TCEC11: the 11th Top Chess Engine Championship

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After the successes of TCEC Season 10 (Haworth and Hernandez, 2018a), the Top Chess Engine Championship moved straight on to Season 11, starting January 3rd 2018 but with a new structure. Five divisions, each of eight engines, played one or more 'DRR' double round robin phases each, with promotions and relegations following. Classic tempi gradually lengthened and the Premier division's top two engines played a 100-game match to determine the Grand Champion. This gave TCEC the opportunity to welcome in nine new engines, see Figs. 1 & 2, and allowed the strategy for the selection of mandated openings to be finessed from division to division.

Fig. 1. Logos for six rebadged TCEC10 engines (top row) and for nine engines which were not in TCEC10.

Besides using FIDE's 3x-repetition and 50-move drawing rules, TCEC terminates a game at move 40 or later if both engines had |evaluation| < 0.05 for ten consecutive plies in the current phase, i.e., since the last pawn-advance and/or capture. TCEC adjudicates 5-man endgames using the Gaviota DTM EGTs which do not recognise the 50-move rule. Games which are apparently decisive are terminated by TCEC if both engines consistently agreed for the last eight plies that the evaluation is at least 6.5 or at most -6.5. No cases of fortresses being mistakenly seen as wins have been logged so far.

The common platform server was formidable and identical to that of TCEC10: Windows Server 2012 R2 supporting UCI and Xboard (Winboard) engines. Only ChessbrainVB and Scorpio used the Xboard protocol. Hardware included two Intel® Xeon® E5-2699V4 processors @ 2.8 GHz (Intel, 2017), 64GB of DDR4 ECC RAM and a 240GB Crucial CT250M500 SSD. Engines could use 43 threads throughout, the 44th thread being for the operating system. Multi-threading, Windows Large Pages, Opening Books and pondering were not used. TCEC provided Gaviota, Nalimov, Scorpio and Syzygy 'EGT' endgame tables on the server (Ballicora, 2018; de Man, 2018; Haworth, 2014; Nalimov et al, 2000; Shawul, 2018). The largest ever Knodes/sec and EGT-accesses/move were visible in the GUI.

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#	Engine	Initial			thr.	proto-col	EGTs	Authors	Country Codes	Final Div.
		Version	ELO	Div.						
01	Andscacs	0.93	3308	1	43	UCI	—	Daniel José Queraltó	AD	↗ P
02	Arasan	20.4.1	3120	2	16	UCI	Syz.	Jon Dart	US	→ 2
03	Bobcat	8	3129	2	43	UCI	—	Gunnar Harms	NL	↘ 3
04	Booot	6.2	3281	1	16	UCI	—	Alex Morozov	UA	→ 1
05	ChessbrainVB	3.61	2981	4	8	xboard	—	Roger Zuehlsdorf	DE	→ 4
06	Chiron	110218	3284	P	43	UCI	Syz.	Ubaldo Andrea Farina	IT	→ P
07	Defenchess	271217	3076	4	43	UCI	—	Can Cetin, Dogac Eldenk	TR/TR	↗ 3
08	Ethereal	8.67	2945	4	43	UCI	—	Andrew Grant	US	→ 4
09	Fire	20718	3350	P	43	UCI	Syz.	Norman Schmidt	US	→ P
10	Fizbo	2	3276	1	43	UCI	Syz.	Youri Matiounine	US	→ 1
11	Fritz	16	3151	3	16	UCI	Nal?	Vasik Rajlich	CZ/US	↗ 2
12	Ginkgo	2.03	3266	P	43	UCI	—	Frank Schneider	DE	↘ 1
13	Gull	3	3217	1	43	UCI	Syz.	Vadim Demichev	RU	→ 1
14	Hannibal	121017	3203	1	43	UCI	—	Sam Hamilton, Edsel Apostol	US/PH	↘ 2
15	Houdini	6.03	3461	P	43	UCI	Syz.	Robert Houdart	BE	→ P
16	Jonny	8.1	3215	2	43	UCI	Syz.	Johannes Zwanzger	DE	↗ 1
17	Komodo	2012.00	3454	P	43	UCI	Syz.	Don Dailey, Larry Kaufman, Mark Lefler	US	→ P
18	Laser	1.5	2562	3	43	UCI	Syz.	Jeffrey An, Michael An	US	↗↗ 1
19	Nemorino	4.01	2977	3	43	UCI	Syz.	Christian Günther	US	→ 3
20	Nirvana	2.4	3221	1	43	UCI	—	Thomas Kolarik	US	↘ 2
21	Pedone	1.7	2477	4	43	UCI	Syz.	Fabio Gobbato	IT	↗ 3
22	Scorpio	2.79	2831	4	32	xboard	—	Daniel Shawul	ET	↘ —
23	Senpai	2.0	2881	4	16	UCI	—	Fabien Letouzey	FR	↗ 3
24	Stockfish	100218	3456	P	43	UCI	Syz.	Tord Romstad, Marco Costalba, Joona Kiiski, Gary Linscott	NO/IT/ FI/CA	→ P
25	Texel	1.08a8	3159	2	43	UCI	Syz.	Peter Österlund	SE	→ 2
26	The Baron	3.41	2840	4	43	UCI	Syz.	Richard Pijl	NL	↘ —
27	Toga II	4.01	2767	4	20	UCI	—	Thomas Gaksch	DE	↘ —
28	Vajolet2	2.5	3064	2	43	UCI	Syz.	Marco Belli	IT	→ 2
29	Wasp	TCEC S11	3094	2	43	UCI	—	John Stanback	US	↘ 3

