

Supplementary Material

Table 1: Comparision runtimes and results with original split algorithm (Prins, 2004)

| Instance | n | Result Obtained | | | Computation Time | | |
|-------------|-----|-----------------|--------------|--------|------------------|--------------|--------|
| | | MQO-Split | Origin Split | GAP | MQO-Split | Origin Split | GAP |
| X-n275-k28 | 274 | 21245 | 21245 | 0.0 | 77.3134 | 81.1131 | 0.047 |
| X-n129-k18 | 128 | 28940 | 28940 | 0.0 | 21.0317 | 20.6901 | -0.017 |
| X-n627-k43 | 626 | 62411 | 62422 | 0.0 | 1046.8 | 1190.31 | 0.121 |
| X-n586-k159 | 585 | 190474 | 190652 | 0.001 | 620.596 | 581.164 | -0.068 |
| X-n303-k21 | 302 | 21791 | 21755 | -0.002 | 122.601 | 142.866 | 0.142 |
| X-n502-k39 | 501 | 69271 | 69271 | 0.0 | 352.601 | 354.023 | 0.004 |
| X-n957-k87 | 956 | 85548 | 85557 | 0.0 | 1651.99 | 1887.06 | 0.125 |
| X-n439-k37 | 438 | 36395 | 36402 | 0.0 | 204.343 | 216.501 | 0.056 |
| X-n701-k44 | 700 | 82120 | 82362 | 0.003 | 923.15 | 1146.09 | 0.195 |
| X-n317-k53 | 316 | 78368 | 78378 | 0.0 | 141.479 | 144.247 | 0.019 |
| X-n270-k35 | 269 | 35309 | 35309 | 0.0 | 71.1886 | 77.0049 | 0.076 |
| X-n561-k42 | 560 | 42775 | 42738 | -0.001 | 368.365 | 419.721 | 0.122 |
| X-n214-k11 | 213 | 10865 | 10874 | 0.001 | 95.8991 | 95.1495 | -0.008 |
| X-n134-k13 | 133 | 10933 | 10916 | -0.002 | 26.8002 | 26.9616 | 0.006 |
| X-n327-k20 | 326 | 27532 | 27532 | -0.0 | 186.221 | 199.64 | 0.067 |
| X-n242-k48 | 241 | 82952 | 82841 | -0.001 | 76.3165 | 78.0709 | 0.022 |
| X-n536-k96 | 535 | 95018 | 95131 | 0.001 | 418.725 | 453.138 | 0.076 |
| X-n573-k30 | 572 | 50773 | 50877 | 0.002 | 955.628 | 1067.47 | 0.105 |
| X-n491-k59 | 490 | 66764 | 66710 | -0.001 | 328.655 | 342.911 | 0.042 |
| X-n513-k21 | 512 | 24272 | 24236 | -0.001 | 409.91 | 404.343 | -0.014 |
| X-n766-k71 | 765 | 114719 | 114705 | -0.0 | 1091.73 | 1197.76 | 0.089 |
| X-n284-k15 | 283 | 20242 | 20256 | 0.001 | 153.478 | 161.338 | 0.049 |
| X-n120-k6 | 119 | 13332 | 13332 | 0.0 | 22.0172 | 22.4886 | 0.021 |
| X-n548-k50 | 547 | 86796 | 86789 | -0.0 | 561.419 | 564.154 | 0.005 |
| X-n384-k52 | 383 | 66141 | 66065 | -0.001 | 215.054 | 218.769 | 0.017 |
| X-n359-k29 | 358 | 51706 | 51529 | -0.003 | 247.598 | 241.012 | -0.027 |
| X-n115-k10 | 114 | 12747 | 12747 | 0.0 | 13.759 | 14.3988 | 0.044 |
| X-n351-k40 | 350 | 25983 | 25959 | -0.001 | 163.403 | 171.798 | 0.049 |
| X-n599-k92 | 598 | 108708 | 108607 | -0.001 | 491.627 | 544.52 | 0.097 |
| X-n393-k38 | 392 | 38269 | 38269 | 0.0 | 186.582 | 209.777 | 0.111 |
| X-n223-k34 | 222 | 40490 | 40463 | -0.001 | 54.6465 | 56.5627 | 0.034 |
| X-n219-k73 | 218 | 117595 | 117595 | 0.0 | 53.9099 | 52.9077 | -0.019 |
| X-n251-k28 | 250 | 38781 | 38692 | -0.002 | 90.7919 | 92.7218 | 0.021 |
| X-n979-k58 | 978 | 119146 | 119317 | 0.001 | 2935.87 | 3158.17 | 0.07 |
| X-n613-k62 | 612 | 59842 | 59691 | -0.003 | 372.004 | 442.098 | 0.159 |
| X-n106-k14 | 105 | 26414 | 26405 | -0.0 | 18.6894 | 18.8831 | 0.01 |
| X-n190-k8 | 189 | 16985 | 16995 | 0.001 | 86.6628 | 90.5957 | 0.043 |
| X-n783-k48 | 782 | 72941 | 72748 | -0.003 | 1113.97 | 1410.71 | 0.21 |
| X-n261-k13 | 260 | 26559 | 26572 | 0.0 | 139.619 | 143.7 | 0.028 |
| X-n749-k98 | 748 | 77631 | 77736 | 0.001 | 833.618 | 999.607 | 0.166 |

