**k-median**

cost

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Lloyd | DP |
| dataAlea2\_50\_ex1 | 2058.093 | 1773.838 | 1704.62 |
| dataAlea2\_50\_ex2 | 2021.817 | 2117.542 | 1954.52 |
| dataAlea2\_50\_ex3 | 3096.82 | 2403.684 | 2351.41 |
| dataAlea2\_100\_ex1 | 5824.758 | 6446.903 | 5718.7 |
| dataAlea2\_100\_ex2 | 3003.123 | 2442.001 | 2377.62 |
| dataAlea2\_100\_ex3 | 6972.896 | 6642.886 | 6515.32 |
| dataAlea2\_500\_ex1 | 15131.000 | 17382.402 |  |
| dataAlea2\_500\_ex2 | 26712.050 | 30616.412 |  |
| dataAlea2\_500\_ex3 | 20900.870 | 24173.468 |  |
| .dataAlea2\_800\_ex1 | 48409.97 | 49581.405 |  |
| dataAlea2\_800\_ex2 | 43972.41 | 47279.519 |  |
| dataAlea2\_800\_ex3 | 15418.06 | 16067.962 |  |
| dataAlea2\_1000\_ex1 | 54125.86 | 55055.569 |  |
| dataAlea2\_1000\_ex2 | 32636.25 | 42775.379 |  |
| dataAlea2\_1000\_ex3 | 35194.71 | 42275.361 |  |

time

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Lloyd | DP |
| dataAlea2\_50\_ex1 | 0.05s | 0.00151s | 1.591s |
| dataAlea2\_50\_ex2 | 0.05s | 0.000914s | 1.872s |
| dataAlea2\_50\_ex3 | 0.05s | 0.00278 | 2.427s |
| dataAlea2\_100\_ex1 | 0,25 sec | 0.00406 | 8.334 Sec |
| dataAlea2\_100\_ex2 | 0.24 sec | 0.00187 | 8.028 Sec |
| dataAlea2\_100\_ex3 | 0,26 sec | 0.00360 | 7.886 Sec |
| dataAlea2\_500\_ex1 | 49,76 sec | 0.0451 |  |
| dataAlea2\_500\_ex2 | 72,64 sec. | 0.0250 |  |
| dataAlea2\_500\_ex3 | 59,90 sec | 0.0252 |  |
| dataAlea2\_800\_ex1 | 397,11 sec. | 0.0603 |  |
| dataAlea2\_800\_ex2 | 381,77 sec | 0.0484 |  |
| dataAlea2\_800\_ex3 | 357,58 sec | 0.0232 |  |
| dataAlea2\_1000\_ex1 | 764,97 sec | 0.0648 |  |
| dataAlea2\_1000\_ex2 | 392,97 sec | 0.0723 |  |
| dataAlea2\_1000\_ex3 | 770,65 sec | 0.0416 |  |

cost

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Lloyd | DP |
| dataConvex\_3\_10\_2\_10\_ex1 | 1.225714 | 1.2257136 | 1.22571 |
| dataConvex\_3\_10\_2\_10\_ex2 | 2.026535 | 2.0265349 | 1.98655 |
| dataConvex\_3\_10\_2\_10\_ex3 | 3.219636 | 3.0694910 | 3.07206 |
| dataConvex\_3\_10\_2\_10\_ex4 | 3.06849 | 2.92485976 | 2.31282 |
| dataConvex\_3\_10\_2\_50\_ex1 | 24.53523 | 22.3258710 | 21.4712 |
| dataConvex\_3\_10\_2\_50\_ex2 | 22.48331 | 22.1634272 | 19.4666 |
| dataConvex\_3\_10\_2\_50\_ex3 | 20.54524 | 17.5826658 | 17.5209 |
| dataConvex\_3\_10\_2\_50\_ex4 | 20.62211 | 17.6912253 | 17.5610 |
| dataConvex\_3\_10\_2\_100\_ex1 | 43.99194 | 41.2834802 | 40.9474 |
| dataConvex\_3\_10\_2\_100\_ex2 | 44.44086 | 42.9955266 | 41.3502 |
| dataConvex\_3\_10\_2\_100\_ex3 | 43.21486 | 41.1860666 | 40.1709 |
| dataConvex\_3\_10\_2\_100\_ex4 | 43.58614 | 42.1334181 | 40.4968 |
| dataConvex\_3\_10\_2\_500\_ex1 | 220.7355 | 218.840070 |  |
| dataConvex\_3\_10\_2\_500\_ex2. | 213.1041 | 210.7200536 |  |
| dataConvex\_3\_10\_2\_500\_ex3. | 214.3776 | 212.4064234 |  |
| dataConvex\_3\_10\_2\_500\_ex4 | 215.9493 | 213.3439748 |  |

