Over the Christmas holiday, I found over 250 derivatives from another existing hard sudoku, of which 15 rated over 10 ED with one rated at 11.9/11.9/11.7 by skfr, which is second only to one other SE rating. It was 9..7.....78....6....6.5.....4...5.3...79..5......2...1..85..9......1...4.....3.2 and its canonical format was 98.7.....6.....9....7....5..4..3...5..95..6.......2.1...86..5......1...3.....4.2. However, in 2015, Eleven produced another with the same ED rating, the same canonical format and the same SE rating of 11.8;11.8;11.6 which was 1.......9..67...2..8....4......75.3...5..2....6.3......9....8..6...4...1..25...6., so they are morph of each other, although possible arrived at by different routes. Eleven may wish to comment?

I used skfr to rate it as it is over 100 times faster than Sudoku Explainer, which is not practical to use to evaluate large numbers of derived sudokus. I am told there are programming bugs in both rating systems, so they may not give identical ratings.

So I decided to produce the table below that sets out and compares the SE and skfr ratings for the published 11.9 and 11.8 sudokus. This took some time so a complete table for all published sudokus of SE 10 and over would be a herculean task! However some conclusions can be drawn from the 62 listed.

1. There were only 3 examples (Numbers 10, 12 and 15) where the skfr rating exceeded the SE rating. These were from Filmer, Eleven and Tarek.
2. There were 16 examples where the ratings from both systems were equal and another 7 where they were almost equal.
3. There were 37 examples where the SE rating exceeded the skfr rating.
4. The SE rating exceeded the skfr rating for the 9 11.9 SE sudokus, 6 @ 11.8, 1 @ 11.7 & 2 @ 11.6. So SE is statistically significantly higher than DE.
5. The frequency of skfr ratings equalling SE ratings seemed to increase as the ratings decreased. This will need to be confirmed when someone compares the ratings for sudokus below SE = 11.8.

I have been striving to produce high rating sudokus that are not morphs of existing ones for some time and so far have produced only one so far rated at 10.6;10.6;10.6 from a group of 15 above 10 ED; see above last December.

.I am informed that the high value sudokus were extensively researched some years ago so possible most, if not all of them have been found! Eleven said *If* *someone finds a 10.6+ puzzle by himself, the chance is far less than 1:10000 to get an equivalent of Arto's puzzles.*  Am I therefore wasting my time? Advice from other members would be welcome!

