Additional material for:

# Role-Usage Role Mining Heuristics for Permission-Role-Usage Cardinality Constraints

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# 1 Fixed $mru$

## 1.1 Americas Large

| $mru$ | $mpr$ | | PRUCC$_1$ OF | PRUCC$_1$ OR | PRUCC$_1$ UF | PRUCC$_1$ UR | PRUCC$_2$ OF | PRUCC$_2$ OR | PRUCC$_2$ UF | PRUCC$_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 367 | $\|\mathcal{R}\|$ | 548 | 549 | 544 | 547 | 564 | 562 | 566 | 564 |
| | | WSC | 99166 | 97229 | 97194 | 97519 | 101079 | 99134 | 100925 | 97834 |
| 2 | 458 | $\|\mathcal{R}\|$ | 471 | 477 | 475 | 477 | 483 | 486 | 491 | 493 |
| | | WSC | 97881 | 98309 | 98237 | 98454 | 100123 | 100391 | 100450 | 99324 |
| 2 | 549 | $\|\mathcal{R}\|$ | 447 | 444 | 447 | 448 | 448 | 453 | 457 | 462 |
| | | WSC | 97721 | 97035 | 97446 | 98001 | 98824 | 98506 | 98733 | 98916 |
| 2 | 640 | $\|\mathcal{R}\|$ | 431 | 426 | 427 | 427 | 428 | 430 | 437 | 437 |
| | | WSC | 101530 | 101212 | 101026 | 101039 | 101848 | 101979 | 101811 | 101811 |
| 2 | 732 | $\|\mathcal{R}\|$ | 423 | 423 | 423 | 423 | 425 | 425 | 432 | 432 |
| | | WSC | 101246 | 101244 | 101028 | 101028 | 101976 | 101957 | 101788 | 101793 |
| 3 | 245 | $\|\mathcal{R}\|$ | 598 | 616 | 596 | 613 | 586 | 626 | 610 | 619 |
| | | WSC | 88891 | 93304 | 90754 | 93503 | 85016 | 94868 | 89596 | 93686 |
| 3 | 367 | $\|\mathcal{R}\|$ | 545 | 542 | 537 | 546 | 554 | 555 | 555 | 554 |
| | | WSC | 97440 | 94817 | 95375 | 96133 | 99390 | 96191 | 98936 | 95236 |
| 3 | 489 | $\|\mathcal{R}\|$ | 451 | 454 | 455 | 457 | 465 | 459 | 463 | 461 |
| | | WSC | 95197 | 95609 | 95107 | 96516 | 98901 | 96005 | 98427 | 96431 |
| 3 | 611 | $\|\mathcal{R}\|$ | 425 | 424 | 427 | 427 | 426 | 425 | 428 | 428 |
| | | WSC | 98027 | 97958 | 96205 | 96183 | 97990 | 97959 | 96208 | 96189 |
| 3 | 732 | $\|\mathcal{R}\|$ | 417 | 420 | 420 | 420 | 419 | 417 | 420 | 420 |
| | | WSC | 98032 | 98208 | 96151 | 96156 | 98125 | 97990 | 96151 | 96156 |

Table 1: Role-set size and WSC value - Dataset Americas large

| | $\|\mathcal{R}\|$ OF | $\|\mathcal{R}\|$ OR | $\|\mathcal{R}\|$ UF | $\|\mathcal{R}\|$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| PRUCC$_1$ | 4 | 4 | 4 | 1 | 2 | 2 | 5 | 2 |
| PRUCC$_2$ | 6 | 5 | 0 | 1 | 1 | 2 | 3 | 5 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 8 | 8 |
| equal | 1 | 1 |
| worse | 1 | 1 |

Table 2: Minumum values - Dataset Americas large

| $\mathcal{R}$ | PRUCC$_1$ 0 | 1 | 2 | 3 | 4 | PRUCC$_2$ 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| OF | 6 | 3 | 0 | 0 | 1 | 4 | 4 | 2 | 0 | 0 |
| OR | 6 | 3 | 0 | 0 | 1 | 5 | 4 | 1 | 0 | 0 |
| UF | 6 | 3 | 0 | 0 | 1 | 10 | 0 | 0 | 0 | 0 |
| UR | 9 | 0 | 0 | 0 | 1 | 9 | 0 | 1 | 0 | 0 |

Table 3: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Americas large

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 8 | 2 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 |
| OR | 8 | 2 | 0 | 0 | 0 | 8 | 2 | 0 | 0 | 0 |
| UF | 5 | 4 | 1 | 0 | 0 | 7 | 2 | 1 | 0 | 0 |
| UR | 8 | 1 | 1 | 0 | 0 | 5 | 4 | 1 | 0 | 0 |

Table 4: Number of times variants reached minumum value for $WSC$ - Dataset Americas large

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 2.6 | 2.9 | 2.8 | 3.95 | 4.2 | 3.4 | 2.0 | 3.5 |
| $\text{PRUCC}_2$ | 4.7 | 5.2 | 6.9 | 6.95 | 6.7 | 6.0 | 5.4 | 4.8 |

Table 5: Heuristics ranking - Dataset Americas large

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas large | 2.6 | 2.9 | 2.8 | 3.95 | 4.7 | 5.2 | 6.9 | 6.95 |

Table 6: Heuristics ranking on $\mathcal{R}$ - Dataset Americas large

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas large | 4.2 | 3.4 | 2.0 | 3.5 | 6.7 | 6.0 | 5.4 | 4.8 |

Table 7: Heuristics ranking on $WSC$ - Dataset Americas large

## 1.2 Americas Small

| $mru$ | $mpr$ | | $\text{PRUCC}_1$ OF | $\text{PRUCC}_1$ OR | $\text{PRUCC}_1$ UF | $\text{PRUCC}_1$ UR | $\text{PRUCC}_2$ OF | $\text{PRUCC}_2$ OR | $\text{PRUCC}_2$ UF | $\text{PRUCC}_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 155 | $\lvert\mathcal{R}\rvert$ | 287 | 289 | 287 | 289 | 299 | 302 | 310 | 314 |
| | | WSC | 22662 | 22692 | 22924 | 22980 | 24297 | 24286 | 24435 | 24508 |
| 2 | 193 | $\lvert\mathcal{R}\rvert$ | 267 | 268 | 267 | 268 | 271 | 271 | 282 | 283 |
| | | WSC | 24688 | 24716 | 24971 | 24978 | 24941 | 24847 | 25092 | 25099 |
| 2 | 231 | $\lvert\mathcal{R}\rvert$ | 263 | 263 | 263 | 263 | 266 | 266 | 278 | 278 |
| | | WSC | 24896 | 24862 | 25121 | 25121 | 24971 | 24948 | 25242 | 25242 |
| 2 | 269 | $\lvert\mathcal{R}\rvert$ | 262 | 262 | 262 | 262 | 265 | 264 | 277 | 277 |
| | | WSC | 25084 | 25107 | 25348 | 25348 | 25152 | 25136 | 25469 | 25469 |
| 2 | 309 | $\lvert\mathcal{R}\rvert$ | 260 | 260 | 260 | 260 | 263 | 262 | 275 | 275 |
| | | WSC | 25143 | 25166 | 25344 | 25344 | 25120 | 25066 | 25465 | 25465 |
| 4 | 78 | $\lvert\mathcal{R}\rvert$ | 325 | 340 | 338 | 350 | 346 | 376 | 361 | 386 |
| | | WSC | 17129 | 18102 | 17694 | 18414 | 18753 | 20727 | 19098 | 20704 |
| 4 | 136 | $\lvert\mathcal{R}\rvert$ | 294 | 300 | 304 | 306 | 302 | 311 | 317 | 325 |
| | | WSC | 20749 | 21360 | 21274 | 21340 | 21627 | 22435 | 22379 | 23048 |
| 4 | 194 | $\lvert\mathcal{R}\rvert$ | 261 | 262 | 270 | 271 | 264 | 265 | 277 | 278 |
| | | WSC | 23011 | 23004 | 23526 | 23532 | 23031 | 23043 | 23513 | 23490 |
| 4 | 252 | $\lvert\mathcal{R}\rvert$ | 256 | 256 | 265 | 265 | 259 | 259 | 271 | 271 |
| | | WSC | 23377 | 23383 | 23904 | 23875 | 23228 | 23215 | 23667 | 23667 |
| 4 | 309 | $\lvert\mathcal{R}\rvert$ | 254 | 254 | 263 | 263 | 257 | 257 | 269 | 269 |
| | | WSC | 23369 | 23372 | 23900 | 23900 | 23211 | 23211 | 23663 | 23663 |
| 6 | 52 | $\lvert\mathcal{R}\rvert$ | 330 | 374 | 354 | 398 | 359 | 423 | 371 | 439 |
| | | WSC | 13834 | 15763 | 14367 | 16292 | 15336 | 18213 | 15446 | 18727 |
| 6 | 116 | $\lvert\mathcal{R}\rvert$ | 302 | 308 | 312 | 317 | 311 | 317 | 302 | 321 |
| | | WSC | 19378 | 19750 | 20283 | 20536 | 20174 | 20582 | 19163 | 21064 |
| 6 | 180 | $\lvert\mathcal{R}\rvert$ | 258 | 259 | 269 | 269 | 262 | 263 | 265 | 265 |
| | | WSC | 21862 | 21883 | 22879 | 22902 | 22058 | 22078 | 22534 | 22345 |
| 6 | 244 | $\lvert\mathcal{R}\rvert$ | 253 | 253 | 263 | 263 | 256 | 256 | 258 | 258 |
| | | WSC | 22217 | 22221 | 23248 | 23249 | 22243 | 22246 | 22714 | 22715 |
| 6 | 309 | $\lvert\mathcal{R}\rvert$ | 251 | 251 | 261 | 261 | 254 | 254 | 256 | 256 |
| | | WSC | 22223 | 22215 | 23244 | 23236 | 22233 | 22239 | 22710 | 22711 |
| 8 | 39 | $\lvert\mathcal{R}\rvert$ | 363 | 408 | 389 | 432 | 383 | 478 | 407 | 485 |
| | | WSC | 13521 | 15212 | 14225 | 15804 | 14348 | 17928 | 14982 | 17952 |
| 8 | 106 | $\lvert\mathcal{R}\rvert$ | 296 | 310 | 310 | 319 | 303 | 327 | 314 | 343 |
| | | WSC | 17247 | 18028 | 18058 | 18517 | 18082 | 19850 | 18828 | 21116 |
| 8 | 173 | $\lvert\mathcal{R}\rvert$ | 262 | 263 | 273 | 275 | 266 | 269 | 271 | 274 |
| | | WSC | 20387 | 20242 | 21544 | 21528 | 20964 | 20991 | 21626 | 21639 |
| 8 | 240 | $\lvert\mathcal{R}\rvert$ | 252 | 252 | 262 | 262 | 253 | 253 | 258 | 258 |
| | | WSC | 21398 | 21394 | 22511 | 22509 | 21293 | 21275 | 21947 | 21927 |
| 8 | 309 | $\lvert\mathcal{R}\rvert$ | 250 | 250 | 262 | 260 | 251 | 251 | 256 | 256 |
| | | WSC | 21393 | 21392 | 22635 | 22506 | 21278 | 21278 | 21922 | 21944 |
| 11 | 29 | $\lvert\mathcal{R}\rvert$ | 390 | 430 | 413 | 477 | 394 | 499 | 401 | 509 |
| | | WSC | 12979 | 14177 | 13116 | 14878 | 13059 | 16200 | 13112 | 16202 |
| 11 | 99 | $\lvert\mathcal{R}\rvert$ | 282 | 294 | 316 | 333 | 297 | 302 | 300 | 310 |
| | | WSC | 16162 | 17217 | 16698 | 17872 | 17614 | 18102 | 17108 | 17712 |
| 11 | 169 | $\lvert\mathcal{R}\rvert$ | 253 | 255 | 282 | 284 | 257 | 260 | 261 | 263 |
| | | WSC | 18622 | 18669 | 20114 | 20150 | 18766 | 18875 | 18239 | 18177 |
| 11 | 239 | $\lvert\mathcal{R}\rvert$ | 242 | 243 | 272 | 273 | 243 | 241 | 245 | 252 |
| | | WSC | 19792 | 19834 | 21274 | 21380 | 19432 | 19244 | 18653 | 19303 |
| 11 | 309 | $\lvert\mathcal{R}\rvert$ | 241 | 240 | 272 | 271 | 242 | 242 | 244 | 244 |
| | | WSC | 19825 | 19778 | 21430 | 21375 | 19421 | 19423 | 18712 | 18755 |

Table 8: Role-set size and WSC value - Dataset Americas small

| | $\lvert\mathcal{R}\rvert$ OF | $\lvert\mathcal{R}\rvert$ OR | $\lvert\mathcal{R}\rvert$ UF | $\lvert\mathcal{R}\rvert$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| $\text{PRUCC}_1$ | 24 | 10 | 5 | 3 | 18 | 7 | 0 | 0 |
| $\text{PRUCC}_2$ | 21 | 12 | 1 | 0 | 13 | 9 | 4 | 1 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 23 | 16 |
| equal | 1 | 0 |
| worse | 1 | 9 |

Table 9: Minumum values - Dataset Americas small

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 1 | 13 | 8 | 0 | 3 | 4 | 12 | 9 | 0 | 0 |
| OR | 15 | 1 | 6 | 0 | 3 | 13 | 3 | 9 | 0 | 0 |
| UF | 20 | 0 | 2 | 0 | 3 | 24 | 1 | 0 | 0 | 0 |
| UR | 22 | 0 | 0 | 0 | 3 | 25 | 0 | 0 | 0 | 0 |

Table 10: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Americas small

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 7 | 18 | 0 | 0 | 0 | 12 | 11 | 2 | 0 | 0 |
| OR | 18 | 7 | 0 | 0 | 0 | 16 | 7 | 2 | 0 | 0 |
| UF | 25 | 0 | 0 | 0 | 0 | 21 | 4 | 0 | 0 | 0 |
| UR | 25 | 0 | 0 | 0 | 0 | 24 | 1 | 0 | 0 | 0 |

Table 11: Number of times variants reached minumum value for $WSC$ - Dataset Americas small

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 1.44 | 2.58 | 4.92 | 5.92 | 2.12 | 3.12 | 5.4 | 6.28 |
| $\text{PRUCC}_2$ | 3.64 | 4.84 | 5.64 | 7.02 | 3.4 | 4.4 | 4.98 | 6.3 |

Table 12: Heuristics ranking - Dataset Americas small

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas small | 1.44 | 2.58 | 4.92 | 5.92 | 3.64 | 4.84 | 5.64 | 7.02 |

Table 13: Heuristics ranking on $\mathcal{R}$ - Dataset Americas small

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas small | 2.12 | 3.12 | 5.4 | 6.28 | 3.4 | 4.4 | 4.98 | 6.3 |

Table 14: Heuristics ranking on $WSC$ - Dataset Americas small

## 1.3 Apj

| | | | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $mru$ | $mpr$ | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 29 | $\|\mathcal{R}\|$ | 509 | 509 | 510 | 510 | 511 | 510 | 512 | 512 |
| | | WSC | 5919 | 5919 | 5919 | 5919 | 5925 | 5923 | 5925 | 5925 |
| 2 | 36 | $\|\mathcal{R}\|$ | 506 | 506 | 507 | 507 | 508 | 508 | 509 | 509 |
| | | WSC | 5913 | 5913 | 5913 | 5913 | 5919 | 5919 | 5919 | 5919 |
| 2 | 43 | $\|\mathcal{R}\|$ | 503 | 503 | 504 | 504 | 504 | 505 | 506 | 506 |
| | | WSC | 5907 | 5907 | 5907 | 5907 | 5911 | 5913 | 5913 | 5913 |
| 2 | 50 | $\|\mathcal{R}\|$ | 501 | 501 | 502 | 502 | 502 | 503 | 504 | 504 |
| | | WSC | 5903 | 5903 | 5903 | 5903 | 5907 | 5909 | 5909 | 5909 |
| 2 | 57 | $\|\mathcal{R}\|$ | 501 | 501 | 502 | 502 | 503 | 502 | 504 | 504 |
| | | WSC | 5903 | 5903 | 5903 | 5903 | 5909 | 5907 | 5909 | 5909 |
| 3 | 20 | $\|\mathcal{R}\|$ | 521 | 524 | 522 | 528 | 520 | 525 | 523 | 526 |
| | | WSC | 5860 | 5869 | 5850 | 5922 | 5801 | 5852 | 5799 | 5844 |
| 3 | 29 | $\|\mathcal{R}\|$ | 501 | 499 | 502 | 502 | 503 | 503 | 504 | 504 |
| | | WSC | 5888 | 5882 | 5878 | 5878 | 5892 | 5892 | 5884 | 5884 |
| 3 | 38 | $\|\mathcal{R}\|$ | 496 | 496 | 499 | 499 | 498 | 500 | 501 | 501 |
| | | WSC | 5876 | 5876 | 5872 | 5872 | 5880 | 5886 | 5878 | 5878 |
| 3 | 47 | $\|\mathcal{R}\|$ | 493 | 493 | 496 | 496 | 495 | 495 | 498 | 498 |
| | | WSC | 5870 | 5870 | 5866 | 5866 | 5874 | 5874 | 5872 | 5872 |
| 3 | 57 | $\|\mathcal{R}\|$ | 494 | 492 | 495 | 495 | 494 | 494 | 497 | 497 |
| | | WSC | 5874 | 5868 | 5864 | 5866 | 5872 | 5872 | 5870 | 5870 |
| 4 | 15 | $\|\mathcal{R}\|$ | 526 | 539 | 530 | 542 | 534 | 537 | 533 | 547 |
| | | WSC | 5579 | 5763 | 5638 | 5858 | 5652 | 5797 | 5658 | 5868 |
| 4 | 25 | $\|\mathcal{R}\|$ | 491 | 493 | 494 | 496 | 499 | 493 | 496 | 498 |
| | | WSC | 5724 | 5754 | 5789 | 5819 | 5785 | 5778 | 5793 | 5815 |
| 4 | 35 | $\|\mathcal{R}\|$ | 489 | 483 | 486 | 486 | 483 | 483 | 488 | 488 |
| | | WSC | 5804 | 5757 | 5798 | 5798 | 5733 | 5757 | 5794 | 5802 |
| 4 | 45 | $\|\mathcal{R}\|$ | 482 | 481 | 484 | 484 | 488 | 481 | 486 | 486 |
| | | WSC | 5741 | 5753 | 5794 | 5794 | 5778 | 5729 | 5798 | 5798 |
| 4 | 57 | $\|\mathcal{R}\|$ | 479 | 479 | 482 | 482 | 479 | 479 | 484 | 484 |
| | | WSC | 5725 | 5725 | 5790 | 5790 | 5749 | 5749 | 5786 | 5794 |
| 5 | 12 | $\|\mathcal{R}\|$ | 505 | 516 | 505 | 549 | 507 | 539 | 505 | 549 |
| | | WSC | 5177 | 5321 | 5179 | 5751 | 5193 | 5591 | 5189 | 5768 |
| 5 | 23 | $\|\mathcal{R}\|$ | 494 | 495 | 493 | 494 | 496 | 496 | 492 | 493 |
| | | WSC | 5799 | 5818 | 5671 | 5718 | 5804 | 5821 | 5678 | 5717 |
| 5 | 34 | $\|\mathcal{R}\|$ | 479 | 479 | 478 | 478 | 480 | 481 | 477 | 477 |
| | | WSC | 5786 | 5785 | 5675 | 5670 | 5786 | 5794 | 5677 | 5665 |
| 5 | 45 | $\|\mathcal{R}\|$ | 477 | 477 | 476 | 476 | 478 | 478 | 475 | 475 |
| | | WSC | 5787 | 5780 | 5666 | 5657 | 5781 | 5782 | 5655 | 5665 |
| 5 | 57 | $\|\mathcal{R}\|$ | 475 | 475 | 474 | 474 | 477 | 476 | 473 | 473 |
| | | WSC | 5776 | 5778 | 5653 | 5653 | 5785 | 5779 | 5651 | 5675 |
| 7 | 9 | $\|\mathcal{R}\|$ | 509 | 532 | 507 | 525 | 515 | 522 | 514 | 528 |
| | | WSC | 5316 | 5517 | 5260 | 5413 | 5338 | 5422 | 5305 | 5439 |
| 7 | 21 | $\|\mathcal{R}\|$ | 478 | 479 | 478 | 479 | 479 | 482 | 480 | 479 |
| | | WSC | 5421 | 5452 | 5362 | 5380 | 5442 | 5450 | 5378 | 5383 |
| 7 | 33 | $\|\mathcal{R}\|$ | 465 | 465 | 463 | 463 | 466 | 465 | 466 | 466 |
| | | WSC | 5389 | 5389 | 5325 | 5325 | 5390 | 5402 | 5363 | 5363 |
| 7 | 45 | $\|\mathcal{R}\|$ | 464 | 463 | 463 | 462 | 465 | 465 | 464 | 464 |
| | | WSC | 5384 | 5382 | 5332 | 5313 | 5376 | 5376 | 5333 | 5336 |
| 7 | 57 | $\|\mathcal{R}\|$ | 462 | 463 | 463 | 461 | 464 | 464 | 463 | 463 |
| | | WSC | 5389 | 5384 | 5392 | 5312 | 5376 | 5374 | 5333 | 5333 |

