Table 1: Additional swap gates and circuit depth, n = 15

| layout | benchmark | g | d | s basic | s sabre | s look | swap (%) | d basic | d swap | d look | d (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| full_10_2 | ghz | 17 | 17 | 0 | 6 | 0 | -100 | 17 | 20 | 17 | -15 |
| full_10_2 | dj | 118 | 22 | 66 | 9 | 9 | 0 | 95 | 33 | 29 | -12.12 |
| full_10_2 | graphstate | 150 | 29 | 30 | 6 | 24 | 300 | 51 | 40 | 34 | -15 |
| full_10_2 | vqe | 253 | 31 | 0 | 6 | 0 | -100 | 31 | 41 | 31 | -24.39 |
| full_10_2 | wstate | 253 | 135 | 0 | 12 | 0 | -100 | 135 | 141 | 135 | -4.26 |
| full_10_2 | qaoa | 285 | 34 | 63 | 6 | 69 | 1050 | 164 | 50 | 65 | 30 |
| full_10_2 | qft | 591 | 118 | 378 | 48 | 321 | 568.75 | 485 | 307 | 241 | -21.5 |
| full_10_2 | qftentangled | 608 | 122 | 378 | 72 | 321 | 345.83 | 489 | 329 | 245 | -25.53 |
| full_10_2 | realamprandom | 615 | 77 | 1146 | 177 | 315 | 77.97 | 1399 | 372 | 210 | -43.55 |
| full_10_2 | twolocalrandom | 615 | 77 | 1146 | 138 | 315 | 128.26 | 1399 | 327 | 210 | -35.78 |
| full_10_2 | su2random | 675 | 81 | 1146 | 189 | 315 | 66.67 | 1433 | 452 | 215 | -52.43 |
| full_10_2 | qnn | 914 | 158 | 720 | 90 | 369 | 310 | 1103 | 527 | 302 | -42.69 |
| full_10_2 | portfolioqaoa | 1260 | 192 | 1146 | 141 | 393 | 178.72 | 1766 | 777 | 351 | -54.83 |
| full_10_2 | random | 1992 | 412 | 534 | 246 | 597 | 142.68 | 1200 | 957 | 529 | -44.72 |
| full_10_2 | portfoliovqe | 2505 | 327 | 1146 | 189 | 534 | 182.54 | 1903 | 984 | 504 | -48.78 |
| full_7_3 | ghz | 17 | 17 | 0 | 6 | 0 | -100 | 17 | 20 | 17 | -15 |
| full_7_3 | dj | 118 | 22 | 96 | 9 | 15 | 66.67 | 116 | 36 | 30 | -16.67 |
| full_7_3 | graphstate | 150 | 29 | 36 | 9 | 27 | 200 | 67 | 35 | 32 | -8.57 |
| full_7_3 | vqe | 253 | 31 | 0 | 12 | 0 | -100 | 31 | 56 | 31 | -44.64 |
| full_7_3 | wstate | 253 | 135 | 0 | 12 | 0 | -100 | 135 | 141 | 135 | -4.26 |
| full_7_3 | qaoa | 285 | 34 | 108 | 15 | 51 | 240 | 223 | 50 | 53 | 6 |
| full_7_3 | qft | 591 | 118 | 501 | 117 | 300 | 156.41 | 588 | 295 | 213 | -27.8 |
| full_7_3 | qftentangled | 608 | 122 | 501 | 150 | 300 | 100 | 592 | 399 | 217 | -45.61 |
| grid_4_5 | ghz | 17 | 17 | 12 | 18 | 33 | 83.33 | 29 | 32 | 25 | -21.88 |
| grid_4_5 | dj | 118 | 22 | 324 | 45 | 27 | -40 | 128 | 75 | 38 | -49.33 |
| grid_4_5 | graphstate | 150 | 29 | 147 | 24 | 111 | 362.5 | 94 | 31 | 38 | 22.58 |