Fig. 2. The TCEC11 engines, details and authors.

1 Division 4: one DRR phase, 14 rounds, 56 games, tempo 30′+10″/m

These engines did not take part in TCEC10 and the top five were promoted to play in Division 3.

The selection of openings for TCEC has been made freely by Nelson Hernandez (2018) who has led on this activity since the middle of Season 5 in 2013, sometimes with the help of invited assistants. His approach has varied across the seasons, and now across divisions, as part of the TCEC tournament evolution determined by TCEC chief Anton Mihailov. This is a good moment to say that neither author claims to be a club player but they are enthusiasts for the game, here making contributions based on statistical rather than chessic observation.

Since 2004, Nelson has diligently collected human and engine games from a multitude of sources. These have been filtered to meet criteria including game length, uniqueness, time controls and Elo – and then adjudicated so that game results match the ending or EGT-truncated positions. The resulting 'CATOBASE' contains over 4 billion unique positions and in conjunction with proprietary query tools, permits Nelson to search for positions that match very specific quantitative criteria: frequency, draw-rate, success rate, ECO, ply length. In this way, he has successfully kept the TCEC draw-rate well below that of undirected engine contests while providing the desired level of opening variety at the highest

levels of competition in the later divisions. Here, the seven most common two-move openings in CATOBASE were allocated to rounds 1-7, and to rounds 8-14 with colours reversed, as in Fig. 3.

#	First four plies	Rounds	ECO	Opening	CHESSBASE ECO coding for the games	TCEC11.D4 results			
						1-0	½-½	0-1	ignored
01	1. e4 c5 2. Nf3 d6	01 & 08	B50	Sicilian Defence	B56, B30, B52, B51; B50, B90, B54, B52	0	5	2	1
02	1. e4 e5 2. Nf3 Nc6	02 & 09	C44	King's Pawn Game	C65, C60, C61, C68; C67, C45, C69, C68	4	3	1	0
03*	1. d4 Nf6 2. c4 e6	03 & 10	E00	Queen's Pawn Game	A45, E51, D37, E51; D37, D37, D40, D35	2	4	1	1
04*	1. e4 e6 2. d4 d5	04 & 11	C00	French Defence	C01, C01, C01, C01; C14, C01, C17, C14	0	5	3	0
05*	1. e4 c5 2. Nf3 Nc6	05 & 12	B30	Sicilian Defence	B31, B57, B30, B51; B30, B31, B30, B22	3	1	4	0
06*	1. e4 c6 2. d4 d5	06 & 13	B12	Caro-Kann Defence	B19, B18, B15, B12; B12, B15, B12, B15	4	3	1	0
07	1. d4 d5 2. c4 c6	07 & 14	D10	Queen's Gambit Declined	D30, D12, D10, D10; D15, D46, D10, D15	3	5	0	0

Fig. 3. CATOBASE's most common two-move openings and CHESSBASE's ECO classification of the resulting games.

The cross-tables include a normalised Sonnerborn-Berger score 'nSB' = SB/#DRR^2 in case readers wish to compare SB scores across divisions. All rounds have four games so game *r.n* is game *4r-4+n* in the pgn files (Haworth and Hernandez, 2018b). The colour-flipped pairings of engines are 28 games apart.