Table 15: Role-set size and WSC value - Dataset Apj

| | $\|\mathcal{R}\|$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 13 | 12 | 8 | 6 | 10 | 7 | 15 | 14 |
| PRUCC$_2$ | 11 | 11 | 9 | 6 | 6 | 6 | 15 | 8 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 16 | 19 |
| equal | 4 | 0 |
| worse | 5 | 6 |

Table 16: Minumum values - Dataset Apj

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 12 | 3 | 10 | 0 | 0 | 14 | 4 | 7 | 0 | 0 |
| OR | 13 | 4 | 8 | 0 | 0 | 14 | 5 | 6 | 0 | 0 |
| UF | 17 | 2 | 6 | 0 | 0 | 16 | 4 | 5 | 0 | 0 |
| UR | 19 | 2 | 4 | 0 | 0 | 19 | 0 | 6 | 0 | 0 |

Table 17: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Apj

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 15 | 4 | 1 | 0 | 5 | 19 | 4 | 1 | 0 | 1 |
| OR | 18 | 1 | 1 | 0 | 5 | 19 | 4 | 1 | 0 | 1 |
| UF | 10 | 5 | 5 | 0 | 5 | 10 | 8 | 6 | 0 | 1 |
| UR | 11 | 4 | 5 | 0 | 5 | 17 | 1 | 6 | 0 | 1 |

Table 18: Number of times variants reached minumum value for $WSC$ - Dataset Apj

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 2.82 | 3.32 | 3.52 | 4.4 | 4.28 | 4.36 | 2.9 | 3.54 |
| PRUCC$_2$ | 5.22 | 5.24 | 5.38 | 6.1 | 5.38 | 5.9 | 4.24 | 5.4 |

Table 19: Heuristics ranking - Dataset Apj

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Apj | 2.82 | 3.32 | 3.52 | 4.4 | 5.22 | 5.24 | 5.38 | 6.1 |

Table 20: Heuristics ranking on $\mathcal{R}$ - Dataset Apj

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Apj | 4.28 | 4.36 | 2.9 | 3.54 | 5.38 | 5.9 | 4.24 | 5.4 |

Table 21: Heuristics ranking on $WSC$ - Dataset Apj

## 1.4 Emea

| $mru$ | $mpr$ | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 277 | $\lvert\mathcal{R}\rvert$ | 47 | 47 | 47 | 47 | 48 | 47 | 48 | 47 |
| | | WSC | 7306 | 7306 | 7306 | 7306 | 7319 | 7306 | 7319 | 7306 |
| 2 | 346 | $\lvert\mathcal{R}\rvert$ | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 45 |
| | | WSC | 7300 | 7300 | 7300 | 7300 | 7300 | 7300 | 7300 | 7305 |
| 2 | 415 | $\lvert\mathcal{R}\rvert$ | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| | | WSC | 7290 | 7290 | 7290 | 7290 | 7290 | 7290 | 7290 | 7290 |
| 2 | 484 | $\lvert\mathcal{R}\rvert$ | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| | | WSC | 7286 | 7286 | 7286 | 7286 | 7286 | 7286 | 7286 | 7286 |
| 2 | 553 | $\lvert\mathcal{R}\rvert$ | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | WSC | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 |

Table 22: Role-set size and WSC value - Dataset Emea

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| $\text{PRUCC}_2$ | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 0 | 0 |
| equal | 5 | 5 |
| worse | 0 | 0 |

Table 23: Minumum values - Dataset Emea

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 3 |
| OR | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 1 | 3 |
| UF | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 3 |
| UR | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 3 |

Table 24: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Emea

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 3 |
| OR | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 1 | 3 |
| UF | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 3 |
| UR | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 3 |

Table 25: Number of times variants reached minumum value for $WSC$ - Dataset Emea

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 |
| $\text{PRUCC}_2$ | 5.0 | 4.2 | 5.0 | 5.0 | 5.0 | 4.2 | 5.0 | 5.0 |

Table 26: Heuristics ranking - Dataset Emea

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Emea | 4.2 | 4.2 | 4.2 | 4.2 | 5.0 | 4.2 | 5.0 | 5.0 |

Table 27: Heuristics ranking on $\mathcal{R}$ - Dataset Emea

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Emea | 4.2 | 4.2 | 4.2 | 4.2 | 5.0 | 4.2 | 5.0 | 5.0 |

Table 28: Heuristics ranking on $WSC$ - Dataset Emea

## 1.5 Healthcare

| $mru$ | $mpr$ | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 23 | $\lvert\mathcal{R}\rvert$ | 21 | 24 | 21 | 24 | 20 | 27 | 23 | 29 |
| | | WSC | 356 | 386 | 356 | 386 | 354 | 480 | 383 | 485 |
| 2 | 28 | $\lvert\mathcal{R}\rvert$ | 21 | 21 | 21 | 20 | 21 | 22 | 22 | 23 |
| | | WSC | 401 | 401 | 401 | 372 | 401 | 430 | 404 | 459 |
| 2 | 33 | $\lvert\mathcal{R}\rvert$ | 21 | 21 | 21 | 21 | 21 | 21 | 22 | 22 |
| | | WSC | 475 | 475 | 475 | 475 | 475 | 475 | 478 | 478 |
| 2 | 38 | $\lvert\mathcal{R}\rvert$ | 20 | 20 | 20 | 20 | 20 | 20 | 21 | 20 |
| | | WSC | 468 | 468 | 468 | 468 | 468 | 468 | 471 | 468 |
| 2 | 45 | $\lvert\mathcal{R}\rvert$ | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 19 |
| | | WSC | 443 | 443 | 443 | 443 | 443 | 443 | 446 | 446 |
| 3 | 16 | $\lvert\mathcal{R}\rvert$ | 21 | 21 | 21 | 21 | 21 | 22 | 22 | 22 |
| | | WSC | 329 | 329 | 329 | 329 | 329 | 346 | 332 | 332 |
| 3 | 23 | $\lvert\mathcal{R}\rvert$ | 17 | 18 | 17 | 18 | 17 | 21 | 17 | 20 |
| | | WSC | 292 | 316 | 292 | 316 | 292 | 388 | 292 | 364 |
| 3 | 30 | $\lvert\mathcal{R}\rvert$ | 17 | 17 | 17 | 17 | 18 | 19 | 18 | 20 |
| | | WSC | 286 | 286 | 286 | 286 | 317 | 348 | 317 | 379 |
| 3 | 37 | $\lvert\mathcal{R}\rvert$ | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | | WSC | 364 | 364 | 364 | 364 | 364 | 364 | 364 | 364 |
| 3 | 45 | $\lvert\mathcal{R}\rvert$ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | | WSC | 338 | 338 | 338 | 338 | 338 | 338 | 338 | 338 |
| 4 | 12 | $\lvert\mathcal{R}\rvert$ | 21 | 20 | 21 | 21 | 20 | 23 | 20 | 23 |
| | | WSC | 330 | 317 | 330 | 330 | 317 | 356 | 317 | 356 |
| 4 | 20 | $\lvert\mathcal{R}\rvert$ | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | | WSC | 285 | 285 | 285 | 285 | 285 | 285 | 285 | 285 |
| 4 | 28 | $\lvert\mathcal{R}\rvert$ | 18 | 18 | 18 | 18 | 18 | 21 | 18 | 21 |
| | | WSC | 296 | 296 | 296 | 296 | 296 | 383 | 296 | 383 |
| 4 | 36 | $\lvert\mathcal{R}\rvert$ | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | | WSC | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| 4 | 45 | $\lvert\mathcal{R}\rvert$ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | | WSC | 338 | 338 | 338 | 338 | 338 | 338 | 338 | 338 |
| 5 | 10 | $\lvert\mathcal{R}\rvert$ | 20 | 20 | 20 | 20 | 22 | 22 | 22 | 23 |
| | | WSC | 326 | 326 | 326 | 326 | 348 | 348 | 348 | 359 |
| 5 | 19 | $\lvert\mathcal{R}\rvert$ | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| | | WSC | 295 | 295 | 295 | 295 | 295 | 295 | 295 | 295 |
| 5 | 28 | $\lvert\mathcal{R}\rvert$ | 18 | 18 | 18 | 18 | 18 | 20 | 19 | 20 |
| | | WSC | 307 | 307 | 307 | 307 | 307 | 365 | 336 | 365 |
| 5 | 37 | $\lvert\mathcal{R}\rvert$ | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | | WSC | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 |
| 5 | 45 | $\lvert\mathcal{R}\rvert$ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | | WSC | 324 | 324 | 324 | 324 | 324 | 324 | 324 | 324 |

Table 29: Role-set size and WSC value - Dataset Healthcare

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 18 | 17 | 18 | 17 | 18 | 17 | 18 | 17 |
| $\text{PRUCC}_2$ | 20 | 12 | 13 | 9 | 20 | 12 | 13 | 9 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 3 | 3 |
| equal | 16 | 16 |
| worse | 1 | 1 |

Table 30: Minumum values - Dataset Healthcare

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 2 | 0 | 2 | 0 | 16 | 0 | 4 | 6 | 2 | 8 |
| OR | 3 | 1 | 0 | 0 | 16 | 8 | 0 | 2 | 2 | 8 |
| UF | 2 | 0 | 2 | 0 | 16 | 7 | 0 | 4 | 1 | 8 |
| UR | 3 | 1 | 0 | 0 | 16 | 11 | 0 | 0 | 1 | 8 |

Table 31: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Healthcare

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 2 | 0 | 2 | 0 | 16 | 0 | 4 | 6 | 2 | 8 |
| OR | 3 | 1 | 0 | 0 | 16 | 8 | 0 | 2 | 2 | 8 |
| UF | 2 | 0 | 2 | 0 | 16 | 7 | 0 | 4 | 1 | 8 |
| UR | 3 | 1 | 0 | 0 | 16 | 11 | 0 | 0 | 1 | 8 |

Table 32: Number of times variants reached minumum value for $WSC$ - Dataset Healthcare

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 3.75 | 3.9 | 3.75 | 3.925 | 3.75 | 3.9 | 3.75 | 3.925 |
| $\text{PRUCC}_2$ | 3.85 | 5.55 | 5.1 | 6.175 | 3.85 | 5.625 | 5.05 | 6.15 |

Table 33: Heuristics ranking - Dataset Healthcare

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Healthcare | 3.75 | 3.9 | 3.75 | 3.925 | 3.85 | 5.55 | 5.1 | 6.175 |

Table 34: Heuristics ranking on $\mathcal{R}$ - Dataset Healthcare

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Healthcare | 3.75 | 3.9 | 3.75 | 3.925 | 3.85 | 5.625 | 5.05 | 6.15 |

Table 35: Heuristics ranking on $WSC$ - Dataset Healthcare

## 1.6 Domino

| $mru$ | $mpr$ | | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 105 | $\|\mathcal{R}\|$ | 24 | 24 | 25 | 25 | 25 | 25 | 25 | 25 |
| | | WSC | 758 | 758 | 767 | 767 | 760 | 760 | 767 | 767 |
| 2 | 131 | $\|\mathcal{R}\|$ | 22 | 22 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | WSC | 754 | 754 | 763 | 763 | 756 | 763 | 763 | 763 |
| 2 | 157 | $\|\mathcal{R}\|$ | 23 | 22 | 23 | 23 | 22 | 23 | 24 | 23 |
| | | WSC | 763 | 754 | 763 | 763 | 758 | 763 | 765 | 763 |
| 2 | 183 | $\|\mathcal{R}\|$ | 22 | 22 | 23 | 23 | 23 | 22 | 23 | 23 |
| | | WSC | 754 | 754 | 763 | 763 | 756 | 758 | 763 | 763 |
| 2 | 208 | $\|\mathcal{R}\|$ | 22 | 22 | 23 | 23 | 23 | 22 | 23 | 23 |
| | | WSC | 754 | 754 | 763 | 763 | 756 | 758 | 763 | 763 |
| 4 | 53 | $\|\mathcal{R}\|$ | 26 | 25 | 26 | 25 | 25 | 27 | 25 | 27 |
| | | WSC | 709 | 660 | 722 | 668 | 655 | 763 | 668 | 776 |
| 4 | 92 | $\|\mathcal{R}\|$ | 25 | 24 | 25 | 25 | 24 | 25 | 24 | 25 |
| | | WSC | 772 | 666 | 772 | 772 | 679 | 759 | 679 | 772 |
| 4 | 131 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 751 | 756 | 764 | 764 | 751 | 751 | 764 | 764 |
| 4 | 170 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 751 | 764 | 764 | 764 | 751 | 764 | 764 | 764 |
| 4 | 208 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 751 | 751 | 764 | 764 | 764 | 751 | 764 | 764 |
| 6 | 35 | $\|\mathcal{R}\|$ | 30 | 30 | 30 | 28 | 30 | 33 | 30 | 32 |
| | | WSC | 680 | 665 | 680 | 642 | 680 | 773 | 680 | 752 |
| 6 | 78 | $\|\mathcal{R}\|$ | 25 | 23 | 25 | 24 | 26 | 25 | 26 | 26 |
| | | WSC | 757 | 604 | 772 | 693 | 778 | 772 | 793 | 793 |
| 6 | 121 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 764 | 764 | 749 | 749 | 764 | 764 |
| 6 | 164 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 764 | 764 | 764 | 764 | 749 | 764 | 764 |
| 6 | 208 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 764 | 764 | 764 | 749 | 749 | 764 | 764 |
| 8 | 27 | $\|\mathcal{R}\|$ | 32 | 32 | 32 | 32 | 34 | 32 | 34 | 34 |
| | | WSC | 655 | 655 | 655 | 655 | 687 | 641 | 701 | 701 |
| 8 | 72 | $\|\mathcal{R}\|$ | 25 | 24 | 25 | 24 | 25 | 25 | 25 | 25 |
| | | WSC | 732 | 689 | 746 | 698 | 732 | 746 | 746 | 746 |
| 8 | 117 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 763 | 763 | 749 | 749 | 763 | 763 |
| 8 | 162 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 763 | 763 | 749 | 749 | 763 | 763 |
| 8 | 208 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 763 | 763 | 754 | 754 | 763 | 763 |

Table 36: Role-set size and WSC value - Dataset Domino

| | $\|\mathcal{R}\|$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 14 | 19 | 10 | 13 | 14 | 15 | 1 | 2 |
| PRUCC$_2$ | 16 | 16 | 15 | 12 | 16 | 11 | 2 | 0 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 5 | 10 |
| equal | 15 | 8 |
| worse | 0 | 2 |

Table 37: Minumum values - Dataset Domino

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 6 | 0 | 4 | 0 | 10 | 4 | 1 | 3 | 0 | 12 |
| OR | 1 | 3 | 6 | 0 | 10 | 4 | 4 | 0 | 0 | 12 |
| UF | 10 | 0 | 0 | 0 | 10 | 5 | 0 | 3 | 0 | 12 |
| UR | 7 | 1 | 2 | 0 | 10 | 8 | 0 | 0 | 0 | 12 |

Table 38: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Domino

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 6 | 4 | 9 | 0 | 1 | 4 | 7 | 9 | 0 | 0 |
| OR | 5 | 5 | 9 | 0 | 1 | 9 | 4 | 7 | 0 | 0 |
| UF | 19 | 0 | 0 | 0 | 1 | 18 | 0 | 2 | 0 | 0 |
| UR | 18 | 1 | 0 | 0 | 1 | 20 | 0 | 0 | 0 | 0 |

Table 39: Number of times variants reached minumum value for $WSC$ - Dataset Domino

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 4.025 | 3.15 | 4.825 | 4.225 | 2.75 | 2.475 | 5.875 | 5.225 |
| $\text{PRUCC}_2$ | 4.65 | 4.725 | 4.975 | 5.425 | 3.3 | 3.875 | 6.05 | 6.45 |

Table 40: Heuristics ranking - Dataset Domino

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Domino | 4.025 | 3.15 | 4.825 | 4.225 | 4.65 | 4.725 | 4.975 | 5.425 |

Table 41: Heuristics ranking on $\mathcal{R}$ - Dataset Domino

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Domino | 2.75 | 2.475 | 5.875 | 5.225 | 3.3 | 3.875 | 6.05 | 6.45 |