| grid_4_5 | vqe | 253 | 31 | 48 | 12 | 78 | 550 | 75 | 60 | 49 | -18.33 |
| grid_4_5 | wstate | 253 | 135 | 39 | 3 | 57 | 1800 | 147 | 138 | 102 | -26.09 |
| grid_4_5 | qaoa | 285 | 34 | 357 | 39 | 141 | 261.54 | 369 | 58 | 70 | 20.69 |
| grid_4_5 | qft | 591 | 118 | 1698 | 312 | 525 | 68.27 | 734 | 324 | 214 | -33.95 |
| grid_4_5 | qftentangled | 608 | 122 | 1575 | 300 | 561 | 87 | 687 | 315 | 223 | -29.21 |
| grid_4_5 | realamprandom | 615 | 77 | 5277 | 645 | 759 | 17.67 | 1840 | 412 | 198 | -51.94 |
| grid_4_5 | twolocalrandom | 615 | 77 | 5277 | 696 | 759 | 9.05 | 1840 | 446 | 198 | -55.61 |
| grid_4_5 | su2random | 675 | 81 | 5277 | 672 | 759 | 12.95 | 1881 | 422 | 202 | -52.13 |
| grid_4_5 | qnn | 914 | 158 | 3384 | 447 | 858 | 91.95 | 1386 | 414 | 355 | -14.25 |
| grid_4_5 | portfolioqaoa | 1260 | 192 | 5277 | 663 | 1170 | 76.47 | 2077 | 585 | 418 | -28.55 |
| grid_4_5 | random | 1992 | 412 | 2250 | 1041 | 1533 | 47.26 | 2103 | 1056 | 629 | -40.44 |
| grid_4_5 | portfoliovqe | 2505 | 327 | 5277 | 648 | 768 | 18.52 | 2244 | 756 | 412 | -45.5 |
| grid_9_3 | ghz | 17 | 17 | 18 | 9 | 42 | 366.67 | 35 | 20 | 25 | 25 |
| grid_9_3 | dj | 118 | 22 | 234 | 48 | 24 | -50 | 122 | 67 | 34 | -49.25 |
| grid_9_3 | graphstate | 150 | 29 | 108 | 30 | 87 | 190 | 86 | 38 | 33 | -13.16 |
| grid_9_3 | vqe | 253 | 31 | 48 | 9 | 66 | 633.33 | 60 | 45 | 47 | 4.44 |
| grid_9_3 | wstate | 253 | 135 | 57 | 18 | 72 | 300 | 156 | 147 | 107 | -27.21 |
| grid_9_3 | qaoa | 285 | 34 | 198 | 36 | 243 | 575 | 247 | 51 | 71 | 39.22 |
| grid_9_3 | qft | 591 | 118 | 1164 | 270 | 450 | 66.67 | 680 | 292 | 203 | -30.48 |
| grid_9_3 | qftentangled | 608 | 122 | 1128 | 279 | 357 | 27.96 | 650 | 327 | 192 | -41.28 |
| grid_9_3 | realamprandom | 615 | 77 | 3018 | 666 | 834 | 25.23 | 1603 | 439 | 240 | -45.33 |
| grid_9_3 | twolocalrandom | 615 | 77 | 3018 | 672 | 834 | 24.11 | 1603 | 453 | 240 | -47.02 |
| grid_9_3 | su2random | 675 | 81 | 3018 | 672 | 831 | 23.66 | 1641 | 489 | 242 | -50.51 |
| grid_9_3 | qnn | 914 | 158 | 2061 | 444 | 771 | 73.65 | 1277 | 456 | 343 | -24.78 |
| grid_9_3 | portfolioqaoa | 1260 | 192 | 3018 | 663 | 1074 | 61.99 | 1843 | 655 | 412 | -37.1 |
| grid_9_3 | random | 1992 | 412 | 1647 | 783 | 1140 | 45.59 | 1913 | 1177 | 576 | -51.06 |
| grid_9_3 | portfoliovqe | 2505 | 327 | 3018 | 636 | 1107 | 74.06 | 2112 | 835 | 471 | -43.59 |