I have a question and a comment

1. Is there a complete list of hard sudokus in canonical format (see last column below)? If so a copy would enable me to evaluate further ones >10DE.
2. I was impressed that 30% 0f the 53 puzzles rated at 11.8 were ED rated exactly the same as the SE rating and 43% were almost the same. However 52% were rated 11.2 to 11.7, some 0.1 to 0.6 below the SE rating. Perhaps it may be possible for a future programmer to resolve the differences so that both give the same rating.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Top 9 Sudokus rated 11.9 by Sudoku Explainer 1.2.1** | **Rated by Sudoku explorer 1.2.1** | **Rated by skfr 2012** | **Canonical format** |
| 1 2  3  4  5  6  7  8 9 | 98.7.....7.....6....6.5.....4...5.3...79..5......2...1..85..9......1...4.....3.2. 98.7.....6.....87...7.....5.4..3.5....65...9......2..1..86...5.....1.3.......4..2 12..3....4....1.2...52..1..5..4..2......6..7......3..8.5....9....9.7..3......8..6 .......39.....1..5..3.5.8....8.9...6.7...2...1..4.......9.8..5..2....6..4..7..... .2.4...8.....8...68....71..2..5...9..95.......4..3.........1..7..28...4.....6.3.. ........1....23.45..51..2....25...1..6...27..8...9......42....7.3...6...9...8.... 12.3.....4.5...6...7.....2.6..1..3....453.........8..9...45.1.........8......2..7 5.6...7...1.3.....8...5.9.....1...2.....8.6.7.....2.4.7...9...6.3...42....5...... ..3..6.8....1..2......7...4..9..8.6..3..4...1.7.2.....3....5.....5...6..98.....5. | 11.90;11.90;11.80;GP;champagne dry;1;22  11.90;11.90;11.60;GP;kz0;11523;23  11.90;11.90;11.30;elev;secondflush;2;23  11.90;11.90;11.30;tax;GoldenNugget;3;21  11.90;11.90;9.90;elev;3;4;22 11.90;11.90;9.90;dob;12\_12\_03;248078;23 11.90;11.90;2.60;elev;1;5;22  11.90;1.20;1.20;OW;2015\_08;1744614;22  11.90;1.20;1.20;elev;2;6;22 | ED=11.8/11.8/11.8  ED=11.8/11.8/11.8  ED=11.7/11.7/11.1  ED=11.8/11.8/11.1  ED=11.6/11.6/9.7  ED=11.8/11.8/9.7  ED=11.6/11.6/2.6  ED=11.8/1.2/1.2  ED=11.8/1.2/1.2 | 98.7.....7.....6....6.5.....4...5.3...79..5......2...1..85..9......1...4.....3.2.  98.7.....6.....87...7.....5.4..3.5....65...9......2..1..86...5.....1.3.......4..2  98.7.....6...9.8....5..8.9.5....6.8....4..3......7...2.5.....1...13..7......2...4  98.7.....6.....8....5....7..4..3......89..5.......2..1..65..9......1..3......4..2  98.7.....6.....7....7.5.....4...5.3...68..5......2...1..95..8......1..4......3..2  98.76....5..........7..59..4....78.....3...2.....1...6.5...97....4.7...1...2...3.  98.7..6..7.....9....5....4.6...9.....3.86.......4.2....7..3.8....1....2......4..5  98.7..6.....9...7.....65...7.......443.....9...2...1...4.3...8...1.2.........65..  98.7.....6.....7....7.5.....6...4.3..2......1..95..8....68..5......1...4.....3.2. |
| 10 | Filmer 2018 |  |  |  |
|  | 9..7.....78....6....6.5.....4...5.3...79..5......2...1..85..9......1...4.....3.2. | 11.80;11.80;11.60 | **ED=11.9/11.9/11.7+** | 98.7.....6.....9....7....5..4..3...5..95..6.......2.1...86..5......1...3.....4.2. |
|  | **All Sudokus rated 11.B by Sudoku Explainer 1.2.1** | **Rated by Sudoku explorer 1.2.1** | **Rated by skfr 2012** | **Canonical format** |