With a range of 599 ELO across the participants, Division 4 saw a 53.6% win-rate, 28.6% 1-0 and 25.0% 0-1. The longest win (0-1) was ETHEREAL-TOGA g17 at 145 moves and the longest draw was SENPAI-PEDONE g36 at 146 moves. This had been a theoretical draw for 86 moves and ended in a KQRPk stalemate. Only 16.7%, 5/30, wins were below the diagonal in the final cross-table of Figure 4, perhaps the most striking being g37, TOGA-SENPAI, and g45, TOGA-ETHEREAL.

# Engine	ELO	Pts	DRR	SB	nSB	D'chess	Senpai	Pedone	Ethrl	Ch'brain	Toga	T'Baron	Scorpio	Move
1 Defenchess 271217	3076	10.0	1	66.25	66.25		==	1=	1=	11	=1	==	=1	↗
2 Senpai 2.0	2881	9.0	1	54.00	54.00	==		==	==	==	10	11	11	↗
3 Pedone 1.7	2477	8.0	1	48.00	48.00	0=	==		=0	1=	01	=1	11	↗
4 Ethereal 8.67	2945	7.5	1	47.50	47.50	0=	==	=1		==	0=	1=	=1	↗
5 ChessBrainVB 3.61	2981	7.5	1	43.50	43.50	00	==	0=	==		1=	11	1=	↗
6 Toga II 4.01	2767	7.0	1	46.00	46.00	=0	01	10	1=	0=		=1	10	↘
7 The Baron 3.41	2840	4.0	1	25.75	25.75	==	00	=0	0=	00	=0		=1	↘
8 Scorpio 2.79	2831	3.0	1	21.50	21.50	=0	00	00	=0	0=	01	=0		↘

Fig. 4. The TCEC11 Division 4 cross-table: one DRR phase, 14 rounds, 56 games.

2   Division 3: two DRR phases, 28 rounds, 112 games, tempo 30′+10″/m

#	First four plies	Rounds	ECO	Opening	CHESSBASE ECO coding for the games	TCEC11.D3 results			
						1-0	½-½	0-1	ignored
01	1. b3 e5 2. Bb2 Nc6	01 & 08	A01	Nimzovich-Larsen attack	A01, A01, A01, A01; A01, A01, C50, A01	2	1	5	0
02	1. Nf3 Nf6 2. g3 g6	02 & 09	A05	Reti, King's Indian attack	D02, D77, D78, A39; A15, D79 D73, D79	2	4	2	0
03	1. e4 c5 2. Nc3 Nc6	03 & 10	B23	Sicilian, closed	B23, B45, B33, B23; B45, B23, B59, B30	1	6	1	0
04	1. e4 c6 2. Nf3 d5	04 & 11	B10	Caro-Kann defence	B11, B10, B12, B11; B15, B10, B11, B15	4	1	3	0
05	1. Nf3 c5 2. c4 Nc6	05 & 12	A04	Reti opening	A30, D30, A35, A30; D40, A33, A33, A30	3	3	1	1
06	1. d4 Nf6 2. Nf3 e6	06 & 13	A46	Queen's pawn game	A46, D38, D38, D43; E11, D41, E52, D37	2	5	1	0
07	1. e4 c5 2. c3 Nf6	07 & 14	B22	Sicilian, Alapin variation	B22, B22, B22, B22; B22, B22, B22, B22	0	8	0	0
08*	1. d4 Nf6 2. c4 e6	15 & 22	E00	Queen's pawn game	E56, E48, D35, D30; D59, D38, E39, E10	4	3	1	0
09	1. c4 Nf6 2. Nc3 e6	16 & 23	A17	English Opening	A18, A18, A18, E11; A18, A34, B44, D55	3	5	0	0
10*	1. e4 c5 2. Nf3 Nc6	17 & 24	B30	Sicilian defence	B30, B31, B31, B54; B30, B30, B30, B30	1	4	3	0
11	1. d4 d5 2. Nf3 c6	18 & 25	D02	Queen's pawn game	D02, D02, D30, D02; D11, D02, D27, D12	3	3	2	0
12	1. e4 e5 2. Nf3 Nf6	19 & 26	C42	Petrov's defence	C42, C42, C42, C42; C42, C42, C42, C42	1	6	1	0
13	1. e4 d5 2. exd5 Qxd5	20 & 27	B01	Scandinavian defence	C10, B01, B01, B01; B01, B01, B01, B01	4	4	0	0
14	1. d4 d6 2. e4 g6	21 & 28	A41	Queen's pawn game	B08, A43, A41, B08; B08, B08, B08, A43	0	8	0	0

Fig. 5. The 14 two-move openings chosen for Division 3 and CHESSBASE's ECO classification of the resulting games.

