.1585112 -0.26911123
#> 2 0.22701621 -0.3278823 -0.04318309 0.00311837 -0.2906127 -0.85498161
#> 3 0.01208249 -0.2899810 0.04046239 -0.15078424 -0.6744526 -0.07572397
#> 4 -0.03434275 0.1634847 -0.64493879 -0.74514297 -0.4353818 -0.34638730
#> 5 0.19413499 0.7307339 -0.22611922 -0.79226821 0.2889934 0.18698111
#>      689      690      691      692      693      694
#> 1 -0.50591432 -0.4462911 -0.97752780 -0.2575835 -0.3271771 0.05612661
#> 2 -0.27227048 -0.2281551 -0.39516080 -0.2053871 -0.1392215 -0.28540239
#> 3 -0.06326605 0.5724286 0.54455423 0.2837370 -0.1943162 -0.29783826
#> 4 -0.34395673 -0.9761569 0.03993129 -0.2742084 0.5706896 -0.19469526
#> 5 0.42890073 0.4332662 0.01608457 -0.2130644 0.1635331 -0.25027053
#>      695      696      697      698      699      700
#> 1 0.6733992 0.0002056087 0.267800419 0.05555859 0.04877295 -0.3223088
#> 2 -0.1730843 0.0294384640 -0.123884412 -0.31594219 0.03361934 -0.2108541
#> 3 0.2713987 -0.5399034998 0.065266281 0.51749277 0.32716817 0.1513930
#> 4 -0.1197391 0.0067361028 0.005600253 -0.04509849 -0.25771697 -0.2835010
#> 5 0.5368062 -0.2537486916 0.552276515 -0.22604104 0.42105520 0.4906314
#>      701      702      703      704      705      706
#> 1 0.4129871 -0.01314213 -0.10365174 -0.48168897 0.30486693 -0.3444593
#> 2 -0.4827319 0.18918093 0.03341905 0.01082181 0.12054284 -0.4532698
#> 3 0.4963209 0.76032691 -0.38427786 0.23527791 0.49669584 0.5398775
#> 4 -0.2223465 0.04973261 -0.52996344 0.51948711 -0.41838555 0.1021773
#> 5 -0.2273532 -0.16957589 -0.22138575 0.41349025 -0.09280737 0.1083587
#>      707      708      709      710      711      712
#> 1 0.08621766 0.60690794 0.228148402 0.1563638 -0.06203594 -0.3337289
#> 2 -0.28624003 -0.36732892 -0.430867547 -0.1570977 0.19640961 -0.1102558
#> 3 -0.25690236 -0.03388069 0.009220486 -0.9959687 0.21231315 0.3383650
#> 4 0.85714697 0.91592657 -0.359961524 -0.5569998 0.59164232 -0.2497281
#> 5 0.28694176 0.15930315 0.070903311 0.1215268 -0.35766699 -0.5784690
#>      713      714      715      716      717      718
#> 1 0.3541947 -0.84861521 -0.07570572 -0.18270293 -0.3494227 0.81568490
#> 2 -0.2315952 -0.06044923 -0.48733508 -0.04815252 -0.2554630 -0.16659214

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#> 3 -0.2060332 -0.76121057 -0.10272078 0.55364598 -0.2407623 -0.02424838
#> 4 -0.5125655 -0.11754422 0.23133304 -0.66637257 1.0155255 0.06261742
#> 5 -0.7025240 -0.60054073 0.90051561 0.29434212 -0.8635087 -0.47232931
#>      719      720      721      722      723      724
#> 1 0.2067350 -0.2204792 -0.3645215 0.54339550 -0.02438388 -0.74684562
#> 2 -0.3116768 -0.2681751 -0.2746189 -0.06196019 -0.11677124 0.03848801
#> 3 0.1814499 0.1955472 -0.2408207 0.66006982 -0.77866199 0.02250287
#> 4 0.7775052 0.3550789 0.1279315 -0.77689323 -1.04618006 0.44140501
#> 5 -0.2968921 0.2611973 -0.3268921 -0.22133921 0.70215981 0.21855242
#>      725      726      727      728      729      730
#> 1 0.4080078 -0.1178629 0.59786457 0.2228159 0.5530162 0.35047523
#> 2 -0.3228195 -0.3745494 0.02705018 -0.2271431 -0.1287634 -0.02936578
#> 3 -0.1962567 -0.4131270 -0.08447310 0.2149648 -0.4798752 -0.22072817
#> 4 -0.5591195 -0.4542465 -0.19271824 -0.3017795 0.2674124 0.31365238
#> 5 0.1802506 0.4065379 -0.73631670 -0.2761799 0.8451155 -0.05151783
#>      731      732      733      734      735      736
#> 1 0.5947580 0.5720788 -0.17340199 0.2972158 0.81762118 -0.125557524
#> 2 -0.3978503 -0.3200450 -0.05286793 -0.3656345 -0.58610503 -0.044137990
#> 3 0.1729577 0.2670610 -0.04901479 0.1762720 -0.50631489 -0.456460145
#> 4 0.5694941 -0.6051393 0.48296560 0.1367838 0.03077847 -0.007713943
#> 5 0.2947579 0.4840861 -0.21907950 0.4896492 -0.14766780 -0.477305607
#>      737      738      739      740      741      742
#> 1 -0.06541808 -0.6739601 -0.39797641 -0.37182339 -0.006726624 0.28575981
#> 2 -0.18607571 -0.2375712 -0.12736731 -0.46191485 0.027784184 -0.04747412
#> 3 -0.15343681 -0.6252137 -0.09732202 0.45804671 -0.623980715 0.32073269
#> 4 0.54398726 0.1904630 0.32249249 0.02905303 0.212637723 0.96025255
#> 5 -0.96277624 -0.8617553 0.68924685 0.41320030 1.356709126 -0.41652852
#>      743      744      745      746      747      748
#> 1 0.12516315 0.21032997 0.3174486 -0.008784443 -0.31504920 -0.11162712
#> 2 0.04289637 -0.23270611 -0.2932020 -0.465098828 -0.16476901 0.04751925
#> 3 -0.16934209 -0.01666233 0.2651599 0.222833582 -0.26407980 0.23906497
#> 4 -0.79899490 -0.50471703 1.3767690 0.117057644 0.06932312 -0.11901909
#> 5 0.24108671 0.51036037 -0.2765438 0.002706145 0.96332355 0.46159625
#>      749      750      751      752      753      754
#> 1 0.2332486 0.5265214 -0.3724518 0.46877457 -0.1307506 0.09236585
#> 2 -0.2248141 -0.2036347 0.1960953 -0.54837525 -0.2473881 -0.05066223
#> 3 -0.6024641 0.6691749 -0.3395556 -0.73180588 -1.2037921 0.42479293