Table 42: Heuristics ranking on $WSC$ - Dataset Domino

## 1.7 Customer

| $mru$ | $mpr$ | | $\text{PRUCC}_1$ OF | $\text{PRUCC}_1$ OR | $\text{PRUCC}_1$ UF | $\text{PRUCC}_1$ UR | $\text{PRUCC}_2$ OF | $\text{PRUCC}_2$ OR | $\text{PRUCC}_2$ UF | $\text{PRUCC}_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 13 | $\lvert\mathcal{R}\rvert$ | 5394 | 5401 | 5394 | 5402 | 5397 | 5406 | 5403 | 5409 |
| | | WSC | 50466 | 50517 | 50466 | 50520 | 50513 | 50542 | 50520 | 50548 |
| 2 | 16 | $\lvert\mathcal{R}\rvert$ | 5351 | 5351 | 5351 | 5352 | 5354 | 5355 | 5354 | 5357 |
| | | WSC | 50420 | 50425 | 50420 | 50413 | 50453 | 50434 | 50441 | 50438 |
| 2 | 19 | $\lvert\mathcal{R}\rvert$ | 5331 | 5333 | 5331 | 5333 | 5333 | 5335 | 5338 | 5341 |
| | | WSC | 50376 | 50384 | 50376 | 50382 | 50380 | 50405 | 50408 | 50418 |
| 2 | 22 | $\lvert\mathcal{R}\rvert$ | 5325 | 5323 | 5325 | 5324 | 5327 | 5327 | 5332 | 5329 |
| | | WSC | 50404 | 50406 | 50404 | 50402 | 50408 | 50408 | 50418 | 50412 |
| 2 | 24 | $\lvert\mathcal{R}\rvert$ | 5323 | 5323 | 5324 | 5324 | 5326 | 5323 | 5331 | 5328 |
| | | WSC | 50406 | 50400 | 50402 | 50402 | 50406 | 50406 | 50416 | 50410 |
| 8 | 4 | $\lvert\mathcal{R}\rvert$ | 1891 | 1951 | 1891 | 1996 | 1937 | 2012 | 1949 | 2008 |
| | | WSC | 45471 | 45639 | 45481 | 45888 | 45721 | 45950 | 45775 | 45959 |
| 8 | 9 | $\lvert\mathcal{R}\rvert$ | 1527 | 1577 | 1532 | 1588 | 1593 | 1660 | 1591 | 1670 |
| | | WSC | 47031 | 47204 | 47069 | 47338 | 47811 | 48008 | 47773 | 48149 |
| 8 | 14 | $\lvert\mathcal{R}\rvert$ | 1312 | 1316 | 1317 | 1319 | 1318 | 1318 | 1317 | 1319 |
| | | WSC | 47728 | 47739 | 47768 | 47773 | 47780 | 47780 | 47790 | 47808 |
| 8 | 19 | $\lvert\mathcal{R}\rvert$ | 1275 | 1278 | 1278 | 1281 | 1275 | 1278 | 1280 | 1282 |
| | | WSC | 47647 | 47677 | 47703 | 47713 | 47687 | 47669 | 47741 | 47733 |
| 8 | 24 | $\lvert\mathcal{R}\rvert$ | 1269 | 1267 | 1272 | 1272 | 1268 | 1269 | 1272 | 1270 |
| | | WSC | 47707 | 47644 | 47731 | 47731 | 47695 | 47697 | 47729 | 47723 |
| 14 | 2 | $\lvert\mathcal{R}\rvert$ | 517 | 525 | 522 | 521 | 527 | 529 | 523 | 531 |
| | | WSC | 46040 | 45996 | 46076 | 46073 | 46065 | 46073 | 46079 | 46104 |
| 14 | 7 | $\lvert\mathcal{R}\rvert$ | 458 | 454 | 455 | 460 | 463 | 458 | 462 | 463 |
| | | WSC | 46103 | 46153 | 46211 | 46238 | 46231 | 46172 | 46273 | 46273 |
| 14 | 12 | $\lvert\mathcal{R}\rvert$ | 420 | 425 | 420 | 419 | 424 | 424 | 422 | 422 |
| | | WSC | 46177 | 46152 | 46211 | 46198 | 46215 | 46223 | 46248 | 46248 |
| 14 | 17 | $\lvert\mathcal{R}\rvert$ | 369 | 370 | 367 | 368 | 372 | 371 | 367 | 367 |
| | | WSC | 46102 | 46098 | 46124 | 46130 | 46052 | 46092 | 46154 | 46128 |
| 14 | 24 | $\lvert\mathcal{R}\rvert$ | 348 | 350 | 348 | 348 | 350 | 349 | 347 | 347 |
| | | WSC | 46098 | 46074 | 46122 | 46122 | 46088 | 46086 | 46120 | 46120 |
| 20 | 2 | $\lvert\mathcal{R}\rvert$ | 339 | 340 | 338 | 336 | 339 | 339 | 337 | 335 |
| | | WSC | 46029 | 46025 | 46047 | 46041 | 46021 | 46024 | 46045 | 46039 |
| 20 | 7 | $\lvert\mathcal{R}\rvert$ | 309 | 312 | 310 | 308 | 310 | 308 | 310 | 309 |
| | | WSC | 46004 | 46007 | 46034 | 46018 | 46000 | 45971 | 46040 | 46032 |
| 20 | 12 | $\lvert\mathcal{R}\rvert$ | 300 | 299 | 298 | 298 | 298 | 297 | 297 | 297 |
| | | WSC | 45988 | 45988 | 46022 | 46022 | 45962 | 45981 | 46020 | 46020 |
| 20 | 17 | $\lvert\mathcal{R}\rvert$ | 300 | 297 | 297 | 298 | 300 | 301 | 296 | 297 |
| | | WSC | 45970 | 45981 | 46017 | 46022 | 45972 | 45939 | 46015 | 46020 |
| 20 | 24 | $\lvert\mathcal{R}\rvert$ | 286 | 288 | 287 | 287 | 290 | 289 | 286 | 286 |
| | | WSC | 45972 | 45973 | 46000 | 46000 | 45957 | 45924 | 45998 | 45998 |
| 24 | 2 | $\lvert\mathcal{R}\rvert$ | 291 | 293 | 288 | 288 | 290 | 290 | 288 | 288 |
| | | WSC | 45926 | 45928 | 46002 | 46002 | 45976 | 45988 | 46002 | 46002 |
| 24 | 7 | $\lvert\mathcal{R}\rvert$ | 283 | 283 | 280 | 280 | 282 | 284 | 280 | 280 |
| | | WSC | 45962 | 45966 | 45986 | 45986 | 45962 | 45903 | 45986 | 45986 |
| 24 | 12 | $\lvert\mathcal{R}\rvert$ | 279 | 279 | 278 | 278 | 282 | 281 | 278 | 278 |
| | | WSC | 45960 | 45961 | 45982 | 45982 | 45939 | 45948 | 45982 | 45982 |
| 24 | 17 | $\lvert\mathcal{R}\rvert$ | 282 | 282 | 278 | 278 | 280 | 281 | 278 | 278 |
| | | WSC | 45908 | 45940 | 45982 | 45982 | 45951 | 45937 | 45982 | 45982 |
| 24 | 24 | $\lvert\mathcal{R}\rvert$ | 279 | 281 | 277 | 277 | 280 | 280 | 277 | 277 |
| | | WSC | 45948 | 45953 | 45980 | 45980 | 45934 | 45934 | 45980 | 45980 |

Table 43: Role-set size and WSC value - Dataset Customer

| | $\lvert\mathcal{R}\rvert$ OF | $\lvert\mathcal{R}\rvert$ OR | $\lvert\mathcal{R}\rvert$ UF | $\lvert\mathcal{R}\rvert$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| $\text{PRUCC}_1$ | 11 | 6 | 13 | 10 | 16 | 8 | 2 | 2 |
| $\text{PRUCC}_2$ | 7 | 5 | 15 | 11 | 15 | 13 | 1 | 0 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 11 | 16 |
| equal | 10 | 0 |
| worse | 4 | 9 |

Table 44: Minumum values - Dataset Customer

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 14 | 5 | 4 | 2 | 0 | 18 | 5 | 2 | 0 | 0 |
| OR | 19 | 3 | 2 | 1 | 0 | 20 | 3 | 1 | 1 | 0 |
| UF | 12 | 1 | 10 | 2 | 0 | 10 | 4 | 10 | 1 | 0 |
| UR | 15 | 3 | 6 | 1 | 0 | 14 | 1 | 9 | 1 | 0 |

Table 45: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Customer

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 9 | 13 | 3 | 0 | 0 | 10 | 11 | 4 | 0 | 0 |
| OR | 17 | 7 | 1 | 0 | 0 | 12 | 9 | 4 | 0 | 0 |
| UF | 23 | 0 | 2 | 0 | 0 | 24 | 1 | 0 | 0 | 0 |
| UR | 23 | 2 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |

Table 46: Number of times variants reached minumum value for $WSC$ - Dataset Customer

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 3.7 | 4.92 | 3.18 | 3.9 | 2.4 | 2.94 | 5.0 | 5.44 |
| PRUCC$_2$ | 5.56 | 5.72 | 4.18 | 4.84 | 3.36 | 3.52 | 6.62 | 6.72 |

Table 47: Heuristics ranking - Dataset Customer

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Customer | 3.7 | 4.92 | 3.18 | 3.9 | 5.56 | 5.72 | 4.18 | 4.84 |

Table 48: Heuristics ranking on $\mathcal{R}$ - Dataset Customer

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Customer | 2.4 | 2.94 | 5.0 | 5.44 | 3.36 | 3.52 | 6.62 | 6.72 |

Table 49: Heuristics ranking on $WSC$ - Dataset Customer

## 1.8 Firewall 1

| $mru$ | $mpr$ | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 309 | $\lvert\mathcal{R}\rvert$ | 90 | 90 | 92 | 92 | 90 | 90 | 92 | 92 |
| | | WSC | 7116 | 7116 | 7122 | 7122 | 7117 | 7116 | 7122 | 7122 |
| 2 | 386 | $\lvert\mathcal{R}\rvert$ | 90 | 90 | 92 | 92 | 90 | 90 | 92 | 92 |
| | | WSC | 7116 | 7117 | 7122 | 7122 | 7117 | 7116 | 7122 | 7122 |
| 2 | 463 | $\lvert\mathcal{R}\rvert$ | 90 | 90 | 92 | 93 | 90 | 90 | 92 | 91 |
| | | WSC | 7117 | 7117 | 7122 | 7124 | 7117 | 7117 | 7122 | 7120 |
| 2 | 540 | $\lvert\mathcal{R}\rvert$ | 90 | 90 | 93 | 93 | 90 | 90 | 91 | 91 |
| | | WSC | 7117 | 7116 | 7124 | 7129 | 7117 | 7117 | 7120 | 7120 |
| 2 | 616 | $\lvert\mathcal{R}\rvert$ | 90 | 90 | 92 | 92 | 90 | 90 | 91 | 92 |
| | | WSC | 7116 | 7117 | 7122 | 7122 | 7117 | 7116 | 7120 | 7122 |
| 4 | 155 | $\lvert\mathcal{R}\rvert$ | 93 | 95 | 94 | 96 | 97 | 100 | 99 | 102 |
| | | WSC | 5636 | 5811 | 5641 | 5816 | 6492 | 6586 | 6501 | 6602 |
| 4 | 270 | $\lvert\mathcal{R}\rvert$ | 87 | 87 | 88 | 88 | 87 | 87 | 89 | 89 |
| | | WSC | 6990 | 6990 | 6995 | 7003 | 6990 | 6990 | 6999 | 6999 |
| 4 | 385 | $\lvert\mathcal{R}\rvert$ | 86 | 86 | 87 | 87 | 86 | 86 | 88 | 88 |
| | | WSC | 6988 | 6983 | 6996 | 6996 | 6988 | 6988 | 6997 | 6997 |
| 4 | 500 | $\lvert\mathcal{R}\rvert$ | 86 | 86 | 87 | 87 | 86 | 86 | 88 | 88 |
| | | WSC | 6988 | 6983 | 6996 | 6996 | 6988 | 6988 | 6994 | 6994 |
| 4 | 616 | $\lvert\mathcal{R}\rvert$ | 86 | 86 | 87 | 87 | 86 | 86 | 88 | 88 |
| | | WSC | 6988 | 6988 | 6993 | 7001 | 6988 | 6988 | 6994 | 6997 |
| 6 | 103 | $\lvert\mathcal{R}\rvert$ | 98 | 99 | 99 | 99 | 105 | 114 | 106 | 114 |
| | | WSC | 3903 | 3921 | 3916 | 3825 | 4762 | 5612 | 4635 | 5386 |
| 6 | 231 | $\lvert\mathcal{R}\rvert$ | 86 | 86 | 87 | 87 | 86 | 86 | 87 | 87 |
| | | WSC | 6863 | 6863 | 6873 | 6871 | 6917 | 6912 | 6870 | 6870 |
| 6 | 359 | $\lvert\mathcal{R}\rvert$ | 84 | 84 | 85 | 85 | 84 | 84 | 85 | 85 |
| | | WSC | 6859 | 6859 | 6864 | 6869 | 6913 | 6913 | 6863 | 6871 |
| 6 | 487 | $\lvert\mathcal{R}\rvert$ | 84 | 84 | 85 | 85 | 84 | 84 | 85 | 85 |
| | | WSC | 6859 | 6859 | 6869 | 6867 | 6913 | 6913 | 6866 | 6866 |
| 6 | 616 | $\lvert\mathcal{R}\rvert$ | 84 | 84 | 85 | 85 | 84 | 84 | 85 | 85 |
| | | WSC | 6859 | 6859 | 6869 | 6867 | 6913 | 6908 | 6863 | 6866 |
| 8 | 78 | $\lvert\mathcal{R}\rvert$ | 92 | 97 | 98 | 107 | 102 | 111 | 106 | 109 |
| | | WSC | 4210 | 4544 | 4385 | 5040 | 4995 | 5496 | 5246 | 5270 |
| 8 | 212 | $\lvert\mathcal{R}\rvert$ | 83 | 83 | 86 | 86 | 86 | 87 | 87 | 88 |
| | | WSC | 5404 | 5399 | 5396 | 5393 | 6033 | 6040 | 6018 | 6033 |
| 8 | 346 | $\lvert\mathcal{R}\rvert$ | 78 | 78 | 81 | 81 | 79 | 79 | 80 | 80 |
| | | WSC | 6228 | 6223 | 6220 | 6220 | 6230 | 6230 | 6218 | 6215 |
| 8 | 480 | $\lvert\mathcal{R}\rvert$ | 78 | 78 | 81 | 81 | 79 | 79 | 80 | 80 |
| | | WSC | 6223 | 6228 | 6217 | 6220 | 6230 | 6230 | 6215 | 6215 |
| 8 | 616 | $\lvert\mathcal{R}\rvert$ | 78 | 78 | 81 | 81 | 79 | 79 | 80 | 80 |
| | | WSC | 6228 | 6228 | 6217 | 6222 | 6230 | 6230 | 6218 | 6218 |

Table 50: Role-set size and WSC value - Dataset Firewall 1

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 20 | 17 | 0 | 0 | 12 | 11 | 3 | 3 |
| $\text{PRUCC}_2$ | 20 | 16 | 0 | 0 | 8 | 9 | 8 | 5 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 7 | 12 |
| equal | 13 | 6 |
| worse | 0 | 2 |

Table 51: Minumum values - Dataset Firewall 1

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 0 | 3 | 17 | 0 | 0 | 0 | 4 | 16 | 0 | 0 |
| OR | 3 | 0 | 17 | 0 | 0 | 4 | 0 | 16 | 0 | 0 |
| UF | 20 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 |
| UR | 20 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 |

Table 52: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Firewall 1

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 8 | 4 | 8 | 0 | 0 | 12 | 2 | 6 | 0 | 0 |
| OR | 9 | 3 | 8 | 0 | 0 | 11 | 3 | 6 | 0 | 0 |
| UF | 17 | 2 | 1 | 0 | 0 | 12 | 4 | 4 | 0 | 0 |
| UR | 17 | 2 | 1 | 0 | 0 | 15 | 1 | 4 | 0 | 0 |

Table 53: Number of times variants reached minumum value for $WSC$ - Dataset Firewall 1

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 2.075 | 2.325 | 5.825 | 6.15 | 2.6 | 2.75 | 4.75 | 5.375 |
| PRUCC$_2$ | 3.05 | 3.6 | 6.3 | 6.675 | 5.125 | 5.2 | 4.825 | 5.375 |

Table 54: Heuristics ranking - Dataset Firewall 1

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 1 | 2.075 | 2.325 | 5.825 | 6.15 | 3.05 | 3.6 | 6.3 | 6.675 |

Table 55: Heuristics ranking on $\mathcal{R}$ - Dataset Firewall 1

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 1 | 2.6 | 2.75 | 4.75 | 5.375 | 5.125 | 5.2 | 4.825 | 5.375 |

Table 56: Heuristics ranking on $WSC$ - Dataset Firewall 1

## 1.9 Firewall 2

| $mru$ | $mpr$ | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 295 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1541 | 1541 | 1541 | 1541 | 1552 | 1552 | 1552 | 1552 |
| 2 | 368 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1541 | 1541 | 1541 | 1541 | 1552 | 1552 | 1552 | 1552 |
| 2 | 441 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1541 | 1541 | 1541 | 1541 | 1552 | 1552 | 1552 | 1552 |
| 2 | 514 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1541 | 1541 | 1541 | 1541 | 1552 | 1552 | 1552 | 1552 |
| 2 | 589 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1541 | 1541 | 1541 | 1541 | 1552 | 1552 | 1552 | 1552 |

Table 57: Role-set size and WSC value - Dataset Firewall 2

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| $\text{PRUCC}_2$ | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 0 | 5 |
| equal | 5 | 0 |
| worse | 0 | 0 |

Table 58: Minumum values - Dataset Firewall 2

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| OR | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| UF | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| UR | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |

Table 59: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Firewall 2

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| OR | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| UF | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| UR | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |

Table 60: Number of times variants reached minumum value for $WSC$ - Dataset Firewall 2

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 4.5 | 4.5 | 4.5 | 4.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| $\text{PRUCC}_2$ | 4.5 | 4.5 | 4.5 | 4.5 | 6.5 | 6.5 | 6.5 | 6.5 |

Table 61: Heuristics ranking - Dataset Firewall 2

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 2 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |

Table 62: Heuristics ranking on $\mathcal{R}$ - Dataset Firewall 2

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 2 | 2.5 | 2.5 | 2.5 | 2.5 | 6.5 | 6.5 | 6.5 | 6.5 |