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|-------------|------|--------------|--------|--------|----------------|---------|--------|
| X-n411-k19 | 410 | 19758 | 19723 | -0.002 | 324.893 | 317.515 | -0.023 |
| X-n1001-k43 | 1000 | 72859 | 72662 | -0.003 | 2590.89 | 2646.27 | 0.021 |
| X-n294-k50 | 293 | 47210 | 47169 | -0.001 | 87.1309 | 83.2751 | -0.046 |
| X-n101-k25 | 100 | 27591 | 27591 | 0.0 | 9.28259 | 9.3356 | 0.006 |
| X-n298-k31 | 297 | 34291 | 34258 | -0.001 | 83.1333 | 89.7515 | 0.074 |
| X-n289-k60 | 288 | 95329 | 95310 | -0.0 | 138.669 | 143.999 | 0.037 |
| X-n200-k36 | 199 | 58624 | 58578 | -0.001 | 42.7216 | 43.187 | 0.011 |
| X-n228-k23 | 227 | 25742 | 25742 | 0.0 | 64.8387 | 66.5641 | 0.026 |
| X-n256-k16 | 255 | 18880 | 18880 | 0.0 | 76.4361 | 79.7617 | 0.042 |
| X-n313-k71 | 312 | 94157 | 94194 | 0.0 | 120.67 | 131.604 | 0.083 |
| X-n367-k17 | 366 | 22814 | 22814 | 0.0 | 247.762 | 238.449 | -0.039 |
| X-n280-k17 | 279 | 33597 | 33599 | 0.0 | 171.676 | 175.712 | 0.023 |
| X-n110-k13 | 109 | 14971 | 14971 | 0.0 | 10.4647 | 11.1395 | 0.061 |
| X-n344-k43 | 343 | 42157 | 42094 | -0.001 | 131.652 | 136.768 | 0.037 |
| X-n336-k84 | 335 | 139548 | 139486 | -0.0 | 174.612 | 194.193 | 0.101 |
| X-n449-k29 | 448 | 55396 | 55345 | -0.001 | 348.549 | 374.507 | 0.069 |
| X-n331-k15 | 330 | 31102 | 31102 | 0.0 | 214.106 | 223.568 | 0.042 |
| X-n195-k51 | 194 | 44237 | 44225 | -0.0 | 39.0068 | 40.7112 | 0.042 |
| X-n801-k40 | 800 | 73430 | 73545 | 0.002 | 1840.46 | 2053.51 | 0.104 |
| X-n153-k22 | 152 | 21225 | 21225 | 0.0 | 31.3907 | 32.1526 | 0.024 |
| X-n204-k19 | 203 | 19565 | 19565 | 0.0 | 47.939 | 50.9774 | 0.06 |
| X-n641-k35 | 640 | 63964 | 63895 | -0.001 | 690.318 | 878.404 | 0.214 |
| X-n685-k75 | 684 | 68510 | 68468 | -0.001 | 573.348 | 641.072 | 0.106 |
| X-n469-k138 | 468 | 222463 | 222243 | -0.001 | 381.384 | 360.326 | -0.058 |
| X-n819-k171 | 818 | 158514 | 158514 | 0.0 | 1018.98 | 1030.71 | 0.011 |
| X-n459-k26 | 458 | 24177 | 24176 | -0.0 | 304.098 | 376.957 | 0.193 |
| X-n176-k26 | 175 | 47812 | 47812 | 0.0 | 41.0299 | 44.7656 | 0.083 |
| X-n856-k95 | 855 | 89086 | 89100 | 0.0 | 854.844 | 994.35 | 0.14 |
| X-n209-k16 | 208 | 30656 | 30680 | 0.001 | 74.1577 | 78.7973 | 0.059 |
| X-n237-k14 | 236 | 27042 | 27042 | 0.0 | 79.7329 | 88.4467 | 0.099 |
| X-n936-k151 | 935 | 133485 | 133245 | -0.002 | 1271.12 | 1533.96 | 0.171 |
| X-n716-k35 | 715 | 43489 | 43477 | -0.0 | 1036.93 | 1121.25 | 0.075 |
| X-n733-k159 | 732 | 136476 | 136407 | -0.001 | 730.989 | 778.894 | 0.062 |
| X-n420-k130 | 419 | 107871 | 107921 | 0.0 | 226.889 | 201.626 | -0.125 |
| X-n895-k37 | 894 | 54276 | 54110 | -0.003 | 1688.73 | 1705.4 | 0.01 |
| X-n916-k207 | 915 | 329653 | 329930 | 0.001 | 2035.98 | 2165.48 | 0.06 |
| X-n233-k16 | 232 | 19257 | 19230 | -0.001 | 60.4253 | 66.2121 | 0.087 |
| X-n837-k142 | 836 | 194045 | 194283 | 0.001 | 1393.86 | 1494.46 | 0.067 |
| X-n148-k46 | 147 | 43448 | 43448 | 0.0 | 23.5475 | 24.7312 | 0.048 |
| X-n480-k70 | 479 | 89600 | 89572 | -0.0 | 330.358 | 345.63 | 0.044 |
| X-n401-k29 | 400 | 66303 | 66330 | 0.0 | 299.882 | 287.172 | -0.044 |
| X-n655-k131 | 654 | 106836 | 106832 | -0.0 | 595.163 | 624.761 | 0.047 |
| X-n143-k7 | 142 | 15700 | 15700 | 0.0 | 31.959 | 32.3875 | 0.013 |
| X-n376-k94 | 375 | 147760 | 147718 | -0.0 | 190.329 | 192.742 | 0.013 |
| X-n172-k51 | 171 | 45607 | 45607 | 0.0 | 30.7844 | 31.6216 | 0.026 |
| X-n429-k61 | 428 | 65520 | 65506 | -0.0 | 211.476 | 200.644 | -0.054 |
| X-n247-k50 | 246 | 37413 | 37406 | -0.0 | 88.4177 | 84.563 | -0.046 |
| X-n322-k28 | 321 | 29891 | 29855 | -0.001 | 104.699 | 121.178 | 0.136 |