#> 4 -0.4684433 0.6562701 -0.3033275 -0.14854936 -0.1341095 0.29256362
#> 5 -0.6463786 0.5933169 0.1023518 0.03050769 0.3814090 -0.81279309
#>      755      756      757      758      759      760
#> 1 -0.4451516 0.4933583 -0.2006178 0.001203015 0.3541405 -0.2218614
#> 2 -0.4164422 -0.1542149 -0.3339746 -0.034104663 -0.1874015 -0.3866756
#> 3 -0.2356788 -0.1281876 0.3914288 0.393100581 -0.2637055 0.1950744
#> 4 0.5901337 -0.5655443 -0.1784834 -0.761625034 -0.9724554 0.5253020
#> 5 -0.4420449 0.1599468 -0.1354026 0.342603218 0.3341643 -0.2892934
#>      761      762      763      764      765
#> 1 0.513768508 0.234922291 -0.07653395 0.22845824 0.454991737
#> 2 -0.299778110 0.063595418 -0.56859454 -0.62147940 0.004776885
#> 3 0.377553207 -0.298925537 0.02919577 -0.02601529 -0.044630232
#> 4 -0.356317011 -0.436141660 -0.65882871 -0.22716375 0.476256201
#> 5 -0.008540054 0.008596552 -0.95516990 -0.40702503 0.113382237
#>      766      767      768      769      770      771
#> 1 0.45000240 0.2517663 0.09586127 -0.4857805 -0.2005510 0.74937155

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#> 2 -0.09423559 -0.5770387 0.06172349 -0.5340129 -0.4064014 -0.03070465
#> 3 0.13837141 0.1225086 0.14656546 -0.4429424 0.2268921 -0.36183517
#> 4 -0.72729075 0.3586778 -0.51605643 0.9327132 -0.4434924 -0.15380438
#> 5 0.03056814 0.4754055 -0.20351638 -1.1551389 0.3235668 -0.54346243
#>      772      773      774      775      776      777
#> 1 0.4215993 -0.4351841 0.06184419 -0.7665268 0.3133624 -0.07344836
#> 2 -0.0575740 -0.1368262 -0.23456369 -0.3483941 -0.2322941 -0.32992470
#> 3 -0.4756680 0.2038822 -0.08976838 0.5713548 -0.3065192 0.07950457
#> 4 -0.1385837 -0.1499774 -0.47236800 -0.4413517 0.8941945 0.42030247
#> 5 0.3774078 -0.7693286 -0.50140739 0.9144138 0.6384829 0.62102867
#>      778      779      780      781      782      783
#> 1 -1.35785742 0.47049262 -0.3945658 0.02442468 -0.1002507 0.22270588
#> 2 -0.08923046 -0.06949418 -0.1893364 0.01323172 -0.1257239 -0.06621611
#> 3 -0.04577351 -0.20227185 0.1387296 -0.39962358 0.2880411 0.77457722
#> 4 1.03669791 0.55172175 0.6497134 -0.27364456 -0.1824620 0.76456424
#> 5 -0.48171580 -0.61314909 0.2274666 0.10569767 -0.2445459 -0.25501468
#>      784      785      786      787      788      789
#> 1 0.7042630 0.490234406 -0.15417123 -0.75762194 0.3074839 0.2071115
#> 2 -0.1663351 0.008883771 -0.37782960 -0.23304770 -0.2719596 -0.2865668
#> 3 -0.6720685 -0.047216221 0.38381815 -0.02771919 -0.1227310 0.4079164
#> 4 0.4555658 1.286441873 -0.57616552 -0.30439396 0.3793404 -0.3283243
#> 5 -0.1227326 0.147460857 0.02023493 -0.54100895 -0.3797271 0.4623765
#>      790      791      792      793      794      795
#> 1 -0.2733179 -0.05351293 0.02433102 -0.74083224 -0.1922083 -0.71994345
#> 2 -0.2869630 -0.30074163 0.34236438 -0.13315825 -0.2173737 -0.01100633
#> 3 -0.1390884 -0.33186611 0.36589339 0.74787787 -0.6430866 0.47076524
#> 4 0.6420398 -0.69538227 -0.09802471 -0.13055521 -0.3152001 -0.79981358
#> 5 -0.2254843 0.16318828 1.08927704 0.02897985 -0.5597298 0.57930740
#>      796      797      798      799      800      801
#> 1 -0.45365766 0.8907950 0.74855687 0.03371556 0.09921554 -0.45109647
#> 2 0.01906554 -0.2008655 -0.14746600 -0.21788625 -0.08788291 -0.02340793
#> 3 -0.22640330 0.1936495 0.51157046 -0.15223191 -0.52869575 -0.45364493
#> 4 0.41791910 0.2002993 0.07564006 2.05008659 0.62022847 -0.19985602
#> 5 -0.64750285 -0.5271013 -0.64709692 -0.61529342 1.32356037 -0.65063803
#>      802      803      804      805      806      807
#> 1 0.4111672 -0.8917421 -0.6103059660 0.5224491 0.05469729 0.3078831
#> 2 -0.3617920 -0.3369655 -0.0004163018 -0.3481966 0.08451213 -0.2743448
#> 3 -0.5253524 -0.6844106 0.2537610718 0.2955570 -0.15957943 -0.8676122
#> 4 -0.3424444 0.3228096 -0.7275175805 0.2291355 0.06758725 0.6451111
#> 5 0.3909614 0.3193829 0.1483275993 0.6780569 0.35365083 0.4347624
#>      808      809      810      811      812      813
#> 1 -0.266918432 0.1041376 0.16863914 -0.3014495 0.14049588 0.09396182
#> 2 -0.006235752 -0.3073398 -0.29517762 -0.1699731 0.11239790 -0.23711809
#> 3 0.861854547 0.3966186 0.01299542 -0.6693434 0.05341637 0.05008262
#> 4 -0.109004327 -0.2094466 0.46214163 0.3230224 -0.63341419 0.33082261
#> 5 -0.707885211 -0.2492797 -0.60933866 -0.6147726 -0.41055354 0.96344416
#>      814      815      816      817      818      819
#> 1 0.1096432 -0.4163902 -0.2505782 -0.5575096 -0.26414160 -0.01259576
#> 2 -0.1097228 -0.2030742 -0.3288650 -0.1852719 -0.23018677 -0.12359768
#> 3 -0.4513159 0.1022995 -0.0378420 0.6608405 0.41456670 -0.46357879
#> 4 -0.7229289 0.3611662 -0.1270804 -0.6661614 0.02586141 0.39192265
#> 5 -0.3937098 0.8577566 0.1004714 -0.3038119 -0.52523473 0.18675303
#>      820      821      822      823      824      825

```

```