time

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Lloyd | DP |
| dataConvex\_3\_10\_2\_10\_ex1 | 0,01 sec | 0.000843 | 2.634 Sec |
| dataConvex\_3\_10\_2\_10\_ex2 | 0.01 sec | 0.000864 | 1.709 Sec |
| dataConvex\_3\_10\_2\_10\_ex3 | 0.01 sec | 0.001361 | 1.011 Sec |
| dataConvex\_3\_10\_2\_10\_ex4 | 0.01 sec | 0.000658 | 1.48 Sec |
| dataConvex\_3\_10\_2\_50\_ex1 | 0,05 sec | 0.003533 | 1.542 Sec |
| dataConvex\_3\_10\_2\_50\_ex2 | 0.06 sec | 0.002842 | 1.325 Sec |
| dataConvex\_3\_10\_2\_50\_ex3 | 0,05 sec | 0.003246 | 1.151 Sec |
| dataConvex\_3\_10\_2\_50\_ex4 | 0,05 sec | 0.003505 | 1.973 Sec |
| dataConvex\_3\_10\_2\_100\_ex1 | 0,28 sec | 0.013531 | 8.027 Sec |
| dataConvex\_3\_10\_2\_100\_ex2 | 0,29 sec | 0.005231 | 8.396 Sec |
| dataConvex\_3\_10\_2\_100\_ex3 | 0,31 sec. | 0.014229 | 7.668 Sec |
| dataConvex\_3\_10\_2\_100\_ex4 | 0,31 sec | 0.007851 | 8.033 Sec |
| dataConvex\_3\_10\_2\_500\_ex1 | 98,74 sec | 0.054555 |  |
| dataConvex\_3\_10\_2\_500\_ex2. | 92,00 sec | 0.084102 |  |
| dataConvex\_3\_10\_2\_500\_ex3. | 125,59 sec | 0.323036 |  |
| dataConvex\_3\_10\_2\_500\_ex4 | 119,21 sec | 0.067142 |  |

Cost –quality

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex-q（%） | Lloyd-q(%) | DP-q(%) |
| dataAlea2\_50\_ex1 | 20.7361758 | 4.06061175 | 0 |
| dataAlea2\_50\_ex2 | 3.443147167 | 8.34076909 | 0 |
| dataAlea2\_50\_ex3 | 31.70055414 | 2.22309168 | 0 |
| dataAlea2\_100\_ex1 | 1.854582335 | 12.7337157 | 0 |
| dataAlea2\_100\_ex2 | 26.3079466 | 2.70779183 | 0 |
| dataAlea2\_100\_ex3 | 7.023077915 | 1.95793913 | 0 |
| dataConvex\_3\_10\_2\_10\_ex1 | 0.000326341 | 0.00029371 | 0 |
| dataConvex\_3\_10\_2\_10\_ex2 | 2.012785986 | 2.01278095 | 0 |
| dataConvex\_3\_10\_2\_10\_ex3 | 4.891527618 | 0 | 0 |
| dataConvex\_3\_10\_2\_10\_ex4 | 32.67310037 | 26.4629223 | 0 |
| dataConvex\_3\_10\_2\_50\_ex1 | 14.27041805 | 3.98054603 | 0 |
| dataConvex\_3\_10\_2\_50\_ex2 | 15.49685102 | 13.8536118 | 0 |
| dataConvex\_3\_10\_2\_50\_ex3 | 17.2613279 | 0.35252641 | 0 |
| dataConvex\_3\_10\_2\_50\_ex4 | 17.43129662 | 0.74155971 | 0 |
| dataConvex\_3\_10\_2\_100\_ex1 | 7.435246194 | 0.82076078 | 0 |
| dataConvex\_3\_10\_2\_100\_ex2 | 7.474353207 | 3.97900518 | 0 |
| dataConvex\_3\_10\_2\_100\_ex3 | 7.577525024 | 2.52711938 | 0 |
| dataConvex\_3\_10\_2\_100\_ex4 | 7.628602754 | 4.04135166 | 0 |