| 1112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263 | .......12......345..3..46....2..1.3..7..6....8..9.......5..2..4.6..8....9..7..... 1.......9..67...2..8....4......75.3...5..2....6.3......9....8..6...4...1..25...6. 1....6.8....7..1........5.6..9.4.....7.2...3.8....76..3....1..5.4.9.......2.7.... 98.76....54.........7..59..4....75.....3...2.....1...6.9...87....4....1....2....3  .2...67..4...8......93........9..57..1...7..2......61.3...4..6...8.......6...5.2.  98.7.....6...5......4..93..5......6..7..8......9..24....1.....4....9.1.......1.32  2.......6.5..8..1...4...9...7.3.1......82.......7.5.3...9...4...8..1..5.6.......2 1.......2..94...5..6....7.....89..4....3.6.....8.4.....2....1..7.......6..5.8..3.  6.......2.9.4...5...1...7...5..84.......2.......3.5.4.2.....6...3...9.8...7.....1  1.......2.9.4...5...6...7...5.3.4.......6........58.4...2...6...3...9.8.7.......1  ...4...89..7..92......3...526...1.....19.....7.....1..5...9..4...6..29.....8....3  ........94....92......7..45..1.3.....7.6..9..8....7..2.3.7..8....6.1....9....5.2.  ........1.....2.3...4.5.6....7.8.....1......96..4..7....85.....59...3.2.7...6.5..  1.......2.3.4...5...6...7...5.9.4.......23......8...9...2...6...9...8.4.7.......1  1.......2.3.4...5...6...7...5.8.4.......29......3...9...7.....1.9...8.4.2.....6..  .2...1......6...3...9.8...7..5....78.3.....6.8...4.5....4.9.7...1.2.....9.......5  ...4...8...7..92......3...526...1.....19......7....1..5......4..1.8....3..6..29..  .2.4..7....6.....17...3......5....6..4.2..9.......5..8..1..8....9..7.......92.3.. .......12.....3..4..2.4.5....4.5..2..6....7..8..9..4....7.1...5.3...8...9..6.....  ........1.....2.3...4.5.6.......1.2....3.7..8.6..9.7...598......76..5...4...7.5..  1.......9.5....2....87...4.2...3......48.5....8.6...7...6..4.5.........1....9.3..  5.......9.2.1...7...8...3...4.6.........5.......2.7.1...3...8...6...4.2.9.......5  ..3.8....7..2......6...9.1.........3.....596..9.....54.1...45..8...3......27.....  1.......6.5.7...8...3...4.....5.8.9.....3.....8.92....6.....3...7...5.2...4.....1  ........1..2..3.4..4..5.6......1.5.....6....78....4.3..8...9.2.2.37.....9...2....  98.76....75....9....6......8...4..3..2......1..95..8....86..5......3...4.....1.2.  98.7.....6..89......5..4...7...3.9....6...7....2....51.6..8.3.......1.4.........2  98.7.....6..89......1..4...7...3.9....6...7....2....51.6..8.3.......5.4.........2  ........1.....2.3....14.5....3.....6.5.7..4..8.......2..6..8..5.4.51.....9..7.1..  98.7.....6..89......5..4...7...3.9....6...7....2....41.6..8.3.......1..5.......2.  1......8......92....6.3...52....8.....5.7.....6.5....4..47...........91..3..6...7  ..34...8.......1.37........2...9.......5..8...6...7.4...51....8.7...5...9...62.5.  98.7.....7.....9....2.95...47........3.4..7....6....1....84.3.......6..2.....2..1  68.7.....3..89......1..4...7...3.9....6...7....2....51.6..8.3.......5.4.........2  68.7.....3..89......5..4...7...3.9....6...7....2....51.6..8.3.......1.4.........2  .......12.....3..4..1.4.5....2.6..5..7....6..8..9..4....4.1...5.3.8.....9....7...  