#> 1 0.5200306 0.2151472 -0.3970393 -0.39985749 -0.23881608 0.07371192
#> 2 -0.1747192 -0.1351410 -0.2638480 -0.27225394 0.05116985 0.09096116
#> 3 0.6455757 -0.4147033 0.3692643 -0.06125604 0.19955879 0.16512674
#> 4 0.1240226 0.1622295 1.0908823 0.66855409 0.38972035 0.93271854
#> 5 -0.3965698 0.6296208 1.4707146 0.21915314 0.41952260 -0.42288624
#>      826      827      828      829      830      831
#> 1 0.04900425 -0.3524713 0.5842493 0.1834240 -0.04719248 -0.17000278
#> 2 -0.11598551 -0.3045434 -0.3390843 -0.1282123 -0.48552754 -0.12691506
#> 3 0.06432228 -0.1295208 -0.2419796 -0.9588546 0.11115675 0.08547814
#> 4 0.07899116 0.1579410 0.4150498 -1.0704664 0.91448121 0.09486115
#> 5 -0.42453788 0.7214207 -0.1413752 -0.2881987 -0.74557360 0.18088705
#>      832      833      834      835      836
#> 1 -0.65894500 -0.56466718 -0.3485018 -1.090704e+00 -0.172510944
#> 2 -0.33314617 0.01347359 -0.2420884 -9.235255e-05 0.005421612
#> 3 -0.06260554 -1.04233690 -0.2577588 -6.106464e-01 -0.734421432
#> 4 0.11602729 0.84739293 -0.3700056 3.268897e-01 -0.138525345
#> 5 0.25874745 0.89140036 0.3135121 9.438072e-01 0.272753850
#>      837      838      839      840      841      842
#> 1 -0.50344286 0.173963327 -0.6587737 0.34992582 -0.72256677 0.2571665
#> 2 -0.30751212 -0.002357671 -0.4499222 -0.42660485 0.02551043 -0.2422559
#> 3 -0.20344324 0.795918142 -0.5308016 0.12468248 0.45117356 -0.2951465
#> 4 -0.00981995 0.779034550 0.7190849 0.43096984 0.20966815 0.5004006
#> 5 0.73366917 -0.113884053 0.0899397 0.05986544 -0.97521206 -0.1754214
#>      843      844      845      846      847      848
#> 1 0.09346708 0.07160959 0.8499797 -0.5802570 0.3431943 -0.009278270
#> 2 -0.08862137 -0.36622634 -0.3334672 0.1180505 -0.4192297 -0.088806143
#> 3 0.15239122 -0.31092460 -0.5426163 0.5492576 0.6249646 -0.159078365
#> 4 0.36153819 -0.26570646 0.1057673 -0.1006741 -0.4959904 -0.377359859
#> 5 0.91872219 0.87195693 -0.2411419 -0.3494477 0.2649281 0.004440631
#>      849      850      851      852      853      854
#> 1 0.10604588 -0.1296886 0.3681700 -0.364173785 -0.5725783 -1.3354532
#> 2 -0.09474761 -0.3313803 0.1729763 0.418483271 -0.1776955 -0.2526549
#> 3 -0.27348343 0.1440613 -0.6663592 0.001153207 -0.5404332 0.2750331
#> 4 0.87804096 -0.1878727 -0.8771883 -0.306840792 -0.6953335 0.7443467
#> 5 0.20405673 -0.1340099 0.0975335 -0.368706252 -0.1287611 -0.1637360
#>      855      856      857      858      859      860
#> 1 0.4123326 0.0414796 -0.16906910 -0.01491473 -1.00378447 -0.04998139
#> 2 -0.0950220 -0.0685519 0.06861395 -0.17488470 0.02532586 0.09229224
#> 3 0.1675265 -0.6450254 0.17713484 -0.33946009 0.12856302 -0.38430507
#> 4 -0.3688605 0.6582869 0.38580287 0.41718772 -0.47628109 -0.27980981
#> 5 -0.8380207 0.4129488 0.44232311 0.40022098 -0.26150181 0.02062770
#>      861      862      863      864      865      866
#> 1 -0.4856728 0.1485241 0.458043263 0.7053622 0.03493369 -0.21438216
#> 2 -0.4948565 -0.3579505 -0.002755344 -0.1000324 -0.27694398 0.03525046
#> 3 0.6540672 0.1924047 -0.479337138 -0.5146872 -0.01151449 0.45587345
#> 4 0.4005725 0.1125520 0.749127380 0.5008604 -1.12171793 -0.13910812
#> 5 0.3269846 0.1595729 -0.397572173 -0.1526729 0.14822439 0.45106430
#>      867      868      869      870      871      872
#> 1 -0.047476941 -0.20031435 0.50114540 0.5740923 -0.22552564 -0.31580737
#> 2 -0.469551107 -0.50779892 0.18616906 -0.4660202 -0.31027427 0.01066211
#> 3 -0.743102929 -0.15468317 -0.03367495 0.9872219 0.45737120 0.23738689
#> 4 0.626126029 0.03690793 0.25154960 -0.4590444 -0.21133195 -0.08048723
#> 5 -0.002646645 0.49606077 0.57912843 -0.3279213 -0.06347086 0.10657610

```

#>	873	874	875	876	877	878
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#> 2	0.03897649	-0.07038718	-0.49981753	-0.05106914	0.00593532	-0.06793132
#> 3	0.71198474	0.56918732	0.09208503	0.44455486	0.19931151	-0.86847439
#> 4	-0.14933172	0.56130413	0.43759367	0.38623448	-0.31086788	0.03958836
#> 5	0.08396222	-0.10027960	-0.69870864	0.26220646	-0.23118136	-0.11888422
#>	879	880	881	882	883	884
#> 1	-0.03916108	-0.24340776	0.1275876	-0.03109459	-0.88908739	-0.43325934
#> 2	-0.50894940	-0.60056105	-0.3980324	-0.48852242	-0.36060196	0.08706226
#> 3	-0.49344274	-0.14061453	-0.5064272	-0.85983119	0.06348581	0.68714568
#> 4	0.50869576	0.05321147	0.3743545	0.01603005	-0.35466407	-0.43002404
#> 5	-0.11856465	0.60490242	0.2621687	0.93575355	-0.47248850	-0.30728164
#>	885	886	887	888	889	890
#> 1	0.1781144	-0.31804395	-0.1196628	0.0880550	0.42565603	-0.6723057
#> 2	-0.3820139	-0.24347529	0.2183143	-0.2796119	-0.09181601	-0.5060207
#> 3	-0.4654928	0.77112306	0.1683189	-0.4127942	0.56369959	-0.5218526
#> 4	-0.9457595	-0.93313609	-0.2558327	-0.5417179	0.08436273	0.4808880
#> 5	0.8517023	0.08273771	1.0042434	0.0885867	0.09213116	-0.5962389
#>	891	892	893	894	895	896