| line_5_4 | ghz | 17 | 17 | 0 | 12 | 42 | 250 | 17 | 23 | 20 | -13.04 |
| line_5_4 | dj | 118 | 22 | 546 | 66 | 36 | -45.45 | 146 | 102 | 45 | -55.88 |
| line_5_4 | graphstate | 150 | 29 | 186 | 36 | 138 | 283.33 | 95 | 33 | 49 | 48.48 |
| line_5_4 | vqe | 253 | 31 | 0 | 69 | 42 | -39.13 | 31 | 83 | 43 | -48.19 |
| line_5_4 | wstate | 253 | 135 | 0 | 0 | 42 | nan | 135 | 135 | 121 | -10.37 |
| line_5_4 | qaoa | 285 | 34 | 438 | 75 | 210 | 180 | 391 | 56 | 71 | 26.79 |
| line_5_4 | qft | 591 | 118 | 2877 | 426 | 519 | 21.83 | 742 | 316 | 170 | -46.2 |
| line_5_4 | qftentangled | 608 | 122 | 2877 | 414 | 543 | 31.16 | 746 | 311 | 177 | -43.09 |

Continued on next page

Table 1: Additional swap gates and circuit depth, n = 15

| layout | benchmark | g | d | s basic | s sabre | s look | swap (%) | d basic | d swap | d look | d (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| line_5_4 | realamprandom | 615 | 77 | 8190 | 888 | 936 | 5.41 | 1996 | 418 | 162 | -61.24 |
| line_5_4 | twolocalrandom | 615 | 77 | 8190 | 876 | 936 | 6.85 | 1996 | 416 | 162 | -61.06 |
| line_5_4 | su2random | 675 | 81 | 8190 | 897 | 936 | 4.35 | 2039 | 461 | 165 | -64.21 |
| line_5_4 | qnn | 914 | 158 | 5460 | 591 | 732 | 23.86 | 1442 | 431 | 234 | -45.71 |
| line_5_4 | portfolioqaoa | 1260 | 192 | 8190 | 888 | 948 | 6.76 | 2165 | 531 | 260 | -51.04 |
| line_5_4 | random | 1992 | 412 | 3348 | 1623 | 1926 | 18.67 | 2915 | 1128 | 656 | -41.84 |
| line_5_4 | portfoliovqe | 2505 | 327 | 8190 | 891 | 948 | 6.4 | 2297 | 695 | 378 | -45.61 |
| ring_10_2 | ghz | 17 | 17 | 0 | 21 | 111 | 428.57 | 17 | 26 | 40 | 53.85 |
| ring_10_2 | dj | 118 | 22 | 336 | 33 | 60 | 81.82 | 122 | 71 | 28 | -60.56 |
| ring_10_2 | graphstate | 150 | 29 | 111 | 27 | 108 | 300 | 84 | 32 | 31 | -3.12 |
| ring_10_2 | vqe | 253 | 31 | 0 | 33 | 192 | 481.82 | 31 | 63 | 59 | -6.35 |
| ring_10_2 | wstate | 253 | 135 | 0 | 15 | 177 | 1080 | 135 | 138 | 78 | -43.48 |
| ring_10_2 | qaoa | 285 | 34 | 291 | 36 | 141 | 291.67 | 303 | 54 | 60 | 11.11 |
| ring_10_2 | qft | 591 | 118 | 2034 | 384 | 504 | 31.25 | 707 | 389 | 186 | -52.19 |
| ring_10_2 | qftentangled | 608 | 122 | 2034 | 360 | 624 | 73.33 | 711 | 344 | 216 | -37.21 |
| ring_10_2 | realamprandom | 615 | 77 | 5427 | 1155 | 1332 | 15.32 | 1879 | 565 | 302 | -46.55 |
| ring_10_2 | twolocalrandom | 615 | 77 | 5427 | 1131 | 1332 | 17.77 | 1879 | 601 | 302 | -49.75 |