|  |  |  |  |
| --- | --- | --- | --- |
| N | Cplex | Lloyd | DP |
| 10 | 0.01 | 0.0008 | 1.5 |
| 50 | 0.05 | 0.0035 | 1.5 |
| 100 | 0.3 | 0.01 | 8 |
| 500 | 100 | 0.03 |  |
| 800 | 370 | 0.06 |  |
| 1000 | 750 | 0.07 |  |

**kmdoids**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Lloyd | DP |
| dataAlea2\_50\_ex1 | 233207.2 | 265975.0147 | 265975 |
| dataAlea2\_50\_ex2 | 270378.0 | 270215.5484 | 256317 |
| dataAlea2\_50\_ex3 | 187504.5 | 199292.1990 | 199292 |
| dataAlea2\_100\_ex1 | 894084.8 | 850628.3129 | 850628 |
| dataAlea2\_100\_ex2 | 553763.9 | 166976.2016 | 166976 |
| dataAlea2\_100\_ex3 | 1051562 | 757190.92736 | 757191 |
| dataConvex\_3\_10\_2\_10\_ex1 | 0.378898 | 0.641745682 | 0.378898 |
| dataConvex\_3\_10\_2\_10\_ex2 | 0.9331854 | 0.883482452 | 0.905099 |
| dataConvex\_3\_10\_2\_10\_ex3 | 2.167675 | 2.031436880 | 2.11595 |
| dataConvex\_3\_10\_2\_10\_ex4 | 1.899827 | 1.398858661 | 1.39886 |
| dataConvex\_3\_10\_2\_50\_ex1 | 23.65862 | 18.61567128 | 13.0637 |
| dataConvex\_3\_10\_2\_50\_ex2 | 19.29901 | 12.862915178 | 12.86291 |
| dataConvex\_3\_10\_2\_50\_ex3 | 15.41585 | 11.181713638 | 9.6588 |
| dataConvex\_3\_10\_2\_50\_ex4 | 19.65059 | 16.797720125 | 9.66223 |
| dataConvex\_3\_10\_2\_100\_ex1 | 37.55434 | 30.440187290 | 23.2781 |
| dataConvex\_3\_10\_2\_100\_ex2 | 37.1074 | 24.330926521 | 24.3309 |
| dataConvex\_3\_10\_2\_100\_ex3 | 35.16401 | 28.057913375 | 23.0744 |
| dataConvex\_3\_10\_2\_100\_ex4 | 36.5449 | 25.533839482 | 23.5052 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| k-medoids | Cplex | Lloyd | DP | min | Cplex-q | Lloyd-q | DP-q |
| dataAlea2\_50\_ex1 | 233207.2 | 265975.0147 | 265975 | 233207.2 | 0 | 14.0509447 | 14.05094 |
| dataAlea2\_50\_ex2 | 270378 | 270215.5484 | 256317 | 256317 | 5.48578518 | 5.42240601 | 0 |
| dataAlea2\_50\_ex3 | 187504.5 | 199292.199 | 199292 | 187504.5 | 0 | 6.28662192 | 6.286516 |
| dataAlea2\_100\_ex1 | 894084.8 | 850628.3129 | 850628 | 850628 | 5.108790211 | 3.6785E-05 | 0 |
| dataAlea2\_100\_ex2 | 553763.9 | 166976.2016 | 166976 | 166976 | 231.6428109 | 0.00012074 | 0 |
| dataAlea2\_100\_ex3 | 1051562 | 757190.9274 | 757191 | 757190.9 | 38.87673003 | 0 | 0 |
| dataConvex\_3\_10\_2\_10\_ex1 | 0.378898 | 0.641745682 | 0.378898 | 0.378898 | 0 | 69.3716203 | 0 |
| dataConvex\_3\_10\_2\_10\_ex2 | 0.9331854 | 0.883482452 | 0.905099 | 0.883482 | 5.625799119 | 0 | 2.446743 |
| dataConvex\_3\_10\_2\_10\_ex3 | 2.167675 | 2.03143688 | 2.11595 | 2.031437 | 6.706490433 | 0 | 4.160263 |
| dataConvex\_3\_10\_2\_10\_ex4 | 1.899827 | 1.398858661 | 1.39886 | 1.398859 | 35.81264877 | 0 | 0 |
| dataConvex\_3\_10\_2\_50\_ex1 | 23.65862 | 18.61567128 | 13.0637 | 13.0637 | 81.10198489 | 42.4992252 | 0 |
| dataConvex\_3\_10\_2\_50\_ex2 | 19.29901 | 12.86291518 | 12.86291 | 12.86291 | 50.03611158 | 4.0255E-05 | 0 |
| dataConvex\_3\_10\_2\_50\_ex3 | 15.41585 | 11.18171364 | 9.6588 | 9.6588 | 59.60419514 | 15.7671102 | 0 |
| dataConvex\_3\_10\_2\_50\_ex4 | 19.65059 | 16.79772013 | 9.66223 | 9.66223 | 103.3753078 | 73.8493094 | 0 |
| dataConvex\_3\_10\_2\_100\_ex1 | 37.55434 | 30.44018729 | 23.2781 | 23.2781 | 61.32906036 | 30.7674909 | 0 |
| dataConvex\_3\_10\_2\_100\_ex2 | 37.1074 | 24.33092652 | 24.3309 | 24.3309 | 52.51141553 | 0.000109 | 0 |
| dataConvex\_3\_10\_2\_100\_ex3 | 35.16401 | 28.05791338 | 23.0744 | 23.0744 | 52.39403841 | 21.597586 | 0 |
| dataConvex\_3\_10\_2\_100\_ex4 | 36.5449 | 25.53383948 | 23.5052 | 23.5052 | 55.47580961 | 8.63059868 | 0 |