#> 1	0.06789178	-0.22696478	0.744027380	0.69106431	-0.2637612	0.381376263
#> 2	-0.01713622	0.02855613	-0.178064042	-0.47779182	0.1970491	0.001879772
#> 3	-1.02496418	0.46801184	0.002665133	-0.03015913	-0.2283493	-0.719741068
#> 4	-0.12875828	-0.20817937	-0.153610314	-0.62350013	-0.1219857	-0.279500631
#> 5	0.26853205	0.34978480	-0.327500406	0.03355600	0.3653258	0.410897495
#>	897	898	899	900	901	902
#> 1	-0.37619353	-0.2031186	-0.5478383	0.4726148	-0.3754247	-5.155391e-02
#> 2	-0.06209988	-0.2198317	0.0168379	-0.1872877	-0.2748914	-1.419353e-02
#> 3	-0.56264208	-0.3372480	-0.2022357	-0.3067012	-0.2457104	-3.110955e-05
#> 4	-0.62100321	0.5662322	-0.2068409	-0.2812690	-0.6304459	-4.510271e-01
#> 5	-0.26048475	0.3369385	-0.2835646	0.2662173	0.1656694	-5.625799e-01
#>	903	904	905	906	907	908
#> 1	-0.03851762	0.2861844	0.09994693	0.7561816	0.37038189	-0.1628279
#> 2	-0.24999178	-0.2918445	-0.23570156	-0.0447524	-0.22483243	-0.4847065
#> 3	0.05673851	0.2596385	-0.70392270	-0.4696924	0.61339249	0.6594252
#> 4	0.18721121	-0.3038926	0.74872725	0.1813533	0.41095820	-0.3702743
#> 5	-0.17629906	0.2601820	-0.33994147	0.6029871	0.06686615	-0.4600238
#>	909	910	911	912	913	914
#> 1	0.02509931	0.31769778	-0.03081071	0.60022939	1.1128917	0.25682801
#> 2	-0.06466259	-0.13073557	-0.42866933	-0.22163836	0.1270801	-0.17090345
#> 3	0.32541359	-0.10079006	0.29543538	-0.21987654	0.1250082	0.75270456
#> 4	-0.75402286	-0.01253961	0.02543239	-0.14352242	-0.3332395	-0.07713992
#> 5	0.07674486	-0.05937173	-0.06063068	0.07313152	-0.6063177	0.40288928
#>	915	916	917	918	919	920
#> 1	-1.1786016	0.30585281	-0.5341049	-0.21403790	-0.1704831	0.62774319
#> 2	-0.1115031	-0.08149816	-0.3359158	-0.07038508	-0.2384565	-0.32314244
#> 3	0.7074596	-0.17590690	0.0802576	0.17475484	-0.5678667	0.04716792
#> 4	0.8058535	-0.41644672	-0.5578503	-1.07481441	-0.8587315	-0.94533494
#> 5	-0.4177336	-1.20729337	0.5518968	-0.56681981	-0.6768762	1.29260645
#>	921	922	923	924	925	926
#> 1	-0.47163998	-0.30749123	0.4424826	0.1382158	-0.11443615	-0.3122141
#> 2	-0.07543868	0.02842824	-0.5056501	-0.1758806	0.01263115	-0.5382058
#> 3	0.31148717	0.43810758	-0.5749079	-0.8501942	-0.25692849	-0.6410251
#> 4	0.64586869	-0.05930989	-0.5204091	0.3077301	0.84866841	0.6002481


```

#> 5 -0.29705678 -0.07918715 0.1045943 0.2617422 -0.11245711 -0.3913766
#>          927          928          929          930          931          932
#> 1 0.15490285 0.3196536 -0.52916218 0.72762371 -1.09595979 -0.3678020
#> 2 -0.21450302 -0.1805928 -0.23057575 -0.25167038 0.02780574 -0.1872114
#> 3 -0.18739461 -0.3107782 0.04012788 -0.31680954 0.17300297 -0.0520401
#> 4 -0.24689772 -0.4340414 0.37161248 -0.24449067 0.04591207 -0.7886644
#> 5 -0.09129663 -0.2262789 -0.31969481 -0.04873302 0.75130060 0.2023166
#>          933          934          935          936          937          938
#> 1 0.63446713 0.4533957 -0.26814048 -0.08416369 0.3413637 -0.8615525
#> 2 -0.09000613 -0.4790011 -0.16989772 -0.03780131 -0.2483854 0.1290663
#> 3 0.09858250 -0.4694131 0.29075234 1.18233416 -0.9281559 0.1878335
#> 4 -0.99205131 0.1237920 -0.07039423 -0.30220562 -1.1321238 -0.3420790
#> 5 0.47492060 -0.2740050 -0.48364044 -0.27242093 -0.2067417 -0.4443152
#>          939          940          941          942          943          944
#> 1 0.4133870 -0.4620677 -0.35859771 0.01334758 0.29335988 0.63161547
#> 2 -0.1515867 -0.2227046 -0.18011008 -0.21777023 0.05833538 -0.01546944
#> 3 0.3756093 -0.3275589 -0.04169907 -0.10426751 0.02307948 -0.64726853
#> 4 -0.1363565 0.2490209 0.37594614 0.53347223 0.04516103 0.34700871
#> 5 -0.2546335 0.3044130 -0.12947645 -0.12407927 -0.09461620 -0.75699534
#>          945          946          947          948          949          950
#> 1 -0.3800867 0.09885320 -0.093622348 0.003854825 -0.1396118 0.03402672
#> 2 -0.2760283 0.05793133 -0.009277419 -0.059871166 -0.2027654 -0.10656315
#> 3 -0.2012601 0.25553942 0.481620591 0.202698232 -0.7341243 0.02659537
#> 4 -1.1855156 -0.01559563 1.478496995 0.397452361 -0.1783053 0.38157813
#> 5 0.8431186 0.42213861 0.675260641 0.217742863 -1.1720931 0.24098797
#>          951          952          953          954          955          956
#> 1 -0.03034646 -0.57397316 0.9215768 -0.69966930 -0.07058964 0.45280810
#> 2 0.01540740 -0.27738068 -0.5602273 -0.24046236 -0.05131833 -0.52980757
#> 3 -0.44509599 -0.37879135 -0.6064055 -0.07824753 -0.05969545 -0.09979373
#> 4 0.21280192 0.06521681 -0.1359811 1.40677852 -0.29236799 0.51700095
#> 5 -1.03508576 0.32554203 0.1416670 -0.08920384 0.04040035 0.07331129
#>          957          958          959          960          961          962
#> 1 -0.04384551 -0.01564051 -0.72376803 -0.09521153 1.0024562 -0.5036704
#> 2 -0.26531408 -0.17102953 -0.03697572 -0.27363341 -0.2436483 -0.4599659
#> 3 -0.49050114 0.49180411 -0.16294076 0.16528762 0.1242479 -0.0992591