| ring_10_2 | su2random | 675 | 81 | 5427 | 1155 | 1338 | 15.84 | 1922 | 661 | 305 | -53.86 |
| ring_10_2 | qnn | 914 | 158 | 3576 | 708 | 1116 | 57.63 | 1356 | 558 | 349 | -37.46 |
| ring_10_2 | portfolioqaoa | 1260 | 192 | 5427 | 1065 | 1701 | 59.72 | 2060 | 793 | 534 | -32.66 |
| ring_10_2 | random | 1992 | 412 | 2127 | 1050 | 1407 | 34 | 2042 | 1129 | 580 | -48.63 |
| ring_10_2 | portfoliovqe | 2505 | 327 | 5427 | 1098 | 1590 | 44.81 | 2195 | 1030 | 520 | -49.51 |
| ring_5_4 | ghz | 17 | 17 | 0 | 27 | 51 | 88.89 | 17 | 41 | 30 | -26.83 |
| ring_5_4 | dj | 118 | 22 | 153 | 36 | 27 | -25 | 113 | 71 | 33 | -53.52 |
| ring_5_4 | graphstate | 150 | 29 | 78 | 18 | 102 | 466.67 | 72 | 38 | 32 | -15.79 |
| ring_5_4 | vqe | 253 | 31 | 0 | 39 | 63 | 61.54 | 31 | 76 | 44 | -42.11 |
| ring_5_4 | wstate | 253 | 135 | 0 | 48 | 72 | 50 | 135 | 150 | 79 | -47.33 |
| ring_5_4 | qaoa | 285 | 34 | 171 | 51 | 93 | 82.35 | 250 | 83 | 43 | -48.19 |
| ring_7_3 | ghz | 17 | 17 | 0 | 18 | 84 | 366.67 | 17 | 32 | 28 | -12.5 |
| ring_7_3 | dj | 118 | 22 | 168 | 39 | 42 | 7.69 | 116 | 66 | 29 | -56.06 |
| ring_7_3 | graphstate | 150 | 29 | 84 | 24 | 96 | 300 | 85 | 43 | 35 | -18.6 |
| ring_7_3 | vqe | 253 | 31 | 0 | 24 | 138 | 475 | 31 | 63 | 53 | -15.87 |
| ring_7_3 | wstate | 253 | 135 | 0 | 15 | 108 | 620 | 135 | 144 | 81 | -43.75 |
| ring_7_3 | qaoa | 285 | 34 | 228 | 51 | 177 | 247.06 | 267 | 76 | 71 | -6.58 |
| ring_7_3 | realamprandom | 615 | 77 | 2679 | 999 | 1224 | 22.52 | 1444 | 740 | 319 | -56.89 |
| ring_7_3 | twolocalrandom | 615 | 77 | 2679 | 882 | 1224 | 38.78 | 1444 | 595 | 319 | -46.39 |
| t_horizontal_5_4 | ghz | 17 | 17 | 27 | 39 | 39 | 0 | 44 | 53 | 28 | -47.17 |
| t_horizontal_5_4 | dj | 118 | 22 | 384 | 42 | 27 | -35.71 | 137 | 65 | 40 | -38.46 |
| t_horizontal_5_4 | graphstate | 150 | 29 | 147 | 42 | 147 | 250 | 96 | 37 | 45 | 21.62 |
| t_horizontal_5_4 | vqe | 253 | 31 | 63 | 6 | 54 | 800 | 79 | 34 | 47 | 38.24 |
| t_horizontal_5_4 | wstate | 253 | 135 | 63 | 21 | 45 | 114.29 | 166 | 141 | 111 | -21.28 |
| t_horizontal_5_4 | qaoa | 285 | 34 | 348 | 54 | 234 | 333.33 | 337 | 56 | 67 | 19.64 |
| t_horizontal_5_4 | qft | 591 | 118 | 1842 | 381 | 519 | 36.22 | 729 | 309 | 170 | -44.98 |
| t_horizontal_5_4 | qftentangled | 608 | 122 | 1788 | 390 | 543 | 39.23 | 698 | 320 | 177 | -44.69 |