Table 63: Heuristics ranking on $WSC$ - Dataset Firewall 2

# 2 Fixed $mpr$

## 2.1 Americas Large

| $mpr$ | $mru$ | | PRUCC$_1$ OF | PRUCC$_1$ OR | PRUCC$_1$ UF | PRUCC$_1$ UR | PRUCC$_2$ OF | PRUCC$_2$ OR | PRUCC$_2$ UF | PRUCC$_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 367 | $\|\mathcal{R}\|$ | 6182 | 8789 | 6189 | 8256 | 6209 | 9092 | 6199 | 8342 |
| | | WSC | 115395 | 126872 | 114292 | 122640 | 115165 | 127860 | 114263 | 123359 |
| 2 | 458 | $\|\mathcal{R}\|$ | 6141 | 8539 | 6140 | 8014 | 6157 | 8507 | 6131 | 8149 |
| | | WSC | 115503 | 128449 | 114412 | 122538 | 115323 | 127771 | 114399 | 123455 |
| 2 | 549 | $\|\mathcal{R}\|$ | 6122 | 8415 | 6149 | 7997 | 6134 | 8416 | 6131 | 7976 |
| | | WSC | 115092 | 128098 | 114304 | 123268 | 115149 | 128259 | 114469 | 122761 |
| 2 | 640 | $\|\mathcal{R}\|$ | 6128 | 8443 | 6132 | 7957 | 6153 | 8387 | 6106 | 8010 |
| | | WSC | 115432 | 128432 | 114465 | 122849 | 115440 | 128384 | 114378 | 123120 |
| 2 | 732 | $\|\mathcal{R}\|$ | 6154 | 8482 | 6103 | 7985 | 6142 | 8435 | 6129 | 7983 |
| | | WSC | 115387 | 128880 | 114422 | 122635 | 115304 | 128506 | 114338 | 123173 |
| 185 | 4 | $\|\mathcal{R}\|$ | 684 | 728 | 699 | 738 | 689 | 742 | 698 | 752 |
| | | WSC | 82795 | 90431 | 85277 | 92034 | 81953 | 91458 | 82013 | 92314 |
| 185 | 186 | $\|\mathcal{R}\|$ | 620 | 728 | 626 | 728 | 618 | 725 | 630 | 726 |
| | | WSC | 71146 | 88587 | 70987 | 87986 | 71105 | 89100 | 71332 | 88154 |
| 185 | 368 | $\|\mathcal{R}\|$ | 620 | 720 | 630 | 732 | 616 | 725 | 628 | 724 |
| | | WSC | 71217 | 87765 | 71814 | 88450 | 70922 | 88129 | 70995 | 87855 |
| 185 | 550 | $\|\mathcal{R}\|$ | 614 | 720 | 631 | 727 | 620 | 725 | 631 | 726 |
| | | WSC | 69814 | 87484 | 71420 | 87930 | 70964 | 88656 | 72149 | 87476 |
| 185 | 732 | $\|\mathcal{R}\|$ | 621 | 727 | 632 | 728 | 616 | 721 | 629 | 727 |
| | | WSC | 70807 | 88547 | 71975 | 87996 | 70292 | 87515 | 70991 | 87989 |
| 368 | 2 | $\|\mathcal{R}\|$ | 548 | 550 | 542 | 546 | 562 | 560 | 567 | 568 |
| | | WSC | 99219 | 97206 | 97066 | 96697 | 101087 | 98947 | 100947 | 98258 |
| 368 | 184 | $\|\mathcal{R}\|$ | 492 | 536 | 525 | 541 | 492 | 542 | 526 | 539 |
| | | WSC | 82826 | 90604 | 83634 | 90960 | 82779 | 91420 | 83631 | 90020 |
| 368 | 366 | $\|\mathcal{R}\|$ | 490 | 539 | 525 | 541 | 493 | 541 | 529 | 539 |
| | | WSC | 82614 | 90551 | 83603 | 91461 | 82354 | 91260 | 84064 | 90057 |
| 368 | 548 | $\|\mathcal{R}\|$ | 492 | 535 | 525 | 540 | 490 | 542 | 526 | 539 |
| | | WSC | 82715 | 90603 | 83605 | 90529 | 82601 | 90920 | 83938 | 91049 |
| 368 | 732 | $\|\mathcal{R}\|$ | 492 | 538 | 527 | 540 | 494 | 541 | 528 | 541 |
| | | WSC | 82799 | 90751 | 83650 | 90119 | 82920 | 90888 | 83965 | 90319 |
| 551 | 2 | $\|\mathcal{R}\|$ | 451 | 447 | 447 | 448 | 448 | 452 | 458 | 459 |
| | | WSC | 99860 | 97159 | 97433 | 97985 | 98805 | 97982 | 98732 | 98275 |
| 551 | 184 | $\|\mathcal{R}\|$ | 434 | 438 | 440 | 441 | 435 | 437 | 440 | 441 |
| | | WSC | 92188 | 92518 | 92155 | 92969 | 92128 | 92405 | 92155 | 92960 |
| 551 | 366 | $\|\mathcal{R}\|$ | 436 | 443 | 440 | 441 | 437 | 439 | 440 | 441 |
| | | WSC | 92249 | 93288 | 92150 | 92926 | 92251 | 93029 | 92137 | 93000 |
| 551 | 548 | $\|\mathcal{R}\|$ | 445 | 441 | 440 | 441 | 436 | 439 | 440 | 441 |
| | | WSC | 92855 | 93163 | 92137 | 92825 | 92248 | 92976 | 92150 | 93020 |
| 551 | 732 | $\|\mathcal{R}\|$ | 439 | 438 | 440 | 441 | 441 | 437 | 440 | 441 |
| | | WSC | 92383 | 92460 | 92150 | 92852 | 92438 | 92763 | 92137 | 92920 |
| 732 | 2 | $\|\mathcal{R}\|$ | 421 | 422 | 423 | 423 | 425 | 425 | 432 | 432 |
| | | WSC | 101164 | 101201 | 101023 | 101010 | 101975 | 101987 | 101788 | 101793 |
| 732 | 184 | $\|\mathcal{R}\|$ | 417 | 416 | 415 | 415 | 414 | 416 | 415 | 415 |
| | | WSC | 93439 | 93317 | 93143 | 93143 | 93205 | 93317 | 93125 | 93138 |
| 732 | 366 | $\|\mathcal{R}\|$ | 414 | 413 | 415 | 415 | 415 | 417 | 415 | 415 |
| | | WSC | 93204 | 93211 | 93143 | 93143 | 93255 | 93362 | 93143 | 93143 |
| 732 | 548 | $\|\mathcal{R}\|$ | 413 | 413 | 415 | 415 | 416 | 417 | 415 | 415 |
| | | WSC | 93194 | 93144 | 93143 | 93125 | 93303 | 93374 | 93143 | 93143 |
| 732 | 732 | $\|\mathcal{R}\|$ | 414 | 414 | 415 | 415 | 415 | 414 | 415 | 415 |
| | | WSC | 93263 | 93203 | 93143 | 93143 | 93323 | 93204 | 93138 | 93143 |

Table 64: Role-set size and WSC value - Dataset Americas large

| | $\|\mathcal{R}\|$ OF | $\|\mathcal{R}\|$ OR | $\|\mathcal{R}\|$ UF | $\|\mathcal{R}\|$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| PRUCC$_1$ | 17 | 5 | 6 | 1 | 8 | 1 | 13 | 6 |
| PRUCC$_2$ | 16 | 4 | 7 | 2 | 10 | 1 | 13 | 3 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 14 | 9 |
| equal | 2 | 1 |
| worse | 9 | 15 |

Table 65: Minumum values - Dataset Americas large

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 8 | 15 | 2 | 0 | 0 | 9 | 14 | 1 | 1 | 0 |
| OR | 20 | 2 | 3 | 0 | 0 | 21 | 3 | 1 | 0 | 0 |
| UF | 19 | 4 | 2 | 0 | 0 | 18 | 5 | 1 | 1 | 0 |
| UR | 24 | 0 | 1 | 0 | 0 | 23 | 0 | 1 | 1 | 0 |

Table 66: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Americas large

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 17 | 8 | 0 | 0 | 0 | 15 | 10 | 0 | 0 | 0 |
| OR | 24 | 1 | 0 | 0 | 0 | 24 | 1 | 0 | 0 | 0 |
| UF | 12 | 10 | 3 | 0 | 0 | 12 | 11 | 2 | 0 | 0 |
| UR | 19 | 3 | 3 | 0 | 0 | 22 | 1 | 2 | 0 | 0 |

Table 67: Number of times variants reached minumum value for $WSC$ - Dataset Americas large

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 2.4 | 5.04 | 3.42 | 5.88 | 3.8 | 6.06 | 2.54 | 5.0 |
| PRUCC$_2$ | 3.1 | 5.92 | 4.0 | 6.24 | 3.6 | 6.78 | 2.72 | 5.5 |

Table 68: Heuristics ranking - Dataset Americas large

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas large | 2.4 | 5.04 | 3.42 | 5.88 | 3.1 | 5.92 | 4.0 | 6.24 |

Table 69: Heuristics ranking on $\mathcal{R}$ - Dataset Americas large

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas large | 3.8 | 6.06 | 2.54 | 5.0 | 3.6 | 6.78 | 2.72 | 5.5 |

Table 70: Heuristics ranking on $WSC$ - Dataset Americas large

## 2.2 Americas Small

| $mpr$ | $mru$ | | $\text{PRUCC}_1$ OF | $\text{PRUCC}_1$ OR | $\text{PRUCC}_1$ UF | $\text{PRUCC}_1$ UR | $\text{PRUCC}_2$ OF | $\text{PRUCC}_2$ OR | $\text{PRUCC}_2$ UF | $\text{PRUCC}_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 155 | $\lvert\mathcal{R}\rvert$ | 1008 | 1100 | 1002 | 1058 | 1008 | 1096 | 998 | 1059 |
| | | WSC | 58208 | 59619 | 58773 | 59413 | 58113 | 59324 | 58452 | 59287 |
| 2 | 193 | $\lvert\mathcal{R}\rvert$ | 987 | 1064 | 982 | 1037 | 988 | 1075 | 982 | 1039 |
| | | WSC | 58354 | 59673 | 58764 | 59412 | 58367 | 59610 | 58632 | 59273 |
| 2 | 231 | $\lvert\mathcal{R}\rvert$ | 987 | 1067 | 981 | 1037 | 989 | 1065 | 981 | 1050 |
| | | WSC | 58256 | 59162 | 58649 | 59264 | 58459 | 59344 | 58617 | 59291 |
| 2 | 269 | $\lvert\mathcal{R}\rvert$ | 986 | 1055 | 981 | 1038 | 987 | 1069 | 981 | 1048 |
| | | WSC | 58293 | 59135 | 58744 | 59152 | 58326 | 59415 | 58607 | 59184 |
| 2 | 309 | $\lvert\mathcal{R}\rvert$ | 983 | 1080 | 981 | 1024 | 984 | 1066 | 978 | 1030 |
| | | WSC | 58189 | 59418 | 58522 | 59069 | 58219 | 59396 | 58423 | 59362 |
| 67 | 5 | $\lvert\mathcal{R}\rvert$ | 325 | 346 | 344 | 368 | 335 | 382 | 356 | 398 |
| | | WSC | 15985 | 17255 | 16721 | 18000 | 16738 | 19706 | 17428 | 20015 |
| 67 | 81 | $\lvert\mathcal{R}\rvert$ | 205 | 206 | 213 | 216 | 205 | 207 | 214 | 216 |
| | | WSC | 11350 | 11336 | 11540 | 11683 | 11396 | 11353 | 11602 | 11637 |
| 67 | 157 | $\lvert\mathcal{R}\rvert$ | 205 | 207 | 214 | 215 | 205 | 207 | 214 | 216 |
| | | WSC | 11399 | 11393 | 11595 | 11618 | 11346 | 11348 | 11594 | 11673 |
| 67 | 233 | $\lvert\mathcal{R}\rvert$ | 205 | 206 | 214 | 215 | 205 | 207 | 213 | 216 |
| | | WSC | 11331 | 11259 | 11602 | 11619 | 11398 | 11467 | 11545 | 11671 |
| 67 | 309 | $\lvert\mathcal{R}\rvert$ | 205 | 206 | 213 | 215 | 205 | 207 | 214 | 216 |
| | | WSC | 11339 | 11335 | 11544 | 11698 | 11412 | 11417 | 11594 | 11637 |
| 132 | 3 | $\lvert\mathcal{R}\rvert$ | 299 | 304 | 307 | 312 | 315 | 320 | 318 | 322 |
| | | WSC | 21686 | 22196 | 21919 | 22392 | 23287 | 23548 | 22899 | 23132 |
| 132 | 79 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 208 | 196 | 196 | 207 | 208 |
| | | WSC | 11125 | 11209 | 11613 | 11652 | 11125 | 11193 | 11613 | 11666 |
| 132 | 155 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 206 | 196 | 196 | 207 | 207 |
| | | WSC | 11105 | 11115 | 11613 | 11633 | 11112 | 11113 | 11614 | 11621 |
| 132 | 231 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 208 | 207 | 196 | 196 | 207 | 208 |
| | | WSC | 11211 | 11124 | 11665 | 11619 | 11194 | 11143 | 11620 | 11652 |
| 132 | 309 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 206 | 196 | 196 | 207 | 207 |
| | | WSC | 11223 | 11211 | 11619 | 11620 | 11112 | 11196 | 11673 | 11672 |
| 197 | 2 | $\lvert\mathcal{R}\rvert$ | 267 | 268 | 267 | 268 | 269 | 271 | 282 | 283 |
| | | WSC | 24724 | 24703 | 24967 | 24970 | 24713 | 24799 | 25088 | 25091 |
| 197 | 79 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 206 | 196 | 196 | 207 | 207 |
| | | WSC | 11217 | 11128 | 11613 | 11633 | 11116 | 11114 | 11609 | 11684 |
| 197 | 156 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 208 | 208 | 196 | 196 | 208 | 207 |
| | | WSC | 11191 | 11126 | 11664 | 11664 | 11117 | 11140 | 11654 | 11602 |
| 197 | 233 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 207 | 196 | 196 | 207 | 207 |
| | | WSC | 11123 | 11112 | 11602 | 11614 | 11104 | 11124 | 11682 | 11620 |
| 197 | 309 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 207 | 196 | 196 | 207 | 206 |
| | | WSC | 11135 | 11125 | 11613 | 11672 | 11200 | 11120 | 11613 | 11640 |
| 262 | 2 | $\lvert\mathcal{R}\rvert$ | 262 | 262 | 262 | 262 | 265 | 265 | 277 | 277 |
| | | WSC | 25152 | 25088 | 25348 | 25348 | 25124 | 25084 | 25469 | 25469 |
| 262 | 79 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 207 | 196 | 196 | 208 | 207 |
| | | WSC | 11207 | 11105 | 11684 | 11610 | 11112 | 11136 | 11653 | 11614 |
| 262 | 156 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 206 | 196 | 196 | 206 | 206 |
| | | WSC | 11107 | 11129 | 11618 | 11640 | 11111 | 11117 | 11632 | 11632 |
| 262 | 233 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 208 | 206 | 196 | 196 | 207 | 207 |
| | | WSC | 11203 | 11125 | 11653 | 11628 | 11187 | 11199 | 11601 | 11600 |
| 262 | 309 | $\lvert\mathcal{R}\rvert$ | 196 | 196 | 207 | 207 | 196 | 196 | 207 | 208 |
| | | WSC | 11194 | 11111 | 11610 | 11612 | 11126 | 11127 | 11603 | 11663 |

Table 71: Role-set size and WSC value - Dataset Americas small

| | $\lvert\mathcal{R}\rvert$ OF | $\lvert\mathcal{R}\rvert$ OR | $\lvert\mathcal{R}\rvert$ UF | $\lvert\mathcal{R}\rvert$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| $\text{PRUCC}_1$ | 20 | 13 | 7 | 1 | 10 | 15 | 0 | 0 |
| $\text{PRUCC}_2$ | 20 | 13 | 5 | 0 | 19 | 5 | 1 | 0 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 4 | 16 |
| equal | 19 | 1 |
| worse | 2 | 8 |

Table 72: Minumum values - Dataset Americas small

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 5 | 6 | 13 | 0 | 1 | 5 | 7 | 13 | 0 | 0 |
| OR | 12 | 0 | 12 | 0 | 1 | 12 | 0 | 13 | 0 | 0 |
| UF | 18 | 5 | 1 | 0 | 1 | 20 | 5 | 0 | 0 | 0 |
| UR | 24 | 0 | 0 | 0 | 1 | 25 | 0 | 0 | 0 | 0 |

Table 73: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Americas small

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 15 | 10 | 0 | 0 | 0 | 6 | 19 | 0 | 0 | 0 |
| OR | 10 | 15 | 0 | 0 | 0 | 20 | 5 | 0 | 0 | 0 |
| UF | 25 | 0 | 0 | 0 | 0 | 24 | 1 | 0 | 0 | 0 |
| UR | 25 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |

Table 74: Number of times variants reached minumum value for $WSC$ - Dataset Americas small

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 2.3 | 3.7 | 4.9 | 5.64 | 2.5 | 3.12 | 5.24 | 6.52 |
| $\text{PRUCC}_2$ | 2.92 | 4.32 | 5.34 | 6.88 | 2.34 | 4.0 | 5.44 | 6.84 |

Table 75: Heuristics ranking - Dataset Americas small

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas small | 2.3 | 3.7 | 4.9 | 5.64 | 2.92 | 4.32 | 5.34 | 6.88 |

Table 76: Heuristics ranking on $\mathcal{R}$ - Dataset Americas small

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Americas small | 2.5 | 3.12 | 5.24 | 6.52 | 2.34 | 4.0 | 5.44 | 6.84 |

Table 77: Heuristics ranking on $WSC$ - Dataset Americas small

## 2.3 Apj

| | | | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $mpr$ | $mru$ | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 29 | $\|\mathcal{R}\|$ | 792 | 811 | 796 | 800 | 794 | 803 | 795 | 804 |
| | | WSC | 6729 | 6737 | 6694 | 6707 | 6738 | 6736 | 6689 | 6709 |
| 2 | 36 | $\|\mathcal{R}\|$ | 792 | 801 | 793 | 802 | 790 | 805 | 795 | 800 |
| | | WSC | 6731 | 6709 | 6691 | 6713 | 6733 | 6748 | 6697 | 6717 |
| 2 | 43 | $\|\mathcal{R}\|$ | 790 | 803 | 792 | 795 | 793 | 802 | 793 | 801 |
| | | WSC | 6732 | 6722 | 6687 | 6694 | 6730 | 6712 | 6693 | 6717 |
| 2 | 50 | $\|\mathcal{R}\|$ | 789 | 807 | 790 | 794 | 793 | 800 | 792 | 799 |
| | | WSC | 6739 | 6740 | 6687 | 6695 | 6728 | 6708 | 6691 | 6707 |
| 2 | 57 | $\|\mathcal{R}\|$ | 792 | 806 | 793 | 799 | 791 | 805 | 794 | 803 |
| | | WSC | 6743 | 6716 | 6689 | 6714 | 6740 | 6743 | 6696 | 6711 |
| 14 | 5 | $\|\mathcal{R}\|$ | 525 | 546 | 520 | 536 | 531 | 543 | 521 | 538 |
| | | WSC | 5574 | 5865 | 5466 | 5677 | 5643 | 5840 | 5501 | 5738 |
| 14 | 18 | $\|\mathcal{R}\|$ | 469 | 469 | 470 | 470 | 470 | 470 | 470 | 470 |
| | | WSC | 5204 | 5202 | 5152 | 5147 | 5184 | 5191 | 5196 | 5153 |
| 14 | 31 | $\|\mathcal{R}\|$ | 469 | 469 | 470 | 470 | 470 | 470 | 470 | 470 |
| | | WSC | 5204 | 5211 | 5148 | 5144 | 5182 | 5195 | 5142 | 5153 |
| 14 | 44 | $\|\mathcal{R}\|$ | 470 | 469 | 470 | 470 | 470 | 469 | 470 | 470 |
| | | WSC | 5193 | 5193 | 5142 | 5197 | 5191 | 5195 | 5143 | 5145 |
| 14 | 57 | $\|\mathcal{R}\|$ | 469 | 470 | 470 | 470 | 469 | 470 | 470 | 470 |
| | | WSC | 5204 | 5191 | 5144 | 5153 | 5193 | 5193 | 5142 | 5142 |
| 26 | 3 | $\|\mathcal{R}\|$ | 507 | 509 | 508 | 510 | 509 | 511 | 510 | 512 |
| | | WSC | 5881 | 5911 | 5871 | 5901 | 5885 | 5915 | 5877 | 5907 |
| 26 | 16 | $\|\mathcal{R}\|$ | 459 | 458 | 459 | 459 | 458 | 459 | 459 | 459 |
| | | WSC | 5158 | 5180 | 5129 | 5124 | 5171 | 5167 | 5120 | 5122 |
| 26 | 29 | $\|\mathcal{R}\|$ | 458 | 459 | 459 | 459 | 458 | 459 | 459 | 459 |
| | | WSC | 5176 | 5167 | 5123 | 5119 | 5178 | 5167 | 5126 | 5127 |
| 26 | 42 | $\|\mathcal{R}\|$ | 458 | 458 | 459 | 459 | 458 | 459 | 459 | 459 |
| | | WSC | 5178 | 5169 | 5124 | 5120 | 5171 | 5167 | 5124 | 5118 |
| 26 | 57 | $\|\mathcal{R}\|$ | 458 | 459 | 459 | 459 | 458 | 459 | 459 | 459 |
| | | WSC | 5169 | 5167 | 5122 | 5119 | 5178 | 5169 | 5121 | 5129 |
| 38 | 2 | $\|\mathcal{R}\|$ | 505 | 505 | 506 | 506 | 506 | 507 | 508 | 508 |
| | | WSC | 5911 | 5911 | 5911 | 5911 | 5915 | 5917 | 5917 | 5917 |
| 38 | 16 | $\|\mathcal{R}\|$ | 454 | 454 | 455 | 455 | 454 | 454 | 455 | 455 |
| | | WSC | 5169 | 5160 | 5110 | 5113 | 5169 | 5169 | 5112 | 5163 |
| 38 | 30 | $\|\mathcal{R}\|$ | 454 | 455 | 455 | 455 | 455 | 455 | 455 | 455 |
| | | WSC | 5171 | 5160 | 5109 | 5118 | 5149 | 5158 | 5110 | 5120 |
| 38 | 44 | $\|\mathcal{R}\|$ | 455 | 454 | 455 | 455 | 454 | 455 | 455 | 455 |
| | | WSC | 5158 | 5160 | 5109 | 5110 | 5160 | 5158 | 5120 | 5111 |
| 38 | 57 | $\|\mathcal{R}\|$ | 454 | 455 | 455 | 455 | 455 | 454 | 455 | 455 |
| | | WSC | 5160 | 5149 | 5113 | 5109 | 5158 | 5169 | 5112 | 5110 |
| 51 | 2 | $\|\mathcal{R}\|$ | 501 | 501 | 502 | 502 | 503 | 502 | 504 | 504 |
| | | WSC | 5903 | 5903 | 5903 | 5903 | 5909 | 5907 | 5909 | 5909 |
| 51 | 16 | $\|\mathcal{R}\|$ | 454 | 454 | 455 | 455 | 454 | 454 | 455 | 455 |
| | | WSC | 5176 | 5171 | 5111 | 5120 | 5169 | 5169 | 5109 | 5116 |
| 51 | 30 | $\|\mathcal{R}\|$ | 455 | 454 | 455 | 455 | 454 | 455 | 455 | 455 |
| | | WSC | 5149 | 5169 | 5119 | 5111 | 5169 | 5151 | 5110 | 5113 |
| 51 | 44 | $\|\mathcal{R}\|$ | 454 | 454 | 455 | 455 | 454 | 454 | 455 | 455 |
| | | WSC | 5160 | 5162 | 5115 | 5109 | 5169 | 5169 | 5111 | 5117 |
| 51 | 57 | $\|\mathcal{R}\|$ | 455 | 454 | 455 | 455 | 455 | 455 | 455 | 455 |
| | | WSC | 5158 | 5160 | 5109 | 5112 | 5158 | 5149 | 5114 | 5113 |