#> 4 0.19456702 -0.43833959 0.63591851 0.49578812 -0.8490087 0.2947275
#> 5 0.12233294 -0.02724637 -0.19582956 -0.20305918 0.3217269 0.2215923
#>          963          964          965          966          967          968
#> 1 0.2349761 -0.11241934 0.03553782 0.09828602 0.2023683 -0.1645724
#> 2 -0.3605081 -0.23856302 -0.46812316 0.28061348 -0.2555891 -0.4698696
#> 3 0.0709320 0.09120613 0.22284600 -0.36700155 0.7102059 1.0059299
#> 4 1.1604714 -0.06825133 -0.25154210 -0.75390696 -0.5109193 -0.3862390
#> 5 -0.2686498 -0.42701786 0.02817307 -0.86618936 -0.6044532 -0.4677948
#>          969          970          971          972          973          974
#> 1 0.2561624 -0.14280886 -0.5185232 0.0791083410 -0.33126645 -0.5315725
#> 2 -0.1698527 -0.03827192 -0.2622173 -0.2149532018 -0.05656158 -0.1150551
#> 3 -0.6969725 -0.11715858 -0.5977882 0.3234219632 0.16189157 0.4132262
#> 4 -0.2678973 0.34715472 -0.3537663 0.4710499099 0.44753342 0.1980659
#> 5 0.1105636 0.25064843 0.4946791 0.0004459663 0.82161055 -0.7150882
#>          975          976          977          978          979          980
#> 1 -0.3527262 0.7951192 0.23564777 0.17931517 -0.283587948 -0.003777557
#> 2 -0.3462707 -0.2572410 -0.34777541 0.08644216 -0.267365188 -0.431048754
#> 3 0.2868030 0.7390336 -0.48256893 -0.24314161 0.739674519 -0.775779960

```

```

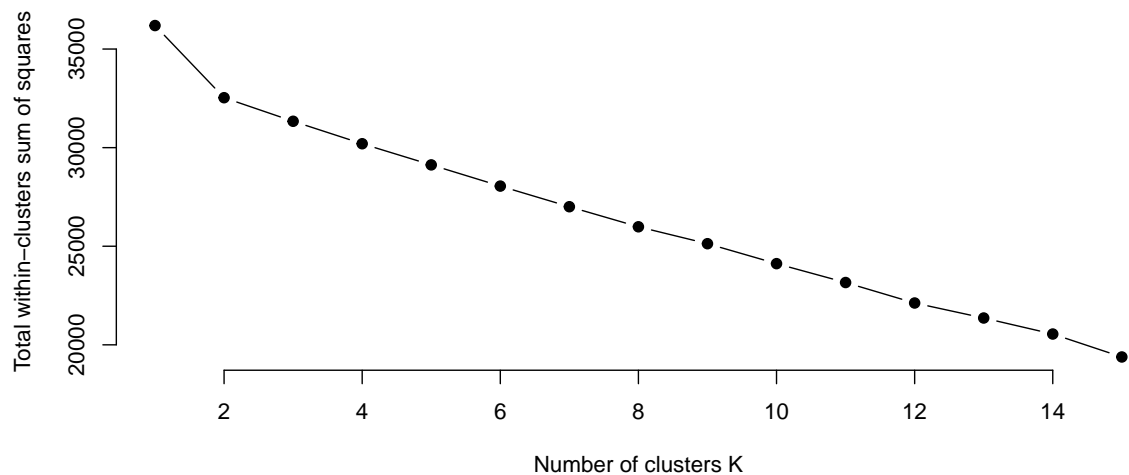
#> 4 -0.4238638 -0.2031635 0.48070025 -0.15223062 -0.946462621 -1.368237194
#> 5 -0.4296394 -0.3489732 -0.05367794 0.51948617 -0.004130759 0.967823724
#>      981      982      983      984      985      986
#> 1 -0.06653708 -0.14259783 -0.2503373 -0.937007985 -0.521694959 0.13818718
#> 2 -0.21156964 0.01731834 -0.3589901 -0.012474619 -0.003492390 -0.21470386
#> 3 0.08876853 0.22209263 -0.8812674 -0.148350368 -0.006195863 -0.61635954
#> 4 0.53148902 -0.91204050 -0.1061298 0.004624396 -0.439815478 0.08970725
#> 5 0.37461871 0.30936225 0.1321706 0.546442403 -0.235517708 -0.57543986
#>      987      988      989      990      991      992
#> 1 0.21774822 -0.79287679 0.45399780 -0.7645174 0.190300077 0.45946229
#> 2 -0.14167112 -0.05977998 -0.43172593 -0.1456071 -0.003537708 -0.26031019
#> 3 -0.86130092 0.27078203 0.06051313 0.3530737 0.384805662 0.13847014
#> 4 0.32870972 0.44429793 -0.32141041 -0.1635785 -0.045666626 -0.05267257
#> 5 0.01039599 -0.13231940 0.35084496 0.4139772 0.280944935 -0.63890435
#>      993      994      995      996      997      998
#> 1 -0.04070182 0.29539476 -0.2474200 -0.25967330 -0.3685144 -0.04007334
#> 2 -0.32712730 -0.03168406 -0.2362432 -0.33453575 -0.2623600 -0.30791152
#> 3 0.09225582 0.28371015 0.4251850 -0.34694729 -0.1582129 0.20518411
#> 4 0.62398628 1.63328452 0.1305629 0.07934175 0.6496092 -0.32123826
#> 5 0.01770253 -0.78682235 0.1379680 -0.58513481 -0.2231518 0.67548014
#>      999
#> 1 0.32975040
#> 2 -0.41400480
#> 3 -0.03068340
#> 4 -0.01658663
#> 5 -0.60957751
#>
#> Clustering vector:
#> X.0.9619334 X0.4418028 X.0.9750051 X1.417504 X0.8188148
#>      5      4      1      1      4
#> X0.3162937 X.0.02496682 X.0.063966 X0.03149702 X.0.3503106
#>      3      4      3      1      3
#> X.0.7227299 X.0.2819547 X1.337515 X0.7019798 X1.007616
#>      5      5      3      3      5
#> X.0.4653828 X0.6385951 X0.2867807 X.0.2270782 X.0.2200452
#>      1      4      3      1      1
#> X.1.242573 X.0.1085056 X.1.864262 X.0.5005122 X.1.325008
#>      2      2      2      2      2
#> X1.063411 X.0.2963712 X.0.1216457 X0.08516605 X0.6241764
#>      2      2      2      2      2
#> X.0.5095915 X.0.2167255 X.0.05550597 X.0.4844491 X.0.5215811
#>      2      2      2      2      2
#> X1.949135 X1.324335 X0.4681471 X1.0611 X1.65597
#>      2      2      2      2      2
#>
#> Within cluster sum of squares by cluster:
#> [1] 4896.690 13540.079 4857.595 2889.281 2934.875
#> (between_SS / total_SS = 19.5 %)
#>
#> Available components:
#>
#> [1] "cluster"      "centers"      "totss"        "withinss"
#> [5] "tot.withinss" "betweenss"    "size"         "iter"

```

```
#> [9] "ifault"
```

Elbow-Method

```
#Elbow Method for finding the optimal number of clusters
set.seed(42)
# Compute and plot wss for k = 2 to k = 15.
k.max <- 15
data <- scaled_data
wss <- sapply(1:k.max,
              function(k){kmeans(data, k, nstart=60, iter.max = 15 )$tot.withinss})
wss
#> [1] 36190.83 32531.95 31337.21 30197.84 29125.14 28050.54 27003.94
#> [8] 25985.95 25128.65 24116.89 23159.64 22120.76 21359.88 20547.72
#> [15] 19384.38
plot(1:k.max, wss,
     type="b", pch = 19, frame = FALSE,
     xlab="Number of clusters K",
     ylab="Total within-clusters sum of squares")
```



Kriterium: Beim Elbow-Kriterium werden die Fehlerquadratsummen in ein Diagramm abgetragen. Zeigt sich im Kurvenverlauf ein Knick („Ellbogen“), so kann dieser Wert als Entscheidungskriterium für die Clusteranzahl verwendet werden.