98.7.......7.6.........57..4...3..2..1...6..3...9..8..2......4..3......1..86..5..  .....6..94...8.2.....7...1.2.9...8....4.3.9...6.....5.3.8.4.......5......7...1...  .2....78.4.......6.9..7..1....5....3.....1.......9.12..7..1.8..5....4.....67.3... .2.4..7...5...9.3.6...7......5..8.9.7...2.....4.6..3.......1..85......1...1...9.3  1....6.......8.2...9.7....5.7.3...5......16....4....73..59....48...2.....3.......  .....6.8....1..2...9..7...5..5.4...734...8...97.........9...6..7...3...4...2...1.  ..3..6.8....1......9..7...4...8..6..3...4...2.....5.1...2.9...37........94....5..  5.6...7...1.3.....7...5.8.....1...2.....7.6.8.....214.8...9...6.3...4.....5......  ........1..2..3.4..3..5.6......6...7..8..2.3..7.1..5....9.2...3.8...9...4......9.  ........1.....2.3...4.5.6...3.....72.4....8..6..8..9...7...1...4.56.....8..59....  .......12.....3..4..4.2.5....2.6...5.7....6..8..9.......6.1..5..9...8...3..7.6...  .......12.....3..4..2.4.5....1....5..3.6.....7....8.....4.2...5.6.3..9..8....7...  98.7.......6.5.4.........9.3..9..2...7..8...9..9..5.4.2..5....3..1.6..5......1...  ........1..2..3.4..5..6.7.......1.3....4....85...7.2....5.2.9...9.....8.76.9.....  9..8..7...8..6......5....4.6...9.....3.7..9.......2..5.9..3.8....4.....1.....1.2.  98.7..6....5.4...........9.8..9...6..4..5...9..9..32..1.........7.1...8...8..2..3  ........1.....2.3....45.6....1.7...2.8.6..7..67.........3..9...4..5..8..85.7..... | 11.80;11.80;11.70;dob;12\_12\_03;248083;22; 11.80;11.80;11.60;elev;15;7;22; 11.80;11.80;11.60;elev;16;8;22;  11.80;11.80;11.50;tarekdb;tarx0075;9;22; 11.80;11.80;11.50;tarekdb;tarx0075;9;22  11.80;11.80;11.40;GP;H1;11;22;  11.80;11.80;11.40;tarek-ultra-0203;10;22;  11.80;11.80;11.20;tax;gsf-003 64879;12;21  11.80;11.80;11.10;tax;coloin-04-10;13;21  11.80;11.80;10.80;tax;coloin-04-10;14;21  11.80;11.80;10.70;elev;17;15;23;  11.80;11.80;10.50;elev;18;16;23;  11.80;11.80;10.50;dob;12\_12\_03;248027;22;  11.80;11.80;10.40;Hp54;1;18;21  11.80;11.80;10.40;Hp54;4;17;21  11.80;11.80;10.00;col;2015\_08;1682984;22;  11.80;11.80;9.90;elev;9;19;22;  11.80;11.80;9.80;elev;10;20;21; 11.80;11.80;9.40;dob;12\_12\_03;247933;22;  11.80;11.80;8.30;dob;12\_12\_17s;762567;23;  11.80;11.80;7.90;elev;11;21;21;  11.80;11.80;3.40;tax;m\_b\_metcalf;22;20;  11.80;11.80;3.40;tax;tarek07122317-;23;21  11.80;11.80;3.40;col;H1;24;21  11.80;11.80;3.40;dob;12\_12\_03;247946;22;  11.80;11.80;3.40;GP;KZ1C;23862;23;  11.80;11.80;2.60;GP;H3;26;22;  11.80;11.80;2.60;col;2012\_11\_10;225580;22  11.80;11.80;2.60;dob;2012\_11\_10;225581;22  11.80;11.80;2.60;GP;H2;25;22;  11.80;11.80;2.60;elev;14;28;21;  11.80;11.80;2.60;elev;13;27;22;  11.80;11.80;2.60;col;2015\_08;1682994;22;  11.80;1.50;1.50;col;2012\_11\_10;225578;22;  11.80;1.50;1.50;col;2012\_11\_10;225579;22;  11.80;1.20;1.20;dob;12\_12\_03;262544;22;  11.80;1.20;1.20;GP;cy4;9253;22;  11.80;1.20;1.20;elev;4;31;21;  11.80;1.20;1.20;elev;7;29;22;  11.80;1.20;1.20;elev;8;34;23;  11.80;1.20;1.20;elev;L1;32;21; 