Quality

|  |  |  |  |
| --- | --- | --- | --- |
| k-medoids | Cplex-q | Lloyd-q | DP-q |
| dataAlea2\_50\_ex1 | 0 | 14.0509447 | 14.05094 |
| dataAlea2\_50\_ex2 | 5.48578518 | 5.42240601 | 0 |
| dataAlea2\_50\_ex3 | 0 | 6.28662192 | 6.286516 |
| dataAlea2\_100\_ex1 | 5.108790211 | 3.6785E-05 | 0 |
| dataAlea2\_100\_ex2 | 231.6428109 | 0.00012074 | 0 |
| dataAlea2\_100\_ex3 | 38.87673003 | 0 | 0 |
| dataConvex\_3\_10\_2\_10\_ex1 | 0 | 69.3716203 | 0 |
| dataConvex\_3\_10\_2\_10\_ex2 | 5.625799119 | 0 | 2.446743 |
| dataConvex\_3\_10\_2\_10\_ex3 | 6.706490433 | 0 | 4.160263 |
| dataConvex\_3\_10\_2\_10\_ex4 | 35.81264877 | 0 | 0 |
| dataConvex\_3\_10\_2\_50\_ex1 | 81.10198489 | 42.4992252 | 0 |
| dataConvex\_3\_10\_2\_50\_ex2 | 50.03611158 | 4.0255E-05 | 0 |
| dataConvex\_3\_10\_2\_50\_ex3 | 59.60419514 | 15.7671102 | 0 |
| dataConvex\_3\_10\_2\_50\_ex4 | 103.3753078 | 73.8493094 | 0 |
| dataConvex\_3\_10\_2\_100\_ex1 | 61.32906036 | 30.7674909 | 0 |
| dataConvex\_3\_10\_2\_100\_ex2 | 52.51141553 | 0.000109 | 0 |
| dataConvex\_3\_10\_2\_100\_ex3 | 52.39403841 | 21.597586 | 0 |
| dataConvex\_3\_10\_2\_100\_ex4 | 55.47580961 | 8.63059868 | 0 |