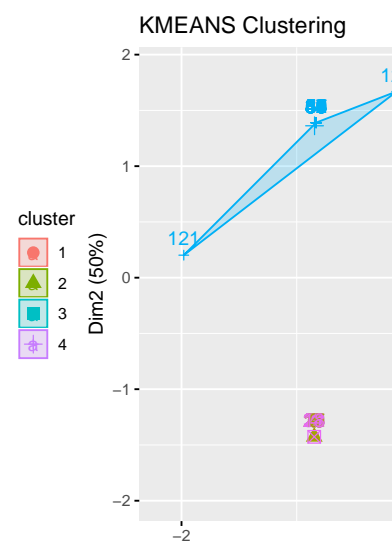
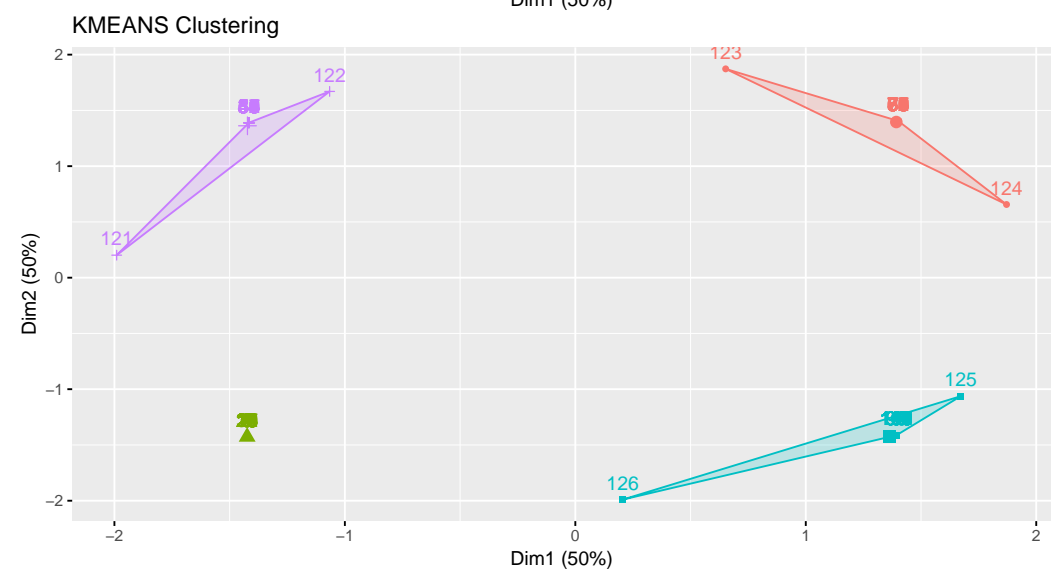
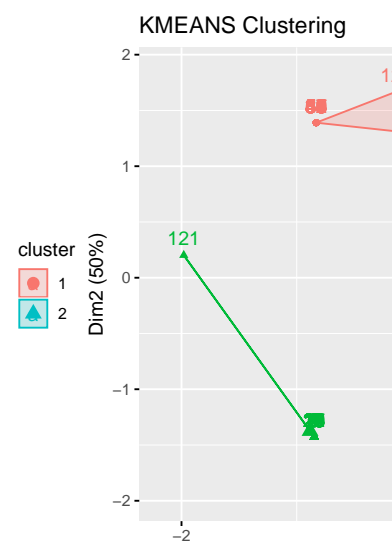
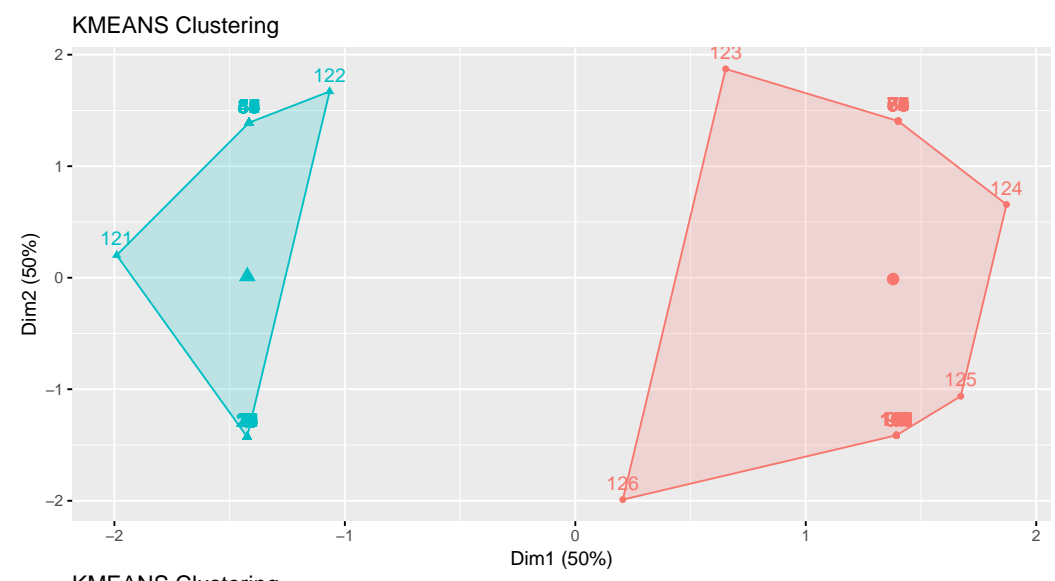
Optimale Anzahl der Cluster K=4.

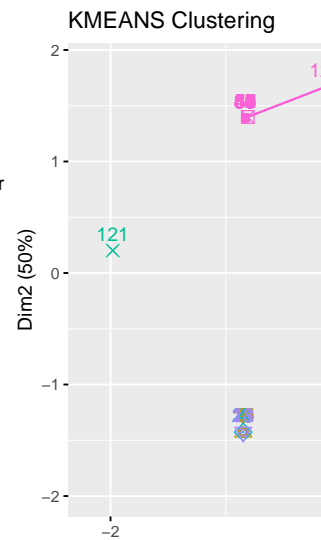
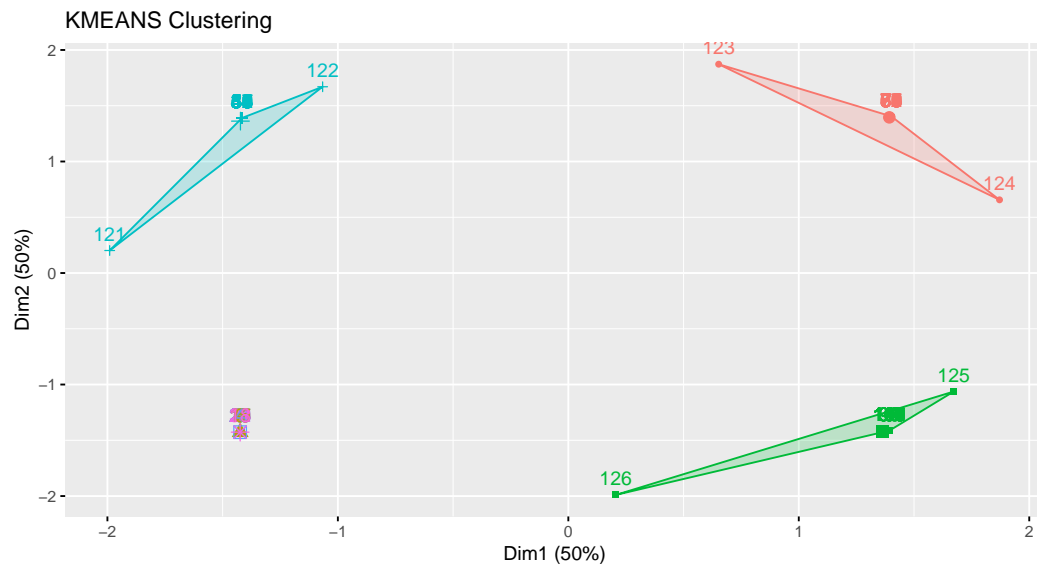
Aufgabe 2 a)

In diesem Aufgabenteil führen wir den Kmeans Algorithmus auf den clust Datensatz durch fuer die Werte $k=\{2, \dots, 7\}$ und visualisieren anschliessend die Cluster.