Fourteen of the most frequent 100 two-move openings in CATOBASE were allocated to rounds 1-7 and 15-21, with colours reversed in rounds 8-14 and 22-28 as in Fig. 5. Two openings, asterisked, were used in Division 4.

# Engine	Rtng	Pts	DRR	SB	nSB	Fritz	Laser	Nemrno	Pedone	D'chess	Senpai	Ch'Brain	Ethrl	Move
1 Fritz 16	3151	18.5	2	238.25	59.56		====	===0	==11	====	=11=	1111	11==	↗
2 Laser 1.5	2562	17.5	2	228.25	57.06	====		10==	====	011=	11=0	=1=1	111=	↗
3 Nemorino 4.01	2977	14.5	2	203.50	50.88	===1	01==		10=0	====	===1	====	=01=	→
4 Pedone 1.7	2477	14.0	2	194.00	48.50	==00	====	01=1		111=	0=10	=0==	====	→
5 Defenchess 271217	3076	14.0	2	188.50	47.13	====	100=	====	000=		011=	1110	==1=	→
6 Senpai 2.0	2881	12.5	2	169.50	42.38	=00=	00=1	===0	1=01	100=		====	=110	→
7 ChessBrainVB 3.61	2981	11.0	2	145.50	36.38	0000	=0=0	====	=1==	0001	====		101=	↘
8 Ethereal 8.77	2945	10.0	2	140.50	35.13	00==	000=	=10=	====	==0=	=001	010=		↘

Fig. 6. The TCEC11 Division 3 cross-table: two DRR phases, 28 rounds, 112 games.

Here we had a 45.5% win-rate, 27.7% 1-0 and 17.8% 0-1. The longest win (1-0) was ETHEREAL-NEMORINO g51 at 149m and the longest draw, SENPAI-PEDONE g52 at 201m. TCEC newcomers DEFENCHESS, PEDONE and SENPAI successfully remained in Division 3 after their promotion. LASER 1.5 was underrated at 2562.

3 Division 2: two DRR phases, 28 rounds, 112 games, tempo 45′+10″/m

#	First four plies	Rounds	ECO	Opening	CHESSBASE ECO coding for the games	TCEC11.D2 results			
						1-0	½-½	0-1	ignored
01	1. d4 Nf6 2. Nc3 d5	01 & 08	A45	Queen's Pawn game	D00, D00, D00, D03; B13, D00, D00, D01	2	2	3	1
02	1. c4 e5 2. Nc3 Nc6	02 & 09	A25	English, Sicilian reversed	C01, C01, A28, A25; A28, A26, A28, A25	3	3	2	0
03	1. e4 c5 2. Nc3 d6	03 & 10	B23	Sicilian Defence, closed	B30, B23, B50, B50; B23, B50, B23, B56	3	4	1	0
04	1. d4 Nf6 2. Bf4 d5	04 & 11	A45	Queen's Pawn game	B13, B13, D00, D02; B13, D00, D02, D00	6	0	2	0
05*	1. e4 e6 2. d4 d5	05 & 12	C00	French Defence	C01, C06, C01, C06; C01, C13, C08, C08	1	5	2	0
06	1. e4 c5 2. Nf3 e6	06 & 13	B40	Sicilian Defence	B45, B22, B45, B40; B45, B30, B40, B22	2	4	2	0
07	1. Nf3 d5 2. c4 c6	07 & 14	A09	Reti opening	D12, D27, D47, D12; D46, D45, D12, A11	2	5	1	0
08	1. d4 d5 2. c4 dxc4	15 & 22	D20	Queen' Gambit Accepted	D25, D20, D26, D25; D11, D27, D27, D20	3	4	1	0
09*	1. e4 c6 2. d4 d5	16 & 23	B12	Caro-Kann Defence	B12, B15, B12, B12; B15, B12, B15, B15	2	6	0	0
10	1. Nf3 Nf6 2. c4 g6	17 & 24	A15	English opening	D98, E60, D85, E91; B36, D85, D92, E90	4	4	0	0
11	1. d4 Nf6 2. c4 c6	18 & 25	A50	Queen's Pawn game	D10, D30, D30, D30; D13, D27, D12, D45	5	3	0	0
12	1. e4 c5 2. c3 d5	19 & 26	B22	Sicilian: Alapin's variation	B22, B22, B22, B22; B22, B22, B22, B22	2	6	0	0
13	1. e4 e5 2. Nf3 d6	20 & 27	C41	Philidor's Defence	C41, C41, C41, C41; C41, C41, C46, B50	3	4	1	0
14	1. e4 d6 2. d4 Nf6	21 & 28	B07	Pirc Defence	A43, B07, B08, B07; B08, B00, B07, B07	1	6	1	0

Fig. 7. The 14 two-move openings chosen for Division 2 and CHESSBASE's ECO classification of the resulting games.