Table 78: Role-set size and WSC value - Dataset Apj

| | $\|\mathcal{R}\|$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 19 | 13 | 1 | 0 | 2 | 2 | 16 | 11 |
| PRUCC$_2$ | 20 | 10 | 7 | 4 | 1 | 1 | 18 | 6 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 11 | 18 |
| equal | 12 | 0 |
| worse | 2 | 7 |

Table 79: Minumum values - Dataset Apj

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 6 | 11 | 8 | 0 | 0 | 5 | 12 | 4 | 0 | 4 |
| OR | 12 | 5 | 8 | 0 | 0 | 15 | 3 | 3 | 0 | 4 |
| UF | 24 | 1 | 0 | 0 | 0 | 18 | 2 | 1 | 0 | 4 |
| UR | 25 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 4 |

Table 80: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Apj

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 23 | 0 | 0 | 0 | 2 | 24 | 1 | 0 | 0 | 0 |
| OR | 23 | 0 | 0 | 0 | 2 | 24 | 1 | 0 | 0 | 0 |
| UF | 9 | 14 | 0 | 0 | 2 | 7 | 17 | 1 | 0 | 0 |
| UR | 14 | 9 | 0 | 0 | 2 | 19 | 5 | 1 | 0 | 0 |

Table 81: Number of times variants reached minumum value for $WSC$ - Dataset Apj

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 2.42 | 3.96 | 4.62 | 5.44 | 6.06 | 6.04 | 2.06 | 2.88 |
| PRUCC$_2$ | 3.18 | 5.18 | 5.22 | 5.98 | 6.24 | 6.22 | 2.64 | 3.86 |

Table 82: Heuristics ranking - Dataset Apj

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Apj | 2.42 | 3.96 | 4.62 | 5.44 | 3.18 | 5.18 | 5.22 | 5.98 |

Table 83: Heuristics ranking on $\mathcal{R}$ - Dataset Apj

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Apj | 6.06 | 6.04 | 2.06 | 2.88 | 6.24 | 6.22 | 2.64 | 3.86 |

Table 84: Heuristics ranking on $WSC$ - Dataset Apj

## 2.4 Emea

| $mpr$ | $mru$ | | PRUCC$_1$ OF | PRUCC$_1$ OR | PRUCC$_1$ UF | PRUCC$_1$ UR | PRUCC$_2$ OF | PRUCC$_2$ OR | PRUCC$_2$ UF | PRUCC$_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 277 | $\|\mathcal{R}\|$ | 1754 | 2152 | 1763 | 2131 | 1754 | 2126 | 1767 | 2166 |
| | | WSC | 8945 | 10146 | 8942 | 10098 | 8945 | 10065 | 8951 | 10189 |
| 2 | 346 | $\|\mathcal{R}\|$ | 1731 | 2071 | 1739 | 2092 | 1731 | 2072 | 1739 | 2088 |
| | | WSC | 8922 | 10004 | 8918 | 10061 | 8922 | 10020 | 8918 | 10006 |
| 2 | 415 | $\|\mathcal{R}\|$ | 1731 | 2083 | 1739 | 2105 | 1731 | 2080 | 1739 | 2078 |
| | | WSC | 8922 | 10080 | 8918 | 10095 | 8922 | 10075 | 8918 | 10004 |
| 2 | 484 | $\|\mathcal{R}\|$ | 1731 | 2079 | 1739 | 2079 | 1731 | 2073 | 1739 | 2068 |
| | | WSC | 8922 | 10054 | 8918 | 10003 | 8922 | 10079 | 8918 | 9989 |
| 2 | 553 | $\|\mathcal{R}\|$ | 1731 | 2092 | 1739 | 2072 | 1731 | 2065 | 1739 | 2100 |
| | | WSC | 8922 | 10100 | 8918 | 9976 | 8922 | 9995 | 8918 | 10062 |
| 140 | 4 | $\|\mathcal{R}\|$ | 68 | 69 | 68 | 69 | 69 | 69 | 69 | 69 |
| | | WSC | 7041 | 7143 | 7041 | 7207 | 7081 | 7204 | 7081 | 7206 |
| 140 | 141 | $\|\mathcal{R}\|$ | 67 | 70 | 67 | 69 | 67 | 70 | 67 | 70 |
| | | WSC | 6779 | 7222 | 6779 | 7091 | 6779 | 7227 | 6779 | 7275 |
| 140 | 278 | $\|\mathcal{R}\|$ | 67 | 70 | 67 | 70 | 67 | 70 | 67 | 70 |
| | | WSC | 6779 | 7226 | 6779 | 7231 | 6779 | 7277 | 6779 | 7223 |
| 140 | 415 | $\|\mathcal{R}\|$ | 67 | 68 | 67 | 70 | 67 | 69 | 67 | 70 |
| | | WSC | 6779 | 6947 | 6779 | 7243 | 6779 | 7235 | 6779 | 7221 |
| 140 | 553 | $\|\mathcal{R}\|$ | 67 | 70 | 67 | 69 | 67 | 70 | 67 | 68 |
| | | WSC | 6779 | 7229 | 6779 | 7210 | 6779 | 7221 | 6779 | 6991 |
| 278 | 2 | $\|\mathcal{R}\|$ | 47 | 47 | 47 | 47 | 48 | 48 | 48 | 48 |
| | | WSC | 7306 | 7306 | 7306 | 7306 | 7319 | 7319 | 7319 | 7311 |
| 278 | 140 | $\|\mathcal{R}\|$ | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 |
| | | WSC | 7180 | 7183 | 7180 | 7183 | 7180 | 7306 | 7180 | 7194 |
| 278 | 278 | $\|\mathcal{R}\|$ | 47 | 47 | 47 | 47 | 47 | 46 | 47 | 47 |
| | | WSC | 7180 | 7183 | 7180 | 7183 | 7180 | 7193 | 7180 | 7306 |
| 278 | 416 | $\|\mathcal{R}\|$ | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 |
| | | WSC | 7180 | 7183 | 7180 | 7306 | 7180 | 7183 | 7180 | 7177 |
| 278 | 553 | $\|\mathcal{R}\|$ | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 |
| | | WSC | 7180 | 7238 | 7180 | 7306 | 7180 | 7238 | 7180 | 7183 |
| 416 | 2 | $\|\mathcal{R}\|$ | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| | | WSC | 7290 | 7290 | 7290 | 7290 | 7290 | 7290 | 7290 | 7290 |
| 416 | 140 | $\|\mathcal{R}\|$ | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| | | WSC | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 |
| 416 | 278 | $\|\mathcal{R}\|$ | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| | | WSC | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 |
| 416 | 416 | $\|\mathcal{R}\|$ | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| | | WSC | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 |
| 416 | 553 | $\|\mathcal{R}\|$ | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| | | WSC | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 | 7272 | 7290 |
| 553 | 2 | $\|\mathcal{R}\|$ | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | WSC | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 |
| 553 | 140 | $\|\mathcal{R}\|$ | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | WSC | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 |
| 553 | 278 | $\|\mathcal{R}\|$ | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | WSC | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 |
| 553 | 416 | $\|\mathcal{R}\|$ | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | WSC | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 |
| 553 | 553 | $\|\mathcal{R}\|$ | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | WSC | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 | 7282 |

Table 85: Role-set size and WSC value - Dataset Emea

| | $\|\mathcal{R}\|$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 25 | 15 | 20 | 15 | 20 | 7 | 25 | 7 |
| PRUCC$_2$ | 24 | 16 | 19 | 15 | 19 | 6 | 22 | 8 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 2 | 3 |
| equal | 22 | 21 |
| worse | 1 | 1 |

Table 86: Minumum values - Dataset Emea

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 0 | 5 | 5 | 0 | 15 | 1 | 5 | 4 | 0 | 15 |
| OR | 10 | 0 | 0 | 0 | 15 | 9 | 1 | 0 | 0 | 15 |
| UF | 5 | 0 | 5 | 0 | 15 | 6 | 0 | 4 | 0 | 15 |
| UR | 10 | 0 | 0 | 0 | 15 | 10 | 0 | 0 | 0 | 15 |

Table 87: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Emea

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 5 | 0 | 13 | 0 | 7 | 6 | 1 | 12 | 0 | 6 |
| OR | 18 | 0 | 0 | 0 | 7 | 19 | 0 | 0 | 0 | 6 |
| UF | 0 | 5 | 13 | 0 | 7 | 3 | 4 | 12 | 0 | 6 |
| UR | 18 | 0 | 0 | 0 | 7 | 17 | 2 | 0 | 0 | 6 |

Table 88: Number of times variants reached minumum value for $WSC$ - Dataset Emea

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 3.4 | 5.24 | 3.78 | 5.28 | 3.14 | 5.74 | 2.76 | 5.98 |
| PRUCC$_2$ | 3.72 | 5.06 | 4.14 | 5.38 | 3.4 | 6.2 | 3.14 | 5.64 |

Table 89: Heuristics ranking - Dataset Emea

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Emea | 3.4 | 5.24 | 3.78 | 5.28 | 3.72 | 5.06 | 4.14 | 5.38 |

Table 90: Heuristics ranking on $\mathcal{R}$ - Dataset Emea

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Emea | 3.14 | 5.74 | 2.76 | 5.98 | 3.4 | 6.2 | 3.14 | 5.64 |

Table 91: Heuristics ranking on $WSC$ - Dataset Emea

## 2.5 Healthcare

| $mpr$ | $mru$ | | PRUCC$_1$ OF | PRUCC$_1$ OR | PRUCC$_1$ UF | PRUCC$_1$ UR | PRUCC$_2$ OF | PRUCC$_2$ OR | PRUCC$_2$ UF | PRUCC$_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 23 | $\|\mathcal{R}\|$ | 35 | 33 | 34 | 33 | 36 | 36 | 35 | 36 |
| | | WSC | 877 | 875 | 877 | 872 | 880 | 884 | 880 | 884 |
| 2 | 28 | $\|\mathcal{R}\|$ | 34 | 33 | 31 | 31 | 34 | 28 | 31 | 30 |
| | | WSC | 953 | 951 | 937 | 943 | 953 | 929 | 937 | 940 |
| 2 | 33 | $\|\mathcal{R}\|$ | 29 | 29 | 31 | 30 | 29 | 28 | 31 | 29 |
| | | WSC | 950 | 951 | 937 | 939 | 950 | 928 | 937 | 953 |
| 2 | 38 | $\|\mathcal{R}\|$ | 29 | 27 | 31 | 30 | 29 | 29 | 31 | 31 |
| | | WSC | 950 | 908 | 937 | 941 | 950 | 954 | 937 | 963 |
| 2 | 45 | $\|\mathcal{R}\|$ | 29 | 29 | 31 | 29 | 29 | 29 | 31 | 30 |
| | | WSC | 950 | 955 | 937 | 958 | 950 | 955 | 937 | 940 |
| 9 | 6 | $\|\mathcal{R}\|$ | 22 | 21 | 22 | 21 | 24 | 25 | 24 | 24 |
| | | WSC | 342 | 332 | 342 | 332 | 362 | 372 | 362 | 362 |
| 9 | 16 | $\|\mathcal{R}\|$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 477 | 477 | 447 | 447 | 477 | 477 | 447 | 447 |
| 9 | 26 | $\|\mathcal{R}\|$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 477 | 477 | 447 | 447 | 477 | 477 | 447 | 447 |
| 9 | 36 | $\|\mathcal{R}\|$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 477 | 477 | 461 | 461 | 477 | 477 | 447 | 447 |
| 9 | 45 | $\|\mathcal{R}\|$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 477 | 477 | 461 | 447 | 477 | 477 | 461 | 447 |
| 16 | 3 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 22 | 22 | 23 |
| | | WSC | 329 | 329 | 329 | 329 | 329 | 346 | 332 | 349 |
| 16 | 13 | $\|\mathcal{R}\|$ | 17 | 17 | 15 | 15 | 17 | 17 | 15 | 15 |
| | | WSC | 285 | 285 | 401 | 401 | 285 | 285 | 401 | 401 |
| 16 | 23 | $\|\mathcal{R}\|$ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | | WSC | 431 | 431 | 401 | 401 | 431 | 431 | 401 | 401 |
| 16 | 33 | $\|\mathcal{R}\|$ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | | WSC | 431 | 431 | 401 | 401 | 431 | 431 | 401 | 401 |
| 16 | 45 | $\|\mathcal{R}\|$ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | | WSC | 431 | 431 | 401 | 415 | 431 | 431 | 401 | 401 |
| 23 | 2 | $\|\mathcal{R}\|$ | 21 | 23 | 21 | 24 | 20 | 27 | 20 | 29 |
| | | WSC | 356 | 384 | 356 | 386 | 354 | 458 | 354 | 485 |
| 23 | 13 | $\|\mathcal{R}\|$ | 16 | 16 | 14 | 14 | 16 | 16 | 14 | 14 |
| | | WSC | 409 | 409 | 369 | 355 | 409 | 409 | 355 | 355 |
| 23 | 24 | $\|\mathcal{R}\|$ | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | WSC | 385 | 385 | 355 | 369 | 385 | 385 | 355 | 355 |
| 23 | 35 | $\|\mathcal{R}\|$ | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | WSC | 385 | 385 | 355 | 355 | 385 | 385 | 355 | 355 |
| 23 | 45 | $\|\mathcal{R}\|$ | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | WSC | 385 | 385 | 355 | 355 | 385 | 385 | 369 | 355 |
| 31 | 2 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 22 | 22 | 23 |
| | | WSC | 449 | 449 | 449 | 449 | 449 | 481 | 452 | 484 |
| 31 | 13 | $\|\mathcal{R}\|$ | 16 | 16 | 14 | 14 | 16 | 16 | 14 | 14 |
| | | WSC | 409 | 409 | 355 | 355 | 409 | 409 | 355 | 355 |
| 31 | 24 | $\|\mathcal{R}\|$ | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | WSC | 385 | 385 | 355 | 355 | 385 | 385 | 355 | 355 |
| 31 | 35 | $\|\mathcal{R}\|$ | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | WSC | 385 | 385 | 369 | 355 | 385 | 385 | 369 | 355 |
| 31 | 45 | $\|\mathcal{R}\|$ | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | WSC | 385 | 385 | 355 | 355 | 385 | 385 | 355 | 355 |

Table 92: Role-set size and WSC value - Dataset Healthcare

| | $\|\mathcal{R}\|$ OF | $\|\mathcal{R}\|$ OR | $\|\mathcal{R}\|$ UF | $\|\mathcal{R}\|$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| PRUCC$_1$ | 18 | 20 | 20 | 22 | 4 | 5 | 18 | 17 |
| PRUCC$_2$ | 19 | 17 | 19 | 17 | 6 | 3 | 17 | 16 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 3 | 3 |
| equal | 19 | 18 |
| worse | 3 | 4 |

Table 93: Minumum values - Dataset Healthcare

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 7 | 0 | 2 | 1 | 15 | 6 | 2 | 3 | 1 | 13 |
| OR | 5 | 1 | 3 | 1 | 15 | 8 | 2 | 2 | 0 | 13 |
| UF | 5 | 0 | 5 | 0 | 15 | 6 | 1 | 4 | 1 | 13 |
| UR | 3 | 0 | 6 | 1 | 15 | 8 | 0 | 3 | 1 | 13 |

Table 94: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Healthcare

| $WSC$ | $\text{PRUCC}_1$ | | | | | $\text{PRUCC}_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 21 | 0 | 2 | 0 | 2 | 19 | 2 | 3 | 1 | 0 |
| OR | 20 | 1 | 2 | 0 | 2 | 22 | 2 | 1 | 0 | 0 |
| UF | 7 | 5 | 11 | 0 | 2 | 8 | 2 | 14 | 1 | 0 |
| UR | 8 | 4 | 11 | 0 | 2 | 9 | 3 | 12 | 1 | 0 |

Table 95: Number of times variants reached minumum value for $WSC$ - Dataset Healthcare

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 4.5 | 4.22 | 4.32 | 3.96 | 5.58 | 5.4 | 2.9 | 3.22 |
| $\text{PRUCC}_2$ | 4.62 | 4.84 | 4.68 | 4.86 | 5.68 | 6.08 | 3.16 | 3.98 |

Table 96: Heuristics ranking - Dataset Healthcare

| $\mathcal{R}$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Healthcare | 4.5 | 4.22 | 4.32 | 3.96 | 4.62 | 4.84 | 4.68 | 4.86 |

Table 97: Heuristics ranking on $\mathcal{R}$ - Dataset Healthcare

| $WSC$ | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Healthcare | 5.58 | 5.4 | 2.9 | 3.22 | 5.68 | 6.08 | 3.16 | 3.98 |