```
load("clust.RData")
packageTest("cluster")
packageTest("factoextra")
data <- clust
colnames(data) <- c("x1", "x2", "x3", "x4")
data <- scale(data)
for(i in 2:7) {
  par(mfrow=c(6,1))
```

```
eclust(data, "kmeans", k=i)
}
```





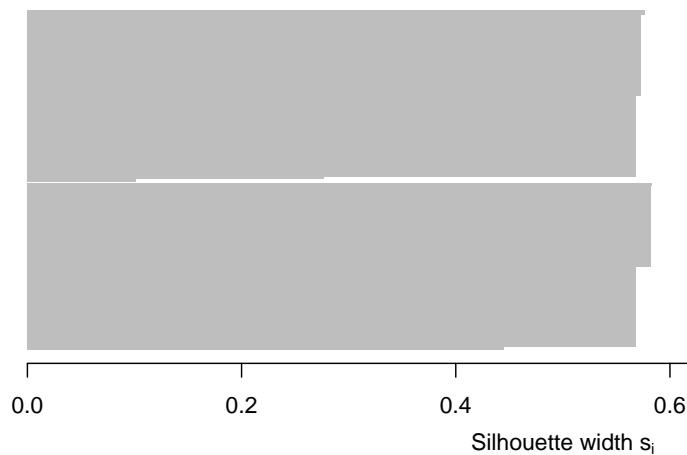
b)

Nun berechnen wir die Silhouetten sowie die Silhouetten-Koeffizienten fuer die Clusterungen aus a) und visualisieren anschliessend die Silhouetten inkl der Koeffizienten.

```
for(i in 2:7){
  km.res <- eclust(data, "kmeans", k=i, graph=FALSE)
  sil <- silhouette(km.res$cluster, dist(data))
  plot(sil, main=sprintf("Silhouette (k=%d)",i))
}
```

Silhouette (k=2)

n = 126



Average silhouette width : 0.57

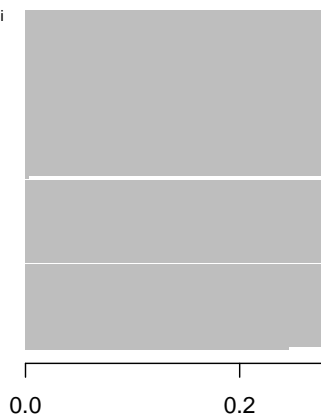
Silhouette (k=3)

n = 126

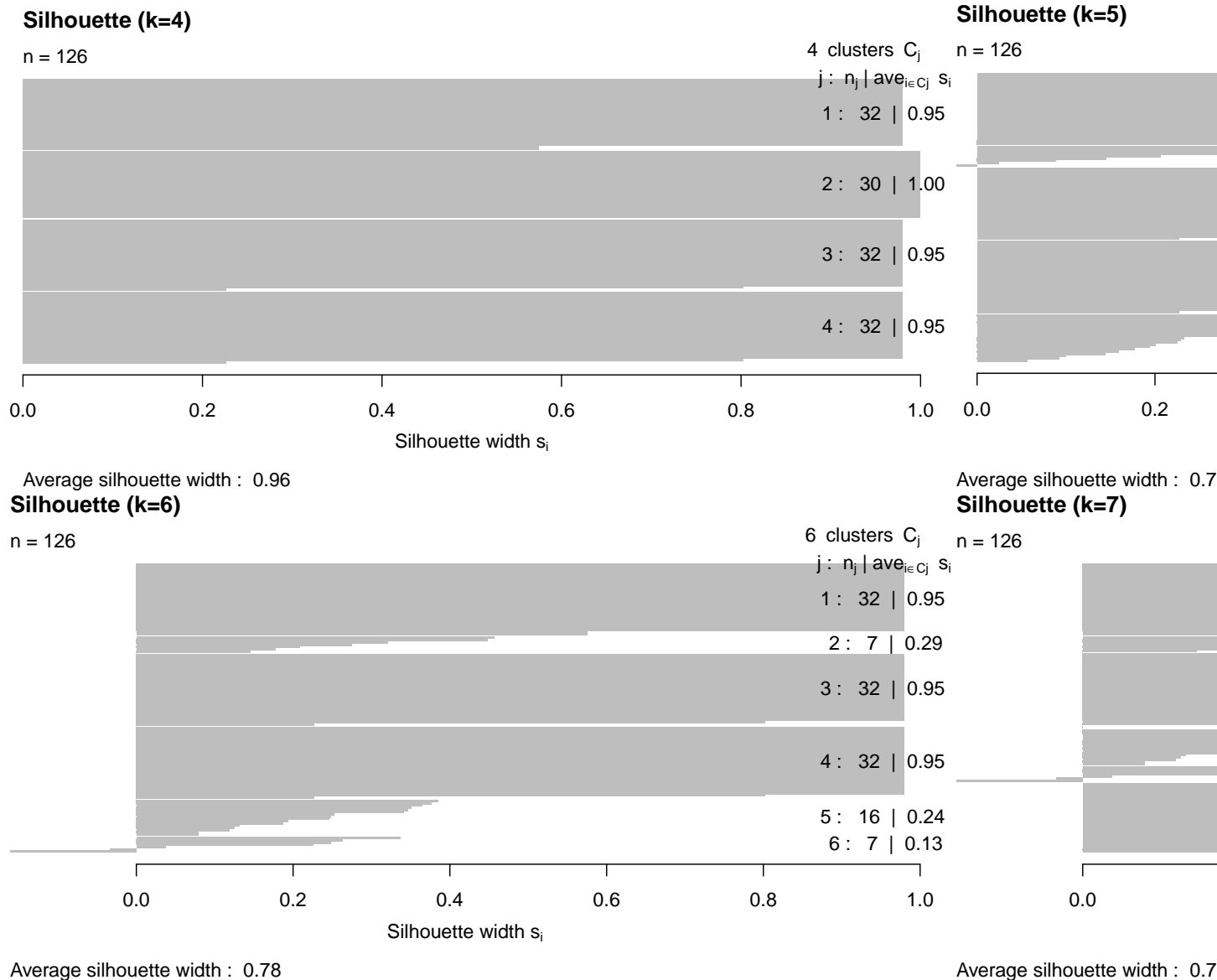
2 clusters C_j
 $j : n_j \mid \text{ave}_{i \in C_j} s_i$

1 : 64 | 0.56

2 : 62 | 0.57



Average silhouette width : 0.57



c)

Die Silhouette eines Datenpunktes entspricht einem Gütekriterium der Cluster. Sie gibt an, wie ähnlich bzw. unähnlich ein Datenpunkt zu seinen Nachbarn im Mittel ist. Dabei werden die Vergleiche zwischen dem Datenpunkt und den Nachbarn innerhalb des eigenen Clusters gemacht sowie zwischen dem Datenpunkt und den Nachbarn des nächsten Nachbar-Clusters.

Die Silhouette kann Werte aus dem Intervall $[-1,1]$ annehmen.

1 bedeutet dabei, dass der Datenpunkt im Mittel relativ zentral innerhalb des eigenen Clusters liegt und somit weiter entfernt zu den Nachbarclustern ist. Diese Eigenschaft entspricht einem guten Clustering.

-1 bedeutet, dass der Datenpunkt im Mittel näher zum Nachbar-Cluster liegt als zum eigenen Cluster.

0 wird einem Datenpunkt zugeordnet, wenn ein Cluster ausschließlich diesen Datenpunkt enthält.

maximieren wir den Wert der Silhouette, so erhalten wir den Silhouetten-Koeffizienten.

Vergleichen wir die Modelle mit unterschiedlicher Anzahl an Clustern, so wählen wir das Modell mit $k=4$, da dieses die höchste Silhouette besitzt sowie die niedrigste Komplexität. Alle Cluster sind ähnlich gefüllt.