time

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Lloyd | DP |
| dataAlea2\_50\_ex1 | 0,06 sec | 0.0065549 | 1.705 Sec |
| dataAlea2\_50\_ex2 | 0,05 sec | 0.0019379 | 1.66 Sec |
| dataAlea2\_50\_ex3 | 0,05 sec | 0.0039140 | 1.705 Sec |
| dataAlea2\_100\_ex1 | 0,25 sec | 0.0104080 | 14.751 Sec |
| dataAlea2\_100\_ex2 | 0,25 sec | 0.0057090 | 14.89 Sec |
| dataAlea2\_100\_ex3 | 0,23 sec | 0.0039949 | 15.353 Sec |
| dataConvex\_3\_10\_2\_10\_ex1 | 0,01 sec | 0.0005862 | 1.436 |
| dataConvex\_3\_10\_2\_10\_ex2 | 0.00 | 0.00056568 | 1.532 |
| dataConvex\_3\_10\_2\_10\_ex3 | 0.00 | 0.00067345 | 1.717 |
| dataConvex\_3\_10\_2\_10\_ex4 | 0.01 | 0.00179101 | 1.357 |
| dataConvex\_3\_10\_2\_50\_ex1 | 0.06 | 0.00205786 | 3.604 |
| dataConvex\_3\_10\_2\_50\_ex2 | 0.05 | 0.00492340 | 2.393 |
| dataConvex\_3\_10\_2\_50\_ex3 | 0.06 | 0.00333372 | 2.284 |
| dataConvex\_3\_10\_2\_50\_ex4 | 0.06 | 0.00245183 | 2.135 |
| dataConvex\_3\_10\_2\_100\_ex1 | 0.30 | 0.00779526 | 17.336 |
| dataConvex\_3\_10\_2\_100\_ex2 | 0.29 | 0.01447455 | 18.334 |
| dataConvex\_3\_10\_2\_100\_ex3 | 0.29 | 0.0095183809 | 17.811 |
| dataConvex\_3\_10\_2\_100\_ex4 | 0.29 | 0.0065462550 | 19.56 |

|  |  |  |  |
| --- | --- | --- | --- |
| N | Cplex | Lloyd | DP |
| 10 | 0.01 | 0.0006 | 1.7 |
| 50 | 0.06 | 0.004 | 2.5 |
| 100 | 0.3 | 0.009 | 16 |

**discrete k-center**

|  |  |  |
| --- | --- | --- |
|  | cplex | DP |
| dataAlea2\_50\_ex1 | 436.3841 | 421.085 |
| dataAlea2\_50\_ex2 | 440.925 | 378.452 |
| dataAlea2\_50\_ex3 | 463.8659 | 416.044 |
| dataAlea2\_100\_ex1 | 493.4239 | 451.817 |
| dataAlea2\_100\_ex2 | 477.7782 | 323.907 |
| dataAlea2\_100\_ex3 | 594.3583 | 456.476 |

|  |  |  |
| --- | --- | --- |
|  | Cplex | DP |
| dataAlea2\_50\_ex1 | 1,03 sec | 1.331 Sec |
| dataAlea2\_50\_ex2 | 1,75 sec | 1.769 Sec |
| dataAlea2\_50\_ex3 | 2,49 sec | 1.767 Sec |
| dataAlea2\_100\_ex1 | 238,95 sec | 2.03 Sec |
| dataAlea2\_100\_ex2 | 19,84 sec | 1.576 Sec |
| dataAlea2\_100\_ex3 | 170,62 sec | 1.419 Sec |