Table 98: Heuristics ranking on $WSC$ - Dataset Healthcare

## 2.6 Domino

| $mpr$ | $mru$ | | PRUCC$_1$ OF | PRUCC$_1$ OR | PRUCC$_1$ UF | PRUCC$_1$ UR | PRUCC$_2$ OF | PRUCC$_2$ OR | PRUCC$_2$ UF | PRUCC$_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 105 | $\|\mathcal{R}\|$ | 142 | 144 | 142 | 143 | 141 | 144 | 143 | 143 |
| | | WSC | 857 | 856 | 857 | 861 | 847 | 859 | 859 | 861 |
| 2 | 131 | $\|\mathcal{R}\|$ | 133 | 136 | 133 | 133 | 133 | 132 | 133 | 136 |
| | | WSC | 834 | 846 | 840 | 836 | 840 | 835 | 840 | 851 |
| 2 | 157 | $\|\mathcal{R}\|$ | 134 | 136 | 133 | 135 | 133 | 137 | 133 | 136 |
| | | WSC | 843 | 850 | 840 | 845 | 834 | 846 | 840 | 846 |
| 2 | 183 | $\|\mathcal{R}\|$ | 133 | 136 | 133 | 135 | 133 | 134 | 133 | 136 |
| | | WSC | 834 | 838 | 840 | 847 | 834 | 841 | 840 | 848 |
| 2 | 208 | $\|\mathcal{R}\|$ | 133 | 138 | 133 | 135 | 133 | 136 | 133 | 136 |
| | | WSC | 834 | 847 | 840 | 847 | 840 | 843 | 840 | 845 |
| 52 | 5 | $\|\mathcal{R}\|$ | 28 | 28 | 28 | 28 | 27 | 29 | 27 | 28 |
| | | WSC | 714 | 714 | 727 | 727 | 674 | 767 | 674 | 727 |
| 52 | 56 | $\|\mathcal{R}\|$ | 24 | 24 | 24 | 25 | 24 | 24 | 24 | 25 |
| | | WSC | 629 | 607 | 629 | 669 | 615 | 607 | 629 | 629 |
| 52 | 107 | $\|\mathcal{R}\|$ | 24 | 24 | 24 | 25 | 24 | 25 | 24 | 25 |
| | | WSC | 629 | 621 | 629 | 628 | 629 | 675 | 629 | 629 |
| 52 | 158 | $\|\mathcal{R}\|$ | 24 | 25 | 24 | 25 | 24 | 25 | 24 | 24 |
| | | WSC | 615 | 667 | 629 | 636 | 615 | 661 | 629 | 622 |
| 52 | 208 | $\|\mathcal{R}\|$ | 24 | 25 | 24 | 25 | 24 | 25 | 24 | 25 |
| | | WSC | 629 | 620 | 629 | 629 | 615 | 661 | 629 | 662 |
| 102 | 3 | $\|\mathcal{R}\|$ | 25 | 25 | 26 | 26 | 25 | 25 | 26 | 26 |
| | | WSC | 759 | 759 | 774 | 774 | 759 | 759 | 774 | 774 |
| 102 | 54 | $\|\mathcal{R}\|$ | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | | WSC | 765 | 756 | 765 | 765 | 751 | 742 | 765 | 756 |
| 102 | 105 | $\|\mathcal{R}\|$ | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | | WSC | 751 | 751 | 765 | 756 | 751 | 742 | 765 | 756 |
| 102 | 156 | $\|\mathcal{R}\|$ | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | | WSC | 751 | 756 | 765 | 756 | 751 | 742 | 765 | 756 |
| 102 | 208 | $\|\mathcal{R}\|$ | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| | | WSC | 765 | 751 | 765 | 765 | 765 | 756 | 765 | 765 |
| 152 | 2 | $\|\mathcal{R}\|$ | 22 | 22 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | WSC | 754 | 754 | 763 | 763 | 756 | 756 | 763 | 763 |
| 152 | 53 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 763 | 749 | 763 | 763 | 749 | 749 | 763 | 763 |
| 152 | 104 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 763 | 763 | 749 | 749 | 763 | 763 |
| 152 | 155 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 763 | 763 | 749 | 749 | 763 | 763 |
| 152 | 208 | $\|\mathcal{R}\|$ | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | WSC | 749 | 749 | 763 | 763 | 749 | 754 | 763 | 763 |
| 200 | 2 | $\|\mathcal{R}\|$ | 22 | 22 | 23 | 23 | 22 | 23 | 23 | 23 |
| | | WSC | 754 | 754 | 763 | 763 | 758 | 756 | 763 | 763 |
| 200 | 53 | $\|\mathcal{R}\|$ | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | | WSC | 747 | 761 | 761 | 761 | 747 | 747 | 761 | 761 |
| 200 | 104 | $\|\mathcal{R}\|$ | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | | WSC | 747 | 747 | 761 | 761 | 747 | 747 | 761 | 761 |
| 200 | 155 | $\|\mathcal{R}\|$ | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | | WSC | 761 | 747 | 761 | 761 | 761 | 747 | 761 | 761 |
| 200 | 208 | $\|\mathcal{R}\|$ | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | | WSC | 761 | 747 | 761 | 761 | 747 | 747 | 761 | 761 |

Table 99: Role-set size and WSC value - Dataset Domino

| | $\|\mathcal{R}\|$ OF | $\|\mathcal{R}\|$ OR | $\|\mathcal{R}\|$ UF | $\|\mathcal{R}\|$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| PRUCC$_1$ | 24 | 18 | 22 | 14 | 15 | 18 | 1 | 0 |
| PRUCC$_2$ | 24 | 16 | 21 | 14 | 17 | 16 | 3 | 1 |

| | $\|\mathcal{R}\|$ | WSC |
|---|---|---|
| better | 1 | 6 |
| equal | 21 | 12 |
| worse | 3 | 7 |

Table 100: Minumum values - Dataset Domino

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 1 | 0 | 8 | 3 | 13 | 1 | 2 | 7 | 2 | 13 |
| OR | 7 | 0 | 3 | 2 | 13 | 9 | 1 | 1 | 1 | 13 |
| UF | 3 | 1 | 5 | 3 | 13 | 4 | 0 | 6 | 2 | 13 |
| UR | 11 | 0 | 0 | 1 | 13 | 11 | 0 | 0 | 1 | 13 |

Table 101: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Domino

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 10 | 6 | 9 | 0 | 0 | 8 | 6 | 10 | 1 | 0 |
| OR | 7 | 9 | 9 | 0 | 0 | 9 | 8 | 8 | 0 | 0 |
| UF | 24 | 1 | 0 | 0 | 0 | 22 | 0 | 2 | 1 | 0 |
| UR | 25 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 1 | 0 |

Table 102: Number of times variants reached minumum value for $WSC$ - Dataset Domino

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 3.7 | 4.88 | 4.1 | 5.2 | 3.32 | 3.3 | 5.6 | 5.92 |
| PRUCC$_2$ | 3.58 | 5.12 | 4.06 | 5.36 | 2.7 | 3.58 | 5.5 | 6.08 |

Table 103: Heuristics ranking - Dataset Domino

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Domino | 3.7 | 4.88 | 4.1 | 5.2 | 3.58 | 5.12 | 4.06 | 5.36 |

Table 104: Heuristics ranking on $\mathcal{R}$ - Dataset Domino

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Domino | 3.32 | 3.3 | 5.6 | 5.92 | 2.7 | 3.58 | 5.5 | 6.08 |

Table 105: Heuristics ranking on $WSC$ - Dataset Domino

## 2.7 Customer

| $mpr$ | $mru$ | | $\text{PRUCC}_1$ OF | $\text{PRUCC}_1$ OR | $\text{PRUCC}_1$ UF | $\text{PRUCC}_1$ UR | $\text{PRUCC}_2$ OF | $\text{PRUCC}_2$ OR | $\text{PRUCC}_2$ UF | $\text{PRUCC}_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 13 | $\lvert\mathcal{R}\rvert$ | 608 | 598 | 612 | 607 | 622 | 625 | 615 | 638 |
| | | WSC | 46038 | 46008 | 46066 | 46052 | 46017 | 46082 | 46077 | 46146 |
| 2 | 16 | $\lvert\mathcal{R}\rvert$ | 430 | 421 | 427 | 420 | 430 | 430 | 426 | 420 |
| | | WSC | 46018 | 46037 | 46083 | 46061 | 46065 | 46067 | 46081 | 46063 |
| 2 | 19 | $\lvert\mathcal{R}\rvert$ | 357 | 358 | 355 | 351 | 360 | 354 | 353 | 355 |
| | | WSC | 46017 | 46030 | 46039 | 46027 | 46019 | 46018 | 46034 | 46040 |
| 2 | 22 | $\lvert\mathcal{R}\rvert$ | 300 | 300 | 297 | 299 | 301 | 299 | 298 | 299 |
| | | WSC | 45988 | 45995 | 46007 | 46013 | 45990 | 45985 | 46010 | 46013 |
| 2 | 24 | $\lvert\mathcal{R}\rvert$ | 290 | 289 | 288 | 288 | 292 | 291 | 288 | 288 |
| | | WSC | 45979 | 45982 | 46002 | 46002 | 45982 | 45984 | 46002 | 46002 |
| 8 | 4 | $\lvert\mathcal{R}\rvert$ | 4305 | 4362 | 4305 | 4373 | 4377 | 4476 | 4382 | 4479 |
| | | WSC | 49793 | 49958 | 49791 | 50040 | 50627 | 50970 | 50655 | 51059 |
| 8 | 9 | $\lvert\mathcal{R}\rvert$ | 1401 | 1495 | 1410 | 1503 | 1452 | 1562 | 1464 | 1575 |
| | | WSC | 46998 | 47274 | 47050 | 47350 | 47494 | 47939 | 47578 | 47934 |
| 8 | 14 | $\lvert\mathcal{R}\rvert$ | 446 | 441 | 445 | 442 | 447 | 445 | 444 | 443 |
| | | WSC | 46221 | 46150 | 46245 | 46212 | 46225 | 46205 | 46243 | 46228 |
| 8 | 19 | $\lvert\mathcal{R}\rvert$ | 324 | 326 | 322 | 319 | 325 | 320 | 321 | 320 |
| | | WSC | 45998 | 45955 | 46046 | 46015 | 46000 | 45981 | 46044 | 46031 |
| 8 | 24 | $\lvert\mathcal{R}\rvert$ | 282 | 284 | 279 | 279 | 282 | 280 | 279 | 279 |
| | | WSC | 45962 | 45903 | 45984 | 45984 | 45965 | 45958 | 45984 | 45984 |
| 14 | 2 | $\lvert\mathcal{R}\rvert$ | 5371 | 5371 | 5371 | 5371 | 5374 | 5375 | 5378 | 5380 |
| | | WSC | 50443 | 50450 | 50443 | 50455 | 50462 | 50465 | 50496 | 50500 |
| 14 | 7 | $\lvert\mathcal{R}\rvert$ | 1801 | 1805 | 1805 | 1807 | 1801 | 1803 | 1806 | 1808 |
| | | WSC | 48517 | 48532 | 48548 | 48566 | 48550 | 48555 | 48582 | 48592 |
| 14 | 12 | $\lvert\mathcal{R}\rvert$ | 501 | 504 | 502 | 505 | 504 | 507 | 504 | 506 |
| | | WSC | 46340 | 46376 | 46378 | 46398 | 46328 | 46376 | 46421 | 46426 |
| 14 | 17 | $\lvert\mathcal{R}\rvert$ | 339 | 335 | 334 | 334 | 337 | 340 | 334 | 334 |
| | | WSC | 45987 | 46033 | 46068 | 46068 | 46052 | 46024 | 46089 | 46081 |
| 14 | 24 | $\lvert\mathcal{R}\rvert$ | 281 | 282 | 278 | 278 | 282 | 281 | 278 | 278 |
| | | WSC | 45945 | 45911 | 45982 | 45982 | 45886 | 45929 | 45982 | 45982 |
| 20 | 2 | $\lvert\mathcal{R}\rvert$ | 5330 | 5330 | 5330 | 5330 | 5332 | 5331 | 5336 | 5336 |
| | | WSC | 50413 | 50414 | 50413 | 50414 | 50417 | 50416 | 50425 | 50407 |
| 20 | 7 | $\lvert\mathcal{R}\rvert$ | 1758 | 1760 | 1765 | 1768 | 1760 | 1761 | 1764 | 1766 |
| | | WSC | 48490 | 48495 | 48520 | 48527 | 48502 | 48505 | 48516 | 48521 |
| 20 | 12 | $\lvert\mathcal{R}\rvert$ | 461 | 462 | 462 | 463 | 461 | 462 | 461 | 462 |
| | | WSC | 46258 | 46325 | 46350 | 46353 | 46312 | 46310 | 46348 | 46351 |
| 20 | 17 | $\lvert\mathcal{R}\rvert$ | 313 | 317 | 310 | 311 | 312 | 314 | 309 | 310 |
| | | WSC | 45962 | 46006 | 46045 | 46048 | 46012 | 45958 | 46043 | 46046 |
| 20 | 24 | $\lvert\mathcal{R}\rvert$ | 283 | 279 | 278 | 278 | 281 | 281 | 278 | 278 |
| | | WSC | 45878 | 45958 | 45982 | 45982 | 45953 | 45952 | 45982 | 45982 |
| 24 | 2 | $\lvert\mathcal{R}\rvert$ | 5324 | 5324 | 5324 | 5323 | 5326 | 5324 | 5331 | 5328 |
| | | WSC | 50402 | 50402 | 50402 | 50400 | 50406 | 50402 | 50416 | 50410 |
| 24 | 7 | $\lvert\mathcal{R}\rvert$ | 1750 | 1755 | 1760 | 1760 | 1754 | 1755 | 1759 | 1760 |
| | | WSC | 48435 | 48470 | 48511 | 48511 | 48458 | 48470 | 48507 | 48509 |
| 24 | 12 | $\lvert\mathcal{R}\rvert$ | 456 | 458 | 457 | 457 | 456 | 456 | 456 | 456 |
| | | WSC | 46304 | 46306 | 46341 | 46341 | 46315 | 46249 | 46339 | 46339 |
| 24 | 17 | $\lvert\mathcal{R}\rvert$ | 306 | 307 | 305 | 305 | 305 | 306 | 304 | 304 |
| | | WSC | 46003 | 45989 | 46036 | 46036 | 46013 | 46013 | 46034 | 46034 |
| 24 | 24 | $\lvert\mathcal{R}\rvert$ | 280 | 281 | 277 | 277 | 282 | 283 | 277 | 277 |
| | | WSC | 45948 | 45936 | 45980 | 45980 | 45952 | 45956 | 45980 | 45980 |

Table 106: Role-set size and WSC value - Dataset Customer

| | $\lvert\mathcal{R}\rvert$ OF | $\lvert\mathcal{R}\rvert$ OR | $\lvert\mathcal{R}\rvert$ UF | $\lvert\mathcal{R}\rvert$ UR | WSC OF | WSC OR | WSC UF | WSC UR |
|---|---|---|---|---|---|---|---|---|
| $\text{PRUCC}_1$ | 10 | 4 | 12 | 13 | 16 | 7 | 3 | 1 |
| $\text{PRUCC}_2$ | 9 | 4 | 14 | 11 | 12 | 12 | 0 | 2 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 13 | 19 |
| equal | 10 | 0 |
| worse | 2 | 6 |

Table 107: Minumum values - Dataset Customer

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 15 | 7 | 1 | 0 | 2 | 16 | 6 | 2 | 0 | 1 |
| OR | 21 | 2 | 0 | 0 | 2 | 21 | 2 | 1 | 0 | 1 |
| UF | 13 | 2 | 8 | 0 | 2 | 11 | 4 | 9 | 0 | 1 |
| UR | 12 | 4 | 7 | 0 | 2 | 14 | 2 | 8 | 0 | 1 |

Table 108: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Customer

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 9 | 14 | 2 | 0 | 0 | 13 | 11 | 1 | 0 | 0 |
| OR | 18 | 7 | 0 | 0 | 0 | 13 | 11 | 1 | 0 | 0 |
| UF | 22 | 1 | 2 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| UR | 24 | 1 | 0 | 0 | 0 | 23 | 2 | 0 | 0 | 0 |

Table 109: Number of times variants reached minumum value for $WSC$ - Dataset Customer

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 4.26 | 4.94 | 3.6 | 3.72 | 1.94 | 2.66 | 5.52 | 5.62 |
| PRUCC$_2$ | 5.38 | 5.52 | 3.84 | 4.74 | 3.68 | 3.64 | 6.38 | 6.56 |

Table 110: Heuristics ranking - Dataset Customer

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Customer | 4.26 | 4.94 | 3.6 | 3.72 | 5.38 | 5.52 | 3.84 | 4.74 |

Table 111: Heuristics ranking on $\mathcal{R}$ - Dataset Customer

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Customer | 1.94 | 2.66 | 5.52 | 5.62 | 3.68 | 3.64 | 6.38 | 6.56 |

Table 112: Heuristics ranking on $WSC$ - Dataset Customer

## 2.8 Firewall 1

| | | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $mpr$ | $mru$ | | OF | OR | UF | UR | OF | OR | UF | UR |
| 2 | 309 | $\lvert\mathcal{R}\rvert$ | 417 | 425 | 419 | 418 | 416 | 418 | 419 | 423 |
| | | WSC | 18175 | 18055 | 18144 | 18113 | 18144 | 18042 | 18147 | 18207 |
| 2 | 386 | $\lvert\mathcal{R}\rvert$ | 401 | 400 | 400 | 398 | 399 | 399 | 399 | 405 |
| | | WSC | 18149 | 17947 | 18108 | 18332 | 18115 | 18127 | 18109 | 18181 |
| 2 | 463 | $\lvert\mathcal{R}\rvert$ | 399 | 406 | 399 | 397 | 399 | 409 | 399 | 399 |
| | | WSC | 18115 | 18016 | 18109 | 17865 | 18115 | 18200 | 18109 | 17905 |
| 2 | 540 | $\lvert\mathcal{R}\rvert$ | 401 | 402 | 400 | 401 | 399 | 404 | 399 | 404 |
| | | WSC | 18149 | 17949 | 18129 | 18132 | 18115 | 18465 | 18109 | 18178 |
| 2 | 616 | $\lvert\mathcal{R}\rvert$ | 399 | 402 | 399 | 403 | 401 | 401 | 400 | 400 |
| | | WSC | 18115 | 18197 | 18106 | 18399 | 18152 | 17909 | 18108 | 18142 |
| 100 | 7 | $\lvert\mathcal{R}\rvert$ | 96 | 98 | 101 | 114 | 105 | 119 | 106 | 124 |
| | | WSC | 4440 | 4642 | 4455 | 5768 | 5382 | 6719 | 5236 | 6974 |
| 100 | 159 | $\lvert\mathcal{R}\rvert$ | 68 | 68 | 71 | 71 | 68 | 68 | 71 | 71 |
| | | WSC | 3305 | 3305 | 3279 | 3279 | 3305 | 3305 | 3282 | 3279 |
| 100 | 311 | $\lvert\mathcal{R}\rvert$ | 68 | 68 | 71 | 71 | 68 | 68 | 71 | 71 |
| | | WSC | 3305 | 3300 | 3279 | 3287 | 3305 | 3305 | 3282 | 3287 |
| 100 | 463 | $\lvert\mathcal{R}\rvert$ | 68 | 68 | 71 | 71 | 68 | 68 | 71 | 71 |
| | | WSC | 3305 | 3305 | 3287 | 3282 | 3300 | 3305 | 3279 | 3279 |
| 100 | 616 | $\lvert\mathcal{R}\rvert$ | 68 | 68 | 71 | 71 | 68 | 68 | 71 | 71 |
| | | WSC | 3305 | 3305 | 3282 | 3282 | 3300 | 3305 | 3279 | 3279 |
| 198 | 4 | $\lvert\mathcal{R}\rvert$ | 92 | 92 | 93 | 93 | 94 | 95 | 96 | 97 |
| | | WSC | 6222 | 6222 | 6230 | 6227 | 6793 | 6819 | 6799 | 6825 |
| 198 | 157 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3296 | 3296 | 3275 | 3278 | 3301 | 3301 | 3278 | 3278 |
| 198 | 310 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3301 | 3301 | 3275 | 3283 | 3301 | 3301 | 3283 | 3278 |
| 198 | 463 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3296 | 3301 | 3278 | 3275 | 3301 | 3301 | 3278 | 3278 |
| 198 | 616 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3296 | 3301 | 3278 | 3278 | 3301 | 3296 | 3278 | 3275 |
| 296 | 3 | $\lvert\mathcal{R}\rvert$ | 88 | 88 | 89 | 89 | 89 | 89 | 90 | 90 |
| | | WSC | 6953 | 6953 | 6958 | 6958 | 6955 | 6955 | 6959 | 6959 |
| 296 | 156 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3301 | 3301 | 3275 | 3275 | 3301 | 3301 | 3275 | 3278 |
| 296 | 309 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3296 | 3301 | 3275 | 3275 | 3301 | 3301 | 3275 | 3275 |
| 296 | 462 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3301 | 3301 | 3278 | 3280 | 3301 | 3301 | 3283 | 3278 |
| 296 | 616 | $\lvert\mathcal{R}\rvert$ | 66 | 66 | 69 | 69 | 66 | 66 | 69 | 69 |
| | | WSC | 3301 | 3301 | 3278 | 3278 | 3301 | 3301 | 3278 | 3280 |
| 394 | 2 | $\lvert\mathcal{R}\rvert$ | 90 | 90 | 92 | 93 | 90 | 90 | 91 | 91 |
| | | WSC | 7117 | 7116 | 7122 | 7129 | 7117 | 7117 | 7120 | 7120 |
| 394 | 155 | $\lvert\mathcal{R}\rvert$ | 65 | 65 | 68 | 68 | 65 | 65 | 68 | 68 |
| | | WSC | 3299 | 3299 | 3276 | 3278 | 3299 | 3299 | 3276 | 3276 |
| 394 | 308 | $\lvert\mathcal{R}\rvert$ | 65 | 65 | 68 | 68 | 65 | 65 | 68 | 68 |
| | | WSC | 3299 | 3299 | 3273 | 3273 | 3299 | 3299 | 3273 | 3276 |
| 394 | 461 | $\lvert\mathcal{R}\rvert$ | 65 | 65 | 68 | 68 | 65 | 65 | 68 | 68 |
| | | WSC | 3299 | 3299 | 3276 | 3273 | 3299 | 3299 | 3273 | 3273 |
| 394 | 616 | $\lvert\mathcal{R}\rvert$ | 65 | 65 | 68 | 68 | 65 | 65 | 68 | 68 |
| | | WSC | 3299 | 3299 | 3273 | 3273 | 3294 | 3299 | 3273 | 3276 |