11.80;1.20;1.20;elev;5;30;22;  11.80;1.20;1.20;elev;6;33;21;  11.80;1.20;1.20;OW;Lightsaber;1682979;22;  11.80;1.20;1.20;dob;12\_12\_03;248311;22;  11.80;1.20;1.20;dob;12\_12\_03;247964;22;  11.80;1.20;1.20;dob;12\_12\_03;247938;22;  11.80;1.20;1.20;dob;12\_12\_03;247926;21;  11.80;1.20;1.20;GP;12\_07;38140;23;  11.80;1.20;1.20;DOB;13\_01;768268;22;\*  11.80;1.20;1.20;GP;2012\_04;32976;21;  11.80;1.20;1.20;GP;12\_05;35497;23;  11.80;1.20;1.20;dob;12\_12\_17s;762565;22; | XED=11.6/11.6/11.3  **ED=11.9/11.9/11.7+**  **W**ED=11.8/11.8/11.4  **W**ED=11.8/11.8/11.4  **ED=11.8/11.8/11.7+**  **W**ED=11.8/11.8/11.2  XED=11.3/11.3/11.3  XED=11.7/11.7/11.1  XED=11.7/11.7/11.0  **ED=11.8/11.8/10.8=**  **W**ED=11.8/11.8/10.5  XED=11.3/11.3/10.4  **W**ED=11.8/11.8/10.3  **ED=11.8/11.8/10.4=**  **W**ED=11.8/11.8/10.3  XED=11.6/11.6/9.8  **W**ED=11.8/11.8/9.7  XED=11.7/11.7/9.7  XED=11.5/11.5/9.2  XED=11.7/11.7/8.3  XED=11.7/11.7/7.8  **ED=11.8/11.8/3.4=**  XED=11.7/11.7/3.4  **ED=11.8/11.8/3.4=**  XED=11.7/11.7/3.4  XED=11.6/11.6/3.4  **ED=11.8/11.8/2.6=**  **ED=11.8/11.8/2.6=**  **ED=11.8/11.8/2.6=**  XED=11.3/11.3/2.6  XED=11.7/11.7/2.6  **ED=11.8/11.8/2.6=**  XED=11.7/11.7/2.6  **ED=11.8/1.5/1.5=**  **ED=11.8/1.5/1.5=**  XED=11.3/1.2/1.2  XED=11.7/1.2/1.2  **ED=11.8/1.2/1.2=**  XED=11.6/1.2/1.2  XED=11.7/1.2/1.2  XED=11.6/1.2/1.2  **ED=11.8/1.2/1.2=**  XED=11.2/1.2/1.2  XED=11.7/1.2/1.2  XED=11.3/1.2/1.2  **ED=11.8/1.2/1.2=**  XED=11.7/1.2/1.2  **ED=11.8/1.2/1.2=**  XED=11.7/1.2/1.2  **ED=11.8/1.2/1.2=**  **ED=11.8/1.2/1.2=**  XED=11.7/1.2/1.2  XED=11.7/1.2/1.2 | 987......65.........49..7..7..6..5......4..3......2..1.9.5..8......1..4......3..2  98.7.....6.....9....7....5..4..3...5..95..6.......2.1...86..5......1...3.....4.2.  98.7.....7.....9....6.5.....4..3..2...74..8.......1..4..86..5......4..1......2..3  98.76....54.........7..59..4....75.....3...2.....1...6.9...87....4....1....2....3  98.76....75....8....6.......4.....3...8.5.7.....2....1..9.7.6.....3....2.....1.4.  98.7.....6...5......4..93..5......6..7..8......9..24....1.....4....9.1.......1.32  987......65.........47..6..8..5..7......4..3......2..1.9.6..5......3..4......1..2  98.7.....7.6...8....5......8..6..4......5..3......2..1.7.4..9......1..2......3..5  98.7.....7.6...9...5.......4..6..8......5..3......2..1..94..7......3...5.....1.2.  98.7.....7.6...8...5.......4..9..6......5..3......2..1..78..4......1..5......3..2  98.7.....6...5......4..93..5..8......7..9..6...9..42....1....3....9..1.......1.42  98.7.....6.....7....7.8..5.4....3..2..84..9......1..4...65..8......4..3......2..1  98.7..6..5...9..4...3.....94...5...2.1...8.....5....3...2.4..9....6..7.......1...  98.7.....7.6...8....5......4..6..9......3..5......2..1.9.4..7......1..3......5..2  98.7.....7.6...9...5.......4..8..6......5..3......2..1..89..4......1...2.....3.5.  98.7.....6...9.5....5....9.5...4..3..7...2..1..6...4....3.6..4....8....2.....1...  98.7.....6...5......7..98..7....64....43...2.........1.7...46.....1....5....2..3.  98.7.....6...5.9....4....3.7...8.6.......2.4.........1.6..9.5....2..1..3...8.....  