**continuous k-center**

cost

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Cplex-Pareto | DP |
| dataAlea2\_50\_ex1 | 408.3283 | 398.0015 | 421.085 |
| dataAlea2\_50\_ex2 | 378.4519 | 185.7544 | 378.452 |
| dataAlea2\_50\_ex3 | 431.0037 | 416.729 | 416.044 |
| dataAlea2\_100\_ex1 | 296,6047 | 164.3702 | 451.817 |
| dataAlea2\_100\_ex2 | 400.5863 | 323.472 | 323.907 |
| dataAlea2\_100\_ex3 | 499,9950 | 498.4939 | 456.476 |
| dataConvex\_3\_10\_2\_10\_ex1 | 0.5907992 | 0.5907992 | 0.590799 |
| dataConvex\_3\_10\_2\_10\_ex2 | 0.9944741 | 0.9944741 | 0.993272 |
| dataConvex\_3\_10\_2\_10\_ex3 | 1.334924 | 1.334924 | 1.53602 |
| dataConvex\_3\_10\_2\_10\_ex4 | 1.255716 | 1.255716 | 1.15641 |
| dataConvex\_3\_10\_2\_50\_ex1 | 2.929918 | 1.569714 | 2.77596 |
| dataConvex\_3\_10\_2\_50\_ex2 | 2.861603 | 1.540522 | 2.60684 |
| dataConvex\_3\_10\_2\_50\_ex3 | 2.526753 | 1.699532 | 2.52675 |
| dataConvex\_3\_10\_2\_50\_ex4 | 2.74341 | 1.594426 | 2.74324 |

Quality

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Cplex-Pareto | DP |
| dataAlea2\_50\_ex1 | 2.594663588 | 0 | 5.799853 |
| dataAlea2\_50\_ex2 | 103.7377849 | 0 | 103.7378 |
| dataAlea2\_50\_ex3 | 3.595701416 | 0.16464605 | 0 |
| dataAlea2\_100\_ex1 | 1804391.933 | 0 | 174.8777 |
| dataAlea2\_100\_ex2 | 23.83955953 | 0 | 0.134478 |
| dataAlea2\_100\_ex3 | 1095236.885 | 9.20484319 | 0 |
| dataConvex\_3\_10\_2\_10\_ex1 | 3.38525E-05 | 3.3852E-05 | 0 |
| dataConvex\_3\_10\_2\_10\_ex2 | 0.121024251 | 0.12102425 | 0 |
| dataConvex\_3\_10\_2\_10\_ex3 | 0 | 0 | 15.06423 |
| dataConvex\_3\_10\_2\_10\_ex4 | 8.587438711 | 8.58743871 | 0 |
| dataConvex\_3\_10\_2\_50\_ex1 | 86.65298265 | 0 | 76.84495 |
| dataConvex\_3\_10\_2\_50\_ex2 | 85.75541278 | 0 | 69.21797 |
| dataConvex\_3\_10\_2\_50\_ex3 | 48.67345834 | 0 | 48.67328 |
| dataConvex\_3\_10\_2\_50\_ex4 | 72.0625479 | 0 | 72.05189 |

Time

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cplex | Cplex-Pareto | DP |
| dataAlea2\_50\_ex1 | 3,49 sec. | 0,09 sec | 1.107 Sec |
| dataAlea2\_50\_ex2 | 3,79 sec | 0,06 sec | 1.484 Sec |
| dataAlea2\_50\_ex3 | 4,30 sec | 0,09 sec | 1.1 Sec |
| dataAlea2\_100\_ex1 | 449,72 sec | 0,68 sec | 1.843 Sec |
| dataAlea2\_100\_ex2 | 143,78 sec | 0,64 sec | 1.308 Sec |
| dataAlea2\_100\_ex3 | 724,63 sec | 0,84 sec | 2.013 Sec |