Table 113: Role-set size and WSC value - Dataset Firewall 1

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 22 | 19 | 2 | 2 | 3 | 6 | 14 | 12 |
| $\text{PRUCC}_2$ | 24 | 19 | 4 | 2 | 3 | 4 | 15 | 12 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 6 | 11 |
| equal | 17 | 9 |
| worse | 2 | 5 |

Table 114: Minumum values - Dataset Firewall 1

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 3 | 2 | 20 | 0 | 0 | 1 | 3 | 19 | 2 | 0 |
| OR | 6 | 0 | 19 | 0 | 0 | 6 | 0 | 18 | 1 | 0 |
| UF | 23 | 1 | 1 | 0 | 0 | 21 | 0 | 2 | 2 | 0 |
| UR | 23 | 2 | 0 | 0 | 0 | 23 | 0 | 1 | 1 | 0 |

Table 115: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Firewall 1

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 22 | 1 | 2 | 0 | 0 | 22 | 1 | 2 | 0 | 0 |
| OR | 19 | 4 | 2 | 0 | 0 | 21 | 2 | 2 | 0 | 0 |
| UF | 11 | 6 | 8 | 0 | 0 | 10 | 8 | 7 | 0 | 0 |
| UR | 13 | 4 | 8 | 0 | 0 | 13 | 5 | 7 | 0 | 0 |

Table 116: Number of times variants reached minumum value for $WSC$ - Dataset Firewall 1

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 2.62 | 3.24 | 5.66 | 5.76 | 5.5 | 5.04 | 2.88 | 3.58 |
| PRUCC$_2$ | 2.84 | 3.5 | 5.86 | 6.52 | 5.74 | 6.02 | 3.26 | 3.98 |

Table 117: Heuristics ranking - Dataset Firewall 1

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 1 | 2.62 | 3.24 | 5.66 | 5.76 | 2.84 | 3.5 | 5.86 | 6.52 |

Table 118: Heuristics ranking on $\mathcal{R}$ - Dataset Firewall 1

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 1 | 5.5 | 5.04 | 2.88 | 3.58 | 5.74 | 6.02 | 3.26 | 3.98 |

Table 119: Heuristics ranking on $WSC$ - Dataset Firewall 1

## 2.9 Firewall 2

| $mpr$ | $mru$ | | $\text{PRUCC}_1$ OF | $\text{PRUCC}_1$ OR | $\text{PRUCC}_1$ UF | $\text{PRUCC}_1$ UR | $\text{PRUCC}_2$ OF | $\text{PRUCC}_2$ OR | $\text{PRUCC}_2$ UF | $\text{PRUCC}_2$ UR |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 295 | $\lvert\mathcal{R}\rvert$ | 298 | 307 | 298 | 298 | 298 | 310 | 298 | 298 |
| | | WSC | 19233 | 19266 | 19233 | 19233 | 19233 | 19277 | 19233 | 19233 |
| 2 | 368 | $\lvert\mathcal{R}\rvert$ | 297 | 305 | 297 | 297 | 297 | 307 | 297 | 297 |
| | | WSC | 19321 | 19721 | 19321 | 19321 | 19321 | 19821 | 19321 | 19321 |
| 2 | 441 | $\lvert\mathcal{R}\rvert$ | 297 | 303 | 297 | 297 | 297 | 307 | 297 | 297 |
| | | WSC | 19321 | 19621 | 19321 | 19321 | 19321 | 19821 | 19321 | 19321 |
| 2 | 514 | $\lvert\mathcal{R}\rvert$ | 297 | 305 | 297 | 297 | 297 | 305 | 297 | 297 |
| | | WSC | 19321 | 19721 | 19321 | 19321 | 19321 | 19721 | 19321 | 19321 |
| 2 | 589 | $\lvert\mathcal{R}\rvert$ | 297 | 303 | 297 | 297 | 297 | 305 | 297 | 297 |
| | | WSC | 19321 | 19621 | 19321 | 19321 | 19321 | 19721 | 19321 | 19321 |
| 78 | 8 | $\lvert\mathcal{R}\rvert$ | 17 | 17 | 17 | 17 | 19 | 19 | 19 | 19 |
| | | WSC | 1589 | 1589 | 1611 | 1611 | 1747 | 1747 | 1769 | 1769 |
| 78 | 153 | $\lvert\mathcal{R}\rvert$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 1863 | 1863 | 1885 | 1885 | 1863 | 1863 | 1885 | 1885 |
| 78 | 298 | $\lvert\mathcal{R}\rvert$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 1863 | 1863 | 1885 | 1885 | 1863 | 1863 | 1885 | 1885 |
| 78 | 443 | $\lvert\mathcal{R}\rvert$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 1863 | 1863 | 1885 | 1885 | 1863 | 1863 | 1885 | 1885 |
| 78 | 589 | $\lvert\mathcal{R}\rvert$ | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | | WSC | 1863 | 1863 | 1885 | 1885 | 1863 | 1863 | 1885 | 1885 |
| 154 | 4 | $\lvert\mathcal{R}\rvert$ | 15 | 15 | 14 | 14 | 15 | 15 | 16 | 16 |
| | | WSC | 1522 | 1522 | 1450 | 1450 | 1663 | 1663 | 1630 | 1630 |
| 154 | 150 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 154 | 296 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 154 | 442 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 154 | 589 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 230 | 3 | $\lvert\mathcal{R}\rvert$ | 13 | 13 | 13 | 13 | 15 | 15 | 15 | 15 |
| | | WSC | 1371 | 1371 | 1371 | 1371 | 1616 | 1616 | 1616 | 1616 |
| 230 | 149 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 230 | 295 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 230 | 441 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 230 | 589 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1649 | 1649 | 1671 | 1671 | 1649 | 1649 | 1671 | 1671 |
| 306 | 2 | $\lvert\mathcal{R}\rvert$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | | WSC | 1541 | 1541 | 1541 | 1541 | 1552 | 1552 | 1552 | 1552 |
| 306 | 149 | $\lvert\mathcal{R}\rvert$ | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | WSC | 1542 | 1542 | 1564 | 1564 | 1542 | 1542 | 1564 | 1564 |
| 306 | 296 | $\lvert\mathcal{R}\rvert$ | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | WSC | 1542 | 1542 | 1564 | 1564 | 1542 | 1542 | 1564 | 1564 |
| 306 | 443 | $\lvert\mathcal{R}\rvert$ | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | WSC | 1542 | 1542 | 1564 | 1564 | 1542 | 1542 | 1564 | 1564 |
| 306 | 589 | $\lvert\mathcal{R}\rvert$ | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | WSC | 1542 | 1542 | 1564 | 1564 | 1542 | 1542 | 1564 | 1564 |

Table 120: Role-set size and WSC value - Dataset Firewall 2

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| $\text{PRUCC}_1$ | 24 | 19 | 25 | 25 | 24 | 19 | 8 | 8 |
| $\text{PRUCC}_2$ | 25 | 20 | 24 | 24 | 24 | 19 | 8 | 8 |

| | $\lvert\mathcal{R}\rvert$ | WSC |
|---|---|---|
| better | 3 | 4 |
| equal | 22 | 21 |
| worse | 0 | 0 |

Table 121: Minumum values - Dataset Firewall 2

| $\mathcal{R}$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 1 | 0 | 0 | 5 | 19 | 0 | 0 | 1 | 5 | 19 |
| OR | 6 | 0 | 0 | 0 | 19 | 5 | 0 | 1 | 0 | 19 |
| UF | 0 | 0 | 1 | 5 | 19 | 1 | 0 | 0 | 5 | 19 |
| UR | 0 | 0 | 1 | 5 | 19 | 1 | 0 | 0 | 5 | 19 |

Table 122: Number of times variants reached minumum value for $\mathcal{R}$ - Dataset Firewall 2

| $WSC$ | PRUCC$_1$ | | | | | PRUCC$_2$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| OF | 1 | 0 | 17 | 5 | 2 | 1 | 0 | 17 | 5 | 2 |
| OR | 6 | 0 | 17 | 0 | 2 | 6 | 0 | 17 | 0 | 2 |
| UF | 17 | 0 | 1 | 5 | 2 | 17 | 0 | 1 | 5 | 2 |
| UR | 17 | 0 | 1 | 5 | 2 | 17 | 0 | 1 | 5 | 2 |

Table 123: Number of times variants reached minumum value for $WSC$ - Dataset Firewall 2

| | $\lvert\mathcal{R}\rvert$ | | | | WSC | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| PRUCC$_1$ | 4.14 | 4.86 | 4.02 | 4.02 | 2.7 | 3.42 | 5.26 | 5.26 |
| PRUCC$_2$ | 4.46 | 5.34 | 4.58 | 4.58 | 3.34 | 4.22 | 5.9 | 5.9 |

Table 124: Heuristics ranking - Dataset Firewall 2

| $\mathcal{R}$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 2 | 4.14 | 4.86 | 4.02 | 4.02 | 4.46 | 5.34 | 4.58 | 4.58 |

Table 125: Heuristics ranking on $\mathcal{R}$ - Dataset Firewall 2

| $WSC$ | PRUCC$_1$ | | | | PRUCC$_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | OF | OR | UF | UR | OF | OR | UF | UR |
| Firewall 2 | 2.7 | 3.42 | 5.26 | 5.26 | 3.34 | 4.22 | 5.9 | 5.9 |

Table 126: Heuristics ranking on $WSC$ - Dataset Firewall 2

# 3 Synthetic Datasets

## 3.1 Constant $nu/nr$, varying permissions, and $mpr = np \cdot nr/nu$

| Set 1 | $nr$ | $nu$ | $np$ | $mru$ | $mpr$ |
|---|---|---|---|---|---|
| d1 | 20 | 200 | 40 | 4 | 4 |
| d2 | 40 | 400 | 80 | 4 | 8 |
| d3 | 80 | 800 | 160 | 4 | 16 |
| d4 | 100 | 1000 | 200 | 4 | 20 |

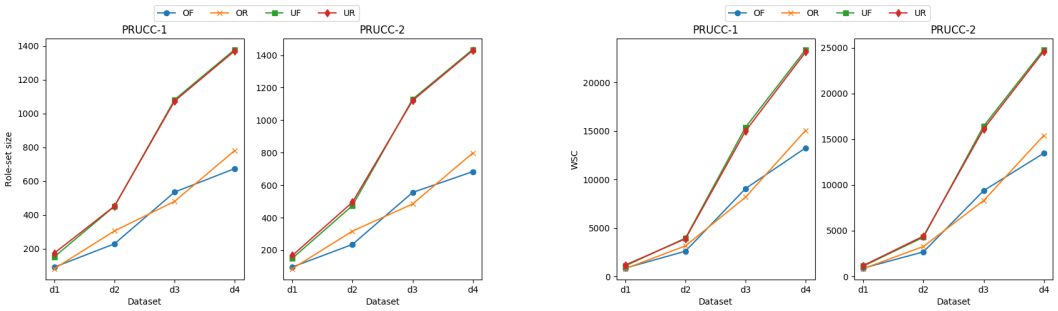


Figure 1: Role-set Size (left) - WSC (right)

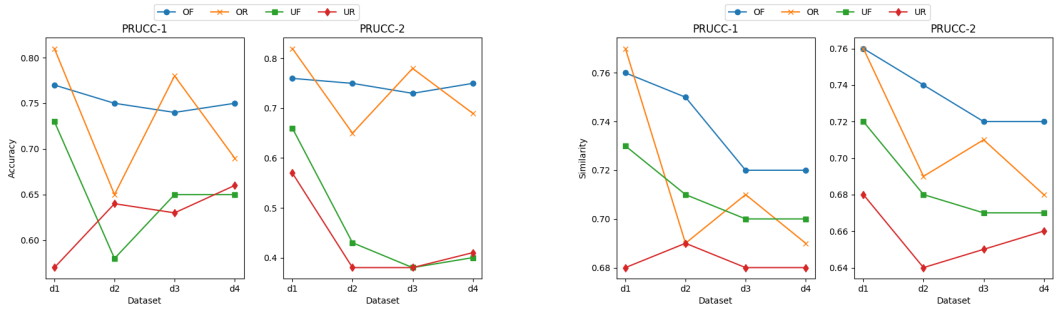


Figure 2: Similarity (left) - Accuracy (right)

| Dataset | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OF | OR | UF | UR | OF | OR | UF | UR |
| Data1 | $\lvert\mathcal{R}\rvert$ | 91 | 82 | 152 | 174 | 96 | 86 | 150 | 167 |
| | WSC | 890 | 837 | 1123 | 1210 | 909 | 856 | 1130 | 1195 |
| | accuracy | 77% | 81% | 73% | 56% | 76% | 82% | 66% | 56% |
| | similarity | 76% | 77% | 73% | 68% | 76% | 76% | 72% | 68% |
| Data2 | $\lvert\mathcal{R}\rvert$ | 229 | 305 | 451 | 452 | 235 | 317 | 474 | 495 |
| | WSC | 2636 | 3180 | 3976 | 3912 | 2690 | 3282 | 4295 | 4412 |
| | accuracy | 75% | 65% | 57% | 64% | 75% | 65% | 43% | 38% |
| | similarity | 75% | 69% | 71% | 69% | 74% | 69% | 68% | 64% |
| Data3 | $\lvert\mathcal{R}\rvert$ | 535 | 480 | 1082 | 1074 | 555 | 484 | 1129 | 1121 |
| | WSC | 9085 | 8198 | 15399 | 15015 | 9376 | 8287 | 16421 | 16113 |
| | accuracy | 74% | 78% | 65% | 63% | 73% | 78% | 38% | 38% |
| | similarity | 72% | 71% | 70% | 68% | 72% | 71% | 67% | 65% |
| Data4 | $\lvert\mathcal{R}\rvert$ | 674 | 781 | 1379 | 1371 | 683 | 797 | 1435 | 1429 |
| | WSC | 13274 | 15080 | 23398 | 23143 | 13466 | 15402 | 24807 | 24598 |
| | accuracy | 75% | 69% | 65% | 66% | 75% | 69% | 40% | 41% |
| | similarity | 72% | 69% | 70% | 68% | 72% | 68% | 67% | 66% |

### 3.2 Constant $nu/nr$ and $np/nr$, $mru = nr/10$, $mpr = 5$, and $mru \cdot mpr = np/4$

| Set 2 | $nr$ | $nu$ | $np$ | $mru$ | $mpr$ |
|---|---|---|---|---|---|
| d1 | 20 | 200 | 40 | 2 | 5 |
| d2 | 40 | 400 | 80 | 4 | 5 |
| d3 | 80 | 800 | 160 | 8 | 5 |
| d4 | 100 | 1000 | 200 | 10 | 5 |

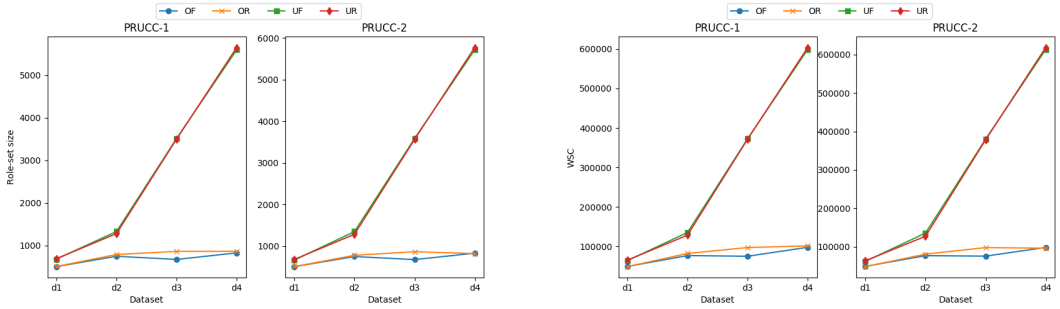


Figure 3: Role-set Size (left) - WSC (right)

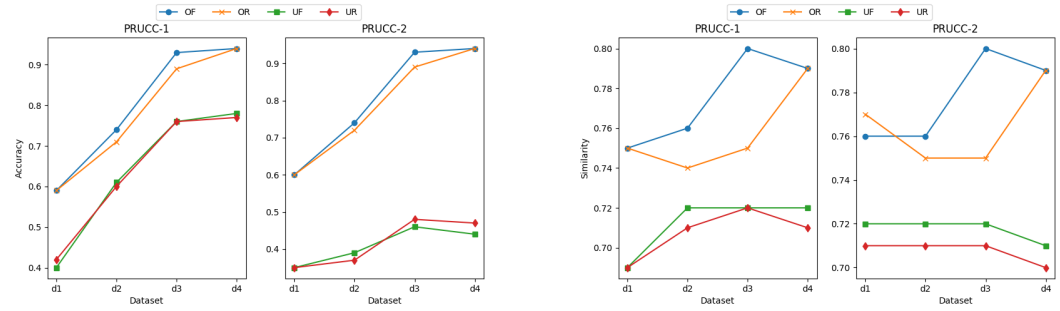


Figure 4: Similarity (left) - Accuracy (right)

| Dataset | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OF | OR | UF | UR | OF | OR | UF | UR |
| Data1 | $\|\mathcal{R}\|$ | 58 | 59 | 86 | 92 | 60 | 64 | 96 | 109 |
| | WSC | 571 | 574 | 695 | 717 | 582 | 596 | 757 | 810 |
| | accuracy | 90% | 86% | 86% | 82% | 87% | 83% | 73% | 65% |
| | similarity | 86% | 84% | 82% | 81% | 85% | 83% | 80% | 76% |
| Data2 | $\|\mathcal{R}\|$ | 209 | 238 | 384 | 479 | 226 | 256 | 366 | 470 |
| | WSC | 2059 | 2196 | 2852 | 3356 | 2154 | 2299 | 2821 | 3379 |
| | accuracy | 80% | 74% | 62% | 55% | 78% | 74% | 57% | 49% |
| | similarity | 76% | 72% | 72% | 67% | 75% | 72% | 71% | 65% |
| Data3 | $\|\mathcal{R}\|$ | 729 | 814 | 1402 | 1699 | 779 | 863 | 1342 | 1595 |
| | WSC | 7543 | 8036 | 10887 | 12459 | 7837 | 8326 | 10740 | 12085 |
| | accuracy | 75% | 73% | 45% | 40% | 75% | 73% | 49% | 45% |
| | similarity | 70% | 66% | 62% | 56% | 69% | 65% | 63% | 57% |
| Data4 | $\|\mathcal{R}\|$ | 1045 | 1281 | 2049 | 2470 | 1099 | 1348 | 1949 | 2352 |
| | WSC | 11214 | 12465 | 16225 | 18516 | 11552 | 12879 | 15918 | 18088 |
| | accuracy | 77% | 74% | 48% | 40% | 77% | 73% | 52% | 45% |
| | similarity | 69% | 64% | 62% | 55% | 68% | 64% | 63% | 56% |