# Engine	Rtng	Pts	DRR	SB	nSB	Jonny	Laser	Texel	Arasan	Fritz	Vajolet	Bobcat	Wasp	Move
1 Jonny 8.1	3215	20.0	2	255.75	63.94		====	1===	1==1	11=1	=11=	==1=	111=	↗
2 Laser 1.5	2562	17.5	2	226.00	56.50	====		====	1===	====	=1=1	1101	11==	↗
3 Texel 1.08a8	3159	16.5	2	210.50	52.63	0===	====		1010	11==	====	11=0	11=1	→
4 Arasan 20.4.1	3120	14.0	2	182.25	45.56	0==0	0===	0101		1==0	==10	1=11	=1=0	→
5 Fritz 16	3151	14.0	2	170.00	42.50	00=0	====	00==	0==1		10==	1101	111=	→
6 Vajolet2 2.5	3064	13.0	2	170.50	42.63	=00=	=0=0	====	==01	01==		=1=1	====	→
7 Bobcat 8	3129	10.0	2	130.75	32.69	==0=	0010	00=1	0=00	0010	=0=0		11=1	↘
8 Wasp TCEC S11	3094	7.0	2	101.75	25.44	000=	00==	00=0	=0=1	000=	====	00=0		↘

Fig. 8. The TCEC11 Division 2 cross-table: two DRR phases, 28 rounds, 112 games.

Fourteen of the most frequent 100 two-move openings in CATOBASE were allocated to rounds 1-7 and 15-28 with colours reversed in rounds 8-14 and 22-28 as in Fig. 7. Two asterisked openings were used in Division 4. This division provided a 50.0% win-rate, 35.7% 1-0 and 14.3% 0-1. JONNY was the undefeated and clear winner and LASER, with only one loss, took second over TEXEL.

4   Division 1: four DRR phases, 56 rounds, 224 games, tempo 60′+10″/m

The games of the first DRR were played without opening books from the initial position. For the remaining 168 games, a TCEC fan, Nikolaos Konstantakis, chose 84 openings according to Nelson Hernandez' (2018) guidelines. Most openings mandated five moves, the remainder being six- and seven-movers.

Engine	Rtng	Pts	S B	nS B	Andscacs	Fizbo	Booot	Jonny	Gull	Laser	Hannibal	Nirvana	Move
Andscacs 0.93	3308	37.0	968.75	60.55		==0===1=	======1=	=====11=	==11=1==	11=1=11=	===1=1==	==11111=	↗
Fizbo 2	3276	31.5	844.50	52.78	==1===0=		1=001===	===0===0	=====1==	=101=111	==1=10==	=111====	↗
Booot 6.2	3281	31.0	838.50	52.41	======0=	0=110===		==0=101=	1==1====	====111=	==01===1	==1=====	→
Jonny 8.1	3284	30.0	815.00	50.94	=====00=	===1===1	==1=010=		0==01===	=011==1=	==1=1===	==01===1	→
Gull 3	3217	26.5	726.50	45.41	==00=0==	=====0==	0==0====	1==10===		1=======	==0101=1	=1=====0	→
Laser 1.5	3201	24.5	639.75	39.98	00=0=00=	=010=000	====000=	=100==0=	0=======		==11=11=	1=11==1=	→
Hannibal 121017	3203	23.0	653.75	40.86	===0=0==	==0=01==	==10===0	==0=0===	==1010=0	==00=00=		=01=1===	↘
Nirvana 2.4	3221	20.5	583.25	36.45	==00000=	=000====	==0=====	==10===0	=0=====1	0=00==0=	=10=0===		↘

Fig. 9. The TCEC11 Division 1 cross-table: four DRR phases, 56 rounds, 224 games.