98.7.....6.....9....7....85.4..3......86..7.......2.1...95..8......4...2.....1.3.  98.7..6..5...4......3..9.7.4.......8.6....5....9..7.2...297.......23..1......1...  98.7.....6...9.5....4..3...5..9..7......8..3......2..1.7.6..8....1....4.........2  98.7.....6.....5....4......7..8..9......3..4......2..1.5.9..6......4..3......1..2  98.7.....7.6...8....5......4..8..9......3..5......2..1.7.6..4......5...3.....1.2.  98.7.....7.6...8....5......4..8..9......3..5......2..1.9.6..4......5...2.....1.3.  98.7.....6...9......5..69..5....48.....3...7.....2...1.9...84....4.1...3.......2.  98.76....75....9....6......8...4..3..2......1..95..8....86..5......3...4.....1.2.  98.7.....6..89......5..4...7...3.9....6...7....2....51.6..8.3.......1.4.........2  98.7.....6..89......5..4...7...3.9....6...7....2....51.6..8.3.......1..4.......2.  98.7..6....5.6..7......4...4.....9...3.........6....25..1.7...6....5..17.....83..  98.7.....6..89......5..4...7...3.9....6...7....2....41.6..8.3.......1..5.......2.  98.........76..5......7..4.3....9....2......8..15...6...4.1.6.....7...1......2..3  98.7..6..7......5...4.3...75..2...8..6....9....7..3.....23....1....14.........5..  98.7.....7.....9....6.95...47........3.4..7....2....1....84.3.......6..1.....2..6  98.7.....6..85......4..3...7...6.5....9...7....2....41.9..8.6.......1..3.......2.  98.7.....6..85......4..3...7...6.5....9...7....2....41.9..8.6.......1.3.........2  98.7.....6.....7....7....85.4..3......86..5.......2.1...68..9......1..2......4..3  98.7.......7.6.........57..4...3..2..1...6..3...9..8..2......4..3......1..86..5..  98.7.....6..9..5....4.3....75....6....2....1.........3.6.8..7......1...2.....9.4.  98.7.....6..8..9....5.4....73....6....2....1.........5.6.3..8......1...6.....8.24  98.7.....6.....7....7.5.....9...4.3...85..6......2...1.2...1.4...9..58......3...2  98.7.....6...9.8....5....4..7.6..3......8.........2..1.6..3.9....1.....2.....4.5.  98.7.....76....9....5.9.....4.....3...68..7.......2..1..76..5......3...2.....1.4.  98.7.....6.....9....5....7.4...3......75..6.......2.1...96..8......1...2.....4.3.  98.76....7.....9...54......6..3..2...4.....5...8..1......63.7......9...3.....8.1.  9..8..7...8..6..5...4.....33..2....4.2...6.8...7.......1.6...2...9..1..8....5....  98.7.....6..85......4..3...7..6..5....9...6....2....41.9..8.7.......1.2.........3  98.7.....6...5......4..93..7......2...1..2..3......41..5.6.......9..1.3.....8...9  98.7.....6.....7....7.5.....4...3.2...89.........4...1..98..6......1...4.....2.3.  98.7.......6.5.4.........9.3..9..2...7..8...9..9..5.4.2..5....3..1.6..5......1...  98.7.....7.....6....5.4..7.5...9..8...4..32..........1.5..8..4....2....6.....13..  9..8..7...8..6......5....4.6...9.....3.7..9.......2..5.9..3.8....4.....1.....1.2.  98.7..6....5.4...........9.8..9...6..4..5...9..9..32..1.........7.1...8...8..2..3  98.7..6....5.4.......9...8.73......6.9....3.8..2....1.3..6..8......2.........1.4. |

**Compare skfr to SE**

**2+ and 16= to SE**

**7 Within 0.2 of =**

**28X below main ED**