### 3.3 Constant $nu/nr$ and $np/nr$, $mru = nr/10$, $mru = 5$, and $mru \cdot mpr = np/4$

| Set 3 | $nr$ | $nu$ | $np$ | $mru$ | $mpr$ |
|---|---|---|---|---|---|
| d1 | 20 | 200 | 40 | 5 | 2 |
| d2 | 40 | 400 | 80 | 5 | 4 |
| d3 | 80 | 800 | 160 | 5 | 8 |
| d4 | 100 | 1000 | 200 | 5 | 10 |

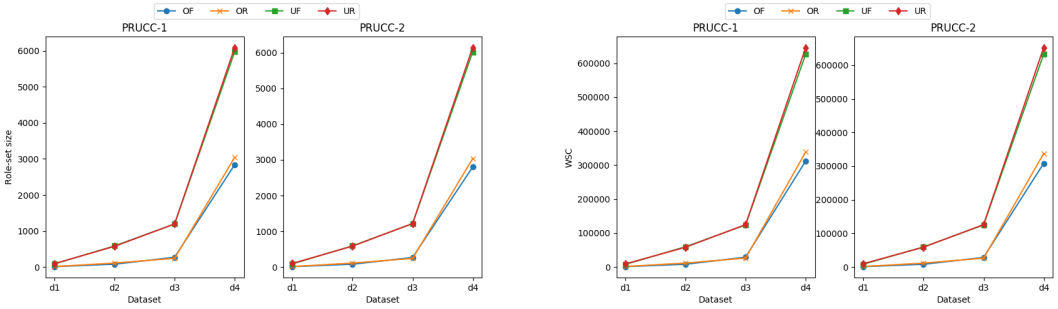


Figure 5: Role-set Size (left) - WSC (right)

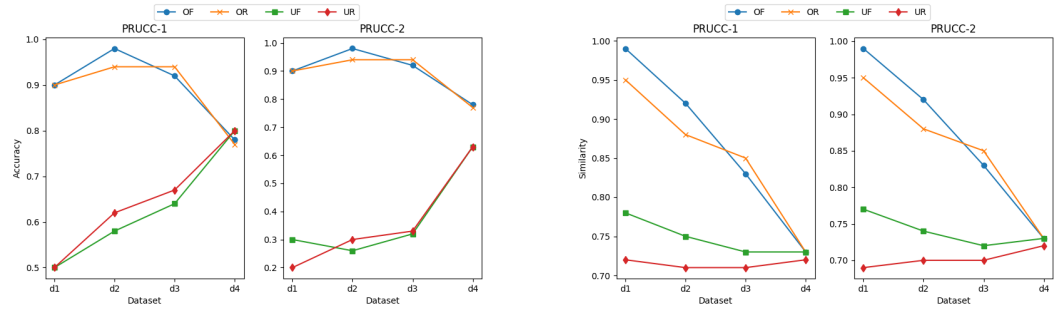


Figure 6: Similarity (left) - Accuracy (right)

| Dataset | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OF | OR | UF | UR | OF | OR | UF | UR |
| Data1 | $\|\mathcal{R}\|$ | 40 | 48 | 63 | 62 | 43 | 51 | 65 | 67 |
| | WSC | 741 | 773 | 832 | 822 | 749 | 785 | 832 | 834 |
| | accuracy | 96% | 92% | 88% | 91% | 97% | 92% | 86% | 86% |
| | similarity | 86% | 82% | 78% | 79% | 86% | 82% | 77% | 77% |
| Data2 | $\|\mathcal{R}\|$ | 223 | 276 | 365 | 467 | 232 | 293 | 366 | 454 |
| | WSC | 2180 | 2428 | 2744 | 3209 | 2226 | 2510 | 2788 | 3174 |
| | accuracy | 78% | 71% | 69% | 51% | 79% | 73% | 64% | 51% |
| | similarity | 74% | 70% | 72% | 65% | 74% | 70% | 70% | 65% |
| Data3 | $\|\mathcal{R}\|$ | 538 | 643 | 1214 | 1303 | 555 | 667 | 1142 | 1235 |
| | WSC | 6394 | 7180 | 11112 | 11661 | 6554 | 7390 | 10879 | 11471 |
| | accuracy | 78% | 73% | 44% | 41% | 78% | 72% | 46% | 41% |
| | similarity | 72% | 68% | 65% | 61% | 72% | 67% | 66% | 61% |
| Data4 | $\|\mathcal{R}\|$ | 762 | 813 | 1564 | 1576 | 773 | 840 | 1525 | 1551 |
| | WSC | 9892 | 10329 | 16325 | 16196 | 10041 | 10616 | 16554 | 16619 |
| | accuracy | 76% | 72% | 50% | 49% | 76% | 72% | 45% | 41% |
| | similarity | 71% | 67% | 66% | 63% | 71% | 67% | 66% | 61% |

## 3.4 Constant number of ratio users/roles and varying permissions

| Set 4 | $nr$ | $nu$ | $np$ | $mru$ | $mpr$ |
|---|---|---|---|---|---|
| d1 | 100 | 2000 | 100 | 3 | 10 |
| d2 | 100 | 2000 | 500 | 3 | 50 |
| d3 | 100 | 2000 | 1000 | 3 | 100 |
| d4 | 100 | 2000 | 2000 | 3 | 200 |

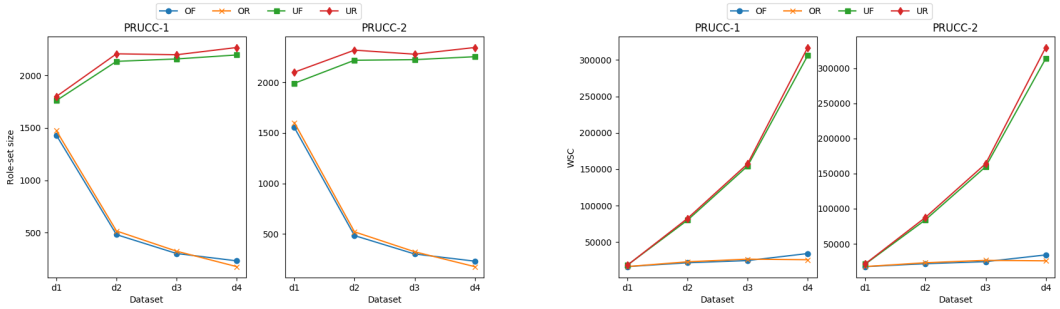


Figure 7: Role-set Size (left) - WSC (right)

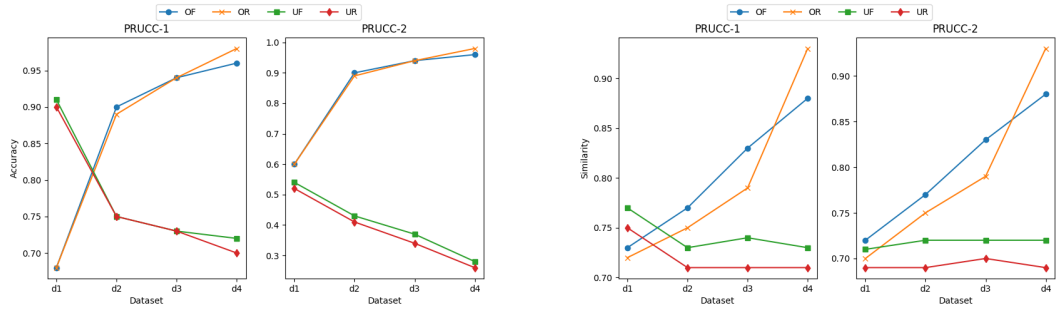


Figure 8: Similarity (left) - Accuracy (right)

| Dataset | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OF | OR | UF | UR | OF | OR | UF | UR |
| d1 | $\lvert\mathcal{R}\rvert$ | 1429 | 1472 | 1760 | 1799 | 1552 | 1601 | 1990 | 2100 |
| | WSC | 16217 | 16304 | 18301 | 18150 | 17549 | 17675 | 21201 | 21673 |
| | accuracy | 68% | 68% | 91% | 90% | 60% | 60% | 54% | 52% |
| | similarity | 73% | 72% | 77% | 75% | 72% | 70% | 71% | 69% |
| d2 | $\lvert\mathcal{R}\rvert$ | 481 | 516 | 2134 | 2206 | 484 | 521 | 2218 | 2318 |
| | WSC | 21505 | 22865 | 79968 | 82357 | 21684 | 23100 | 84233 | 87679 |
| | accuracy | 90% | 89% | 75% | 75% | 90% | 89% | 43% | 41% |
| | similarity | 77% | 75% | 73% | 71% | 77% | 75% | 72% | 69% |
| d3 | $\lvert\mathcal{R}\rvert$ | 301 | 323 | 2157 | 2197 | 302 | 324 | 2224 | 2278 |
| | WSC | 24521 | 26448 | 154306 | 157379 | 24592 | 26478 | 159685 | 163975 |
| | accuracy | 94% | 94% | 73% | 73% | 94% | 94% | 37% | 34% |
| | similarity | 83% | 79% | 74% | 71% | 83% | 79% | 72% | 70% |
| d4 | $\lvert\mathcal{R}\rvert$ | 231 | 176 | 2195 | 2266 | 231 | 177 | 2253 | 2344 |
| | WSC | 34167 | 25652 | 306028 | 317055 | 34187 | 25793 | 313653 | 329474 |
| | accuracy | 96% | 98% | 72% | 70% | 96% | 98% | 28% | 26% |
| | similarity | 88% | 93% | 73% | 71% | 88% | 93% | 72% | 69% |

## 3.5 Constant number of the ratio permissions/roles and varying users

| Set 5 | $nr$ | $nu$ | $np$ | $mru$ | $mpr$ |
|---|---|---|---|---|---|
| d1 | 200 | 500 | 1500 | 3 | 150 |
| d2 | 200 | 1000 | 1500 | 3 | 150 |
| d3 | 200 | 3000 | 1500 | 3 | 150 |
| d4 | 200 | 5000 | 1500 | 3 | 150 |

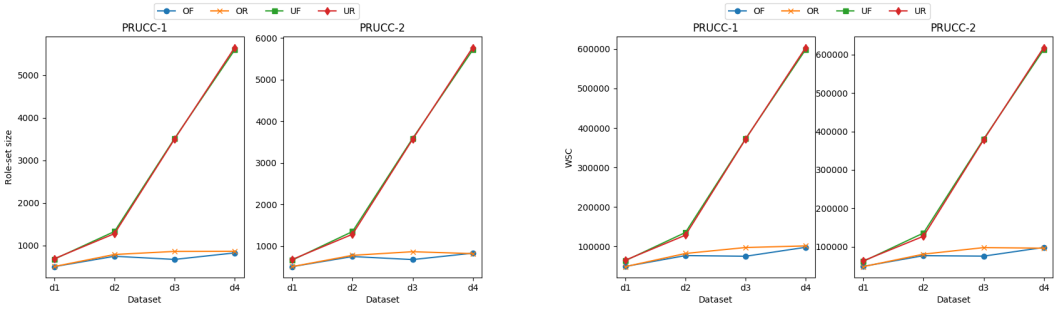


Figure 9: Role-set Size (left) - WSC (right)

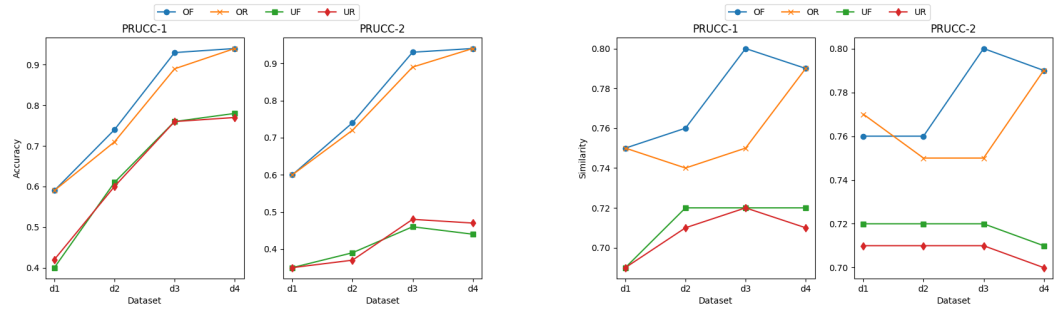


Figure 10: Similarity (left) - Accuracy (right)

| Dataset | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | `OF` | `OR` | `UF` | `UR` | `OF` | `OR` | `UF` | `UR` |
| d1 | $\lvert\mathcal{R}\rvert$ | 504 | 507 | 680 | 690 | 505 | 506 | 663 | 678 |
| | WSC | 49416 | 49078 | 64223 | 65356 | 48910 | 48238 | 61975 | 63335 |
| | accuracy | 59% | 59% | 40% | 42% | 60% | 60% | 35% | 35% |
| | similarity | 75% | 75% | 69% | 69% | 76% | 77% | 72% | 71% |
| d2 | $\lvert\mathcal{R}\rvert$ | 747 | 789 | 1329 | 1279 | 747 | 776 | 1347 | 1282 |
| | WSC | 77011 | 82368 | 135580 | 128726 | 76745 | 80718 | 135690 | 127313 |
| | accuracy | 74% | 71% | 61% | 60% | 74% | 72% | 39% | 37% |
| | similarity | 76% | 74% | 72% | 71% | 76% | 75% | 72% | 71% |
| d3 | $\lvert\mathcal{R}\rvert$ | 673 | 861 | 3515 | 3501 | 674 | 863 | 3582 | 3561 |
| | WSC | 75310 | 97433 | 372589 | 371760 | 75510 | 97689 | 379924 | 378051 |
| | accuracy | 93% | 89% | 76% | 76% | 93% | 89% | 46% | 48% |
| | similarity | 80% | 75% | 72% | 72% | 80% | 75% | 72% | 71% |
| d4 | $\lvert\mathcal{R}\rvert$ | 826 | 864 | 5595 | 5651 | 827 | 817 | 5708 | 5767 |
| | WSC | 97991 | 101500 | 598720 | 603666 | 98142 | 96238 | 613283 | 618525 |
| | accuracy | 94% | 94% | 78% | 77% | 94% | 94% | 44% | 47% |
| | similarity | 79% | 79% | 72% | 71% | 79% | 79% | 71% | 70% |

## 3.6 Constant number of permissions and varying ratio users/roles

| Set 6 | $nr$ | $nu$ | $np$ | $mru$ | $mpr$ |
|---|---|---|---|---|---|
| d1 | 10 | 100 | 1500 | 3 | 150 |
| d2 | 50 | 500 | 1500 | 3 | 150 |
| d3 | 100 | 1000 | 1500 | 3 | 150 |
| d4 | 500 | 5000 | 1500 | 3 | 150 |

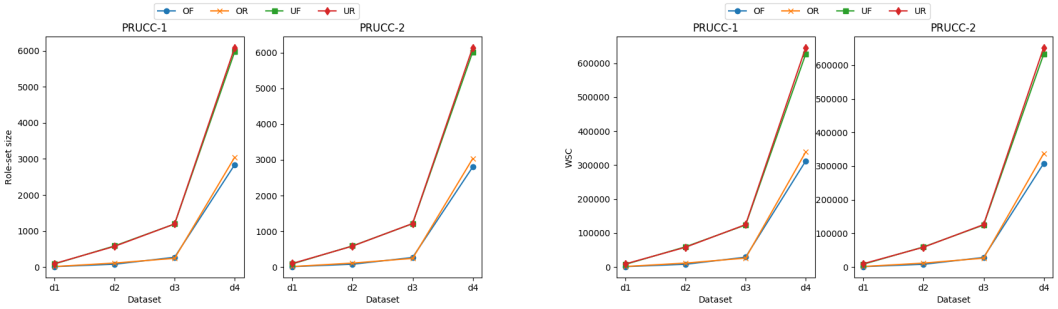


Figure 11: Role-set Size (left) - WSC (right)

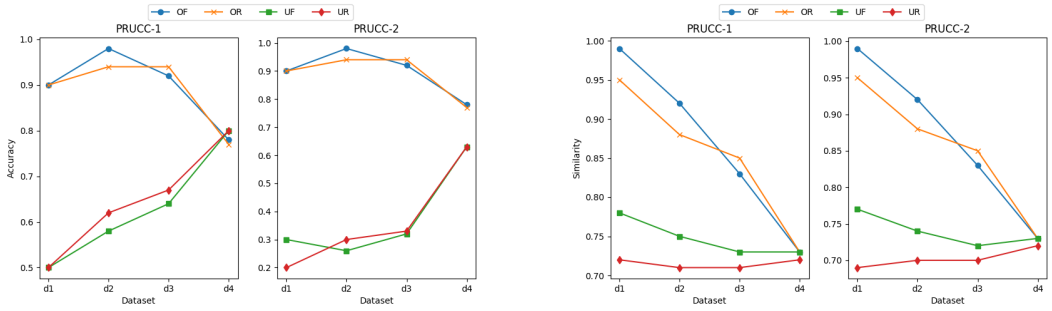


Figure 12: Similarity (left) - Accuracy (right)

| Dataset | | $\text{PRUCC}_1$ | | | | $\text{PRUCC}_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OF | OR | UF | UR | OF | OR | UF | UR |
| d1 | $\lvert\mathcal{R}\rvert$ | 11 | 13 | 84 | 94 | 11 | 13 | 88 | 100 |
| | WSC | 1097 | 1458 | 7627 | 9158 | 1097 | 1458 | 8285 | 9863 |
| | accuracy | 90% | 90% | 50% | 50% | 90% | 90% | 30% | 20% |
| | similarity | 99% | 95% | 78% | 72% | 99% | 95% | 77% | 69% |
| d2 | $\lvert\mathcal{R}\rvert$ | 77 | 110 | 585 | 573 | 77 | 110 | 591 | 585 |
| | WSC | 7948 | 11519 | 59503 | 58094 | 7965 | 11550 | 59585 | 58783 |
| | accuracy | 98% | 94% | 57% | 62% | 98% | 94% | 26% | 30% |
| | similarity | 92% | 88% | 75% | 71% | 92% | 88% | 74% | 70% |
| d3 | $\lvert\mathcal{R}\rvert$ | 271 | 241 | 1194 | 1195 | 267 | 241 | 1213 | 1218 |
| | WSC | 28931 | 26181 | 123709 | 124840 | 28400 | 26183 | 124875 | 126057 |
| | accuracy | 92% | 94% | 64% | 67% | 92% | 94% | 32% | 33% |
| | similarity | 83% | 85% | 73% | 71% | 83% | 85% | 72% | 70% |
| d4 | $\lvert\mathcal{R}\rvert$ | 2839 | 3047 | 5974 | 6092 | 2800 | 3035 | 6022 | 6146 |
| | WSC | 312202 | 338525 | 626903 | 646308 | 308120 | 337470 | 633122 | 652863 |
| | accuracy | 78% | 77% | 80% | 80% | 78% | 77% | 63% | 63% |
| | similarity | 73% | 73% | 73% | 72% | 73% | 73% | 73% | 72% |