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|-------------|-----|--------------|--------|--------|----------------|---------|--------|
| X-n139-k10 | 138 | 13590 | 13590 | 0.0 | 19.7577 | 20.0871 | 0.016 |
| X-n157-k13 | 156 | 16876 | 16876 | 0.0 | 25.0584 | 27.2184 | 0.079 |
| X-n186-k15 | 185 | 24145 | 24145 | 0.0 | 47.1376 | 47.7148 | 0.012 |
| X-n125-k30 | 124 | 55539 | 55539 | 0.0 | 18.8477 | 18.7173 | -0.007 |
| X-n181-k23 | 180 | 25569 | 25576 | 0.0 | 32.3961 | 33.7338 | 0.04 |
| X-n167-k10 | 166 | 20557 | 20557 | 0.0 | 48.2004 | 47.7329 | -0.01 |
| X-n876-k59 | 875 | 99714 | 99660 | -0.001 | 1945.04 | 2054.75 | 0.053 |
| X-n524-k153 | 523 | 154757 | 154982 | 0.001 | 379.909 | 401.12 | 0.053 |
| X-n162-k11 | 161 | 14138 | 14138 | 0.0 | 27.3326 | 28.328 | 0.035 |
| X-n266-k58 | 265 | 75741 | 75650 | -0.001 | 116.116 | 100.124 | -0.16 |
| X-n670-k130 | 669 | 147027 | 146828 | -0.001 | 680.719 | 685.988 | 0.008 |
| X-n308-k13 | 307 | 25891 | 25869 | -0.001 | 238.867 | 237.133 | -0.007 |