| t_horizontal_5_4 | realamprandom | 615 | 77 | 5859 | 885 | 1020 | 15.25 | 1927 | 446 | 234 | -47.53 |
| t_horizontal_5_4 | twolocalrandom | 615 | 77 | 5859 | 876 | 1020 | 16.44 | 1927 | 424 | 234 | -44.81 |
| t_horizontal_5_4 | su2random | 675 | 81 | 5859 | 993 | 1020 | 2.72 | 1970 | 538 | 237 | -55.95 |
| t_horizontal_5_4 | qnn | 914 | 158 | 4041 | 606 | 1065 | 75.74 | 1458 | 481 | 355 | -26.2 |
| t_horizontal_5_4 | portfolioqaoa | 1260 | 192 | 5859 | 822 | 1359 | 65.33 | 2156 | 636 | 420 | -33.96 |
| t_horizontal_5_4 | random | 1992 | 412 | 2613 | 1407 | 1815 | 29 | 2408 | 1130 | 644 | -43.01 |
| t_horizontal_5_4 | portfoliovqe | 2505 | 327 | 5859 | 975 | 1047 | 7.38 | 2288 | 893 | 431 | -51.74 |
| t_vertical_5_4 | ghz | 17 | 17 | 45 | 51 | 54 | 5.88 | 62 | 59 | 29 | -50.85 |
| t_vertical_5_4 | dj | 118 | 22 | 318 | 48 | 27 | -43.75 | 131 | 69 | 38 | -44.93 |
| t_vertical_5_4 | graphstate | 150 | 29 | 150 | 30 | 138 | 360 | 107 | 35 | 41 | 17.14 |
| t_vertical_5_4 | vqe | 253 | 31 | 150 | 12 | 99 | 725 | 94 | 54 | 48 | -11.11 |
| t_vertical_5_4 | wstate | 253 | 135 | 126 | 45 | 84 | 86.67 | 200 | 153 | 97 | -36.6 |
| t_vertical_5_4 | qaoa | 285 | 34 | 336 | 63 | 234 | 271.43 | 351 | 62 | 89 | 43.55 |
| t_vertical_5_4 | qft | 591 | 118 | 1680 | 396 | 615 | 55.3 | 642 | 352 | 222 | -36.93 |
| t_vertical_5_4 | qftentangled | 608 | 122 | 1764 | 411 | 621 | 51.09 | 653 | 393 | 234 | -40.46 |
| t_vertical_5_4 | realamprandom | 615 | 77 | 5304 | 1047 | 1098 | 4.87 | 1919 | 564 | 261 | -53.72 |
| t_vertical_5_4 | twolocalrandom | 615 | 77 | 5304 | 1011 | 1098 | 8.61 | 1919 | 593 | 261 | -55.99 |

Continued on next page

Table 1: Additional swap gates and circuit depth, n = 15

| layout | benchmark | g | d | s basic | s sabre | s look | swap (%) | d basic | d swap | d look | d (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| t_vertical_5_4 | su2random | 675 | 81 | 5304 | 1086 | 1098 | 1.1 | 1962 | 658 | 265 | -59.73 |
| t_vertical_5_4 | qnn | 914 | 158 | 3669 | 600 | 1077 | 79.5 | 1449 | 509 | 344 | -32.42 |
| t_vertical_5_4 | portfolioqaoa | 1260 | 192 | 5304 | 879 | 1440 | 63.82 | 2150 | 641 | 430 | -32.92 |
| t_vertical_5_4 | random | 1992 | 412 | 2475 | 1203 | 1800 | 49.63 | 2366 | 1214 | 658 | -45.8 |
| t_vertical_5_4 | portfoliovqe | 2505 | 327 | 5304 | 942 | 1251 | 32.8 | 2280 | 834 | 456 | -45.32 |