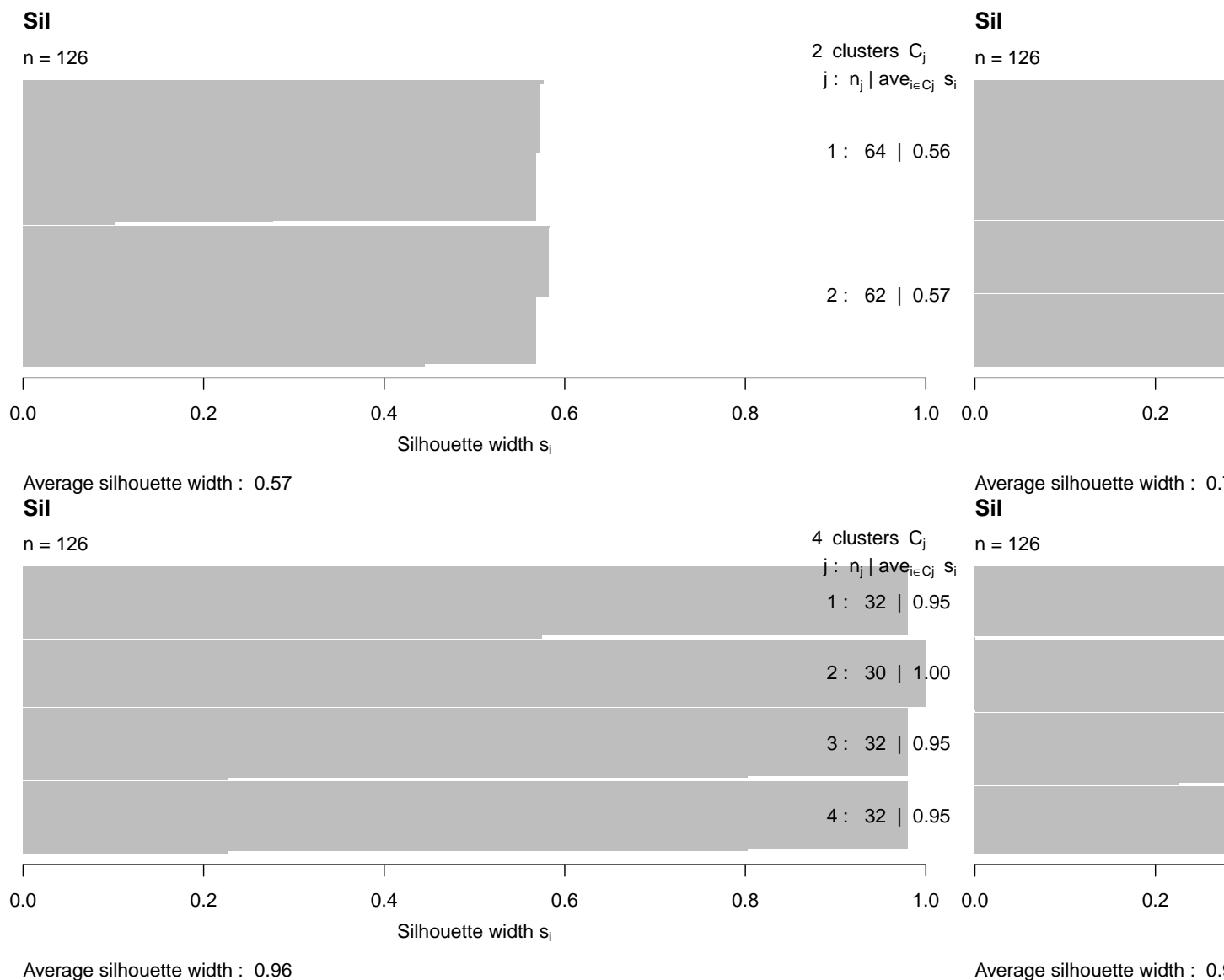
Erhöhen wir die Anzahl der Cluster, so bleibt der Wert der Silhouette gleich, jedoch erhalten wir Silhouetten

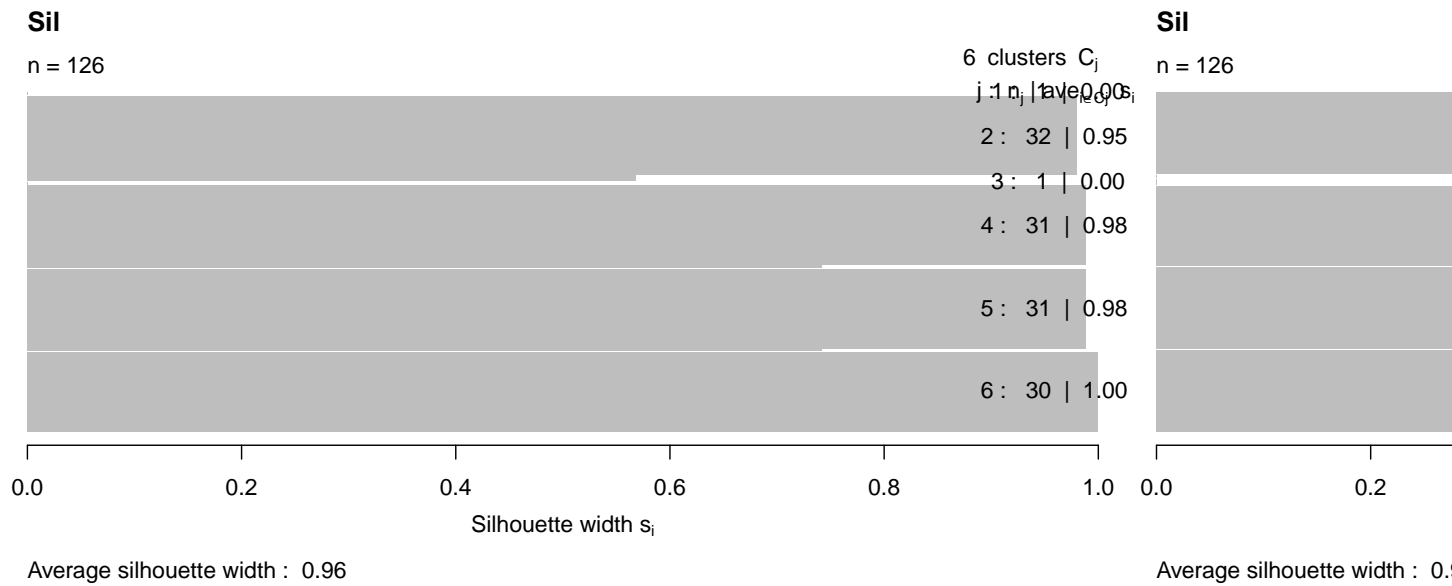
Werte gleich 0, diese entsprechen einem Cluster von einem Datenpunkt.

d)

Da das Ergebnis des K-Means-Verfahrens sehr stark von dem Initialzustand abhaengt, wiederholen wir im Folgenden den Algorithmus und setzen dabei fuer jeden Wert $k \in \{2, \dots, 7\}$ zufaellig einen Startzustand. Diese Option wird mit dem parameter *nstart* erreicht, den wir z.B. auf 25 setzen, so dass der Algorithmus 25 Mal durchlauft mit jeweils zufaelligem Startzustand. Im default betraegt dieser Parameterwert 1.

```
for(i in 2:7) {
  km.res <- eclust(data, "kmeans", k=i, graph=FALSE, nstart=25)
  sil <- silhouette(km.res$cluster, dist(data))
  plot(sil, main="Sil")
}
```





In unserem Fall erkennen keine signifikanten Unterschiede zu unserer Beobachtung auf Aufgabenteil b).