Given the ELO range of 107, the winrate was 37.1%, 26.8% 1-0 and 10.3% 0-1. Following promotions from Divisions 3 and 2, the clearly under-rated LASER 1.5 had its ELO uplifted by 639 to 3201. It just survived in Division 1, taking half its points from the demoted HANNIBAL and NIRVANA. Also just promoted, JONNY continued to acquit itself well in mid-table. ANDSCACS ran out a clear winner of this division. Perhaps the most notable wins 'below the diagonal' were LASER-FIZBO g59, HANNIBAL-BOOOT g74, NIRVANA-JONNY g77 and HANNIBAL-FIZBO g146.

5   Division P: six DRR phases, 84 rounds, 336 games, tempo 90′+10″/m

There is always speculation as to whether engine authors will update their engines before their next appearance, particularly with regard to Robert Houdart and HOUDINI, the current TCEC champion. Robert in fact advised TCEC that there was a popular misconception among TCEC fans that an updated version of HOUDINI existed!

In the Premier Division, the games of the first DRR were also played without opening books from the initial position. The second author chose 4-move openings for the remaining games. Given the ELO range of 195, this produced a 39.0% win rate, 29.2% 1-0 and 9.8% 0-1 with just 6.9% of the wins being below the diagonal of the final x-table of Fig. 10. First-player advantage, ELO rating and consistent form were starting to show a clearer advantage.

The longest win was FIZBO-FIRE g314's 1-0 at 217m, and the longest draw HOUDINI-STOCKFISH, g260 at 198m. GINKGO-FIRE, g171, was a good argument for 6m-EGT adjudication, theoretically drawn at 6-man KRPkbp position 54b and only ending with position 148w.

KOMODO-STOCKFISH, g28, 1-0 was a notable 'underdog win and STOCKFISH's sole loss. ANDSCACS-KOMODO, g210, was another, finishing in KRPPPkrpp, a 1-0 win which FINALGEN (Romero, 2018) is able to confirm. The decisive games between the top three were g28 (as above), g58, g170, g224, g232 and the final g336.

The chat site Twitch (2018) and Wool (2018) provided observations across TCEC11 and 'GM Thechesspuzzler' (2018) dedicated a comprehensive Youtube playlist to this division and was perhaps the most frequent commentator, covering the following games:

draws 02, 27, 56, 84, 86, 92, 112, 114, 120, 168 & 196: wins 14, 19, 28, 46, 58, 170 & 224.

With the exception of STOCKFISH, which outperformed its TCEC ELO, the engines here ranked in ELO order. The top three, just 9 ELO apart, were rated 100 ELO better than the others so the eventual podium was no surprise. KOMODO took third place on 51.5 points, losing its head-to-head matches with HOUDINI and STOCKFISH while the latter was notably more successful than in TCEC10 in winning against lesser opposition. The one decisive result between STOCKFISH and HOUDINI suggested a close Superfinal.

Engine	Rtng	Pts	nSB	Stockfish	Houdini	Komodo	Fire	Chiron	Andscacs	Fizbo	Ginkgo	Move
Stockfish 100218	3456	61.0	63.69		=======l===	0=====l==1	l=l==l=l=l=	==ll==llll=	ll=l=l=l=1	lll=llllll=	=lll=ll=ll=1	↗
Houdini 6.03	3461	54.5	58.70	=======0==		==l===l=l==	=l=l==l=l=	====l=lll==	l=====l=l=ll	=l=l=l=l=1	lll=l=l=====	↗
Komodo 2012.00	3454	51.5	54.85	l=====0==0	=0==0=0===		=======l==ll	=l=ll==ll=	l=l=l==0=lll	====l==lll=1	l===ll==l==1	→
Fire 020718	3350	42.5	45.24	0=0===0=0=	=0==0===0=	=======0==00		===l==l===1	=======l====	l=l=l==l==0	=l=l=l==l==1	→
Chiron 110218	3284	36.0	38.85	==00===0000=	==0=0000===	=0==00==00==	===0=0===0		====0====l=	ll0l======1	=ll==l======	→
Andscacs 0.93	3347	35.0	37.56	00=0=0=0=0=	0=====0=0=00	0=0=0=l=000	=======0====	====l===0=		l==0==01=0=	l=l=lll=====	→
Fizbo 2	3273	31.0	32.82	000=0000000=	=0=0=0=0=0=	====0===000=0	0=0==0==0=1	00l0======0	0==l==l0==l=		=l=l=l=l0=l=	↘
Ginkgo 2.03	3266	24.5	29.17	=000=00==0=0	000=0=0====	0==00==0==0	=0=0=0=0=0	=00==0======	0=0=000=====	=0=0=0=01=0=		↘

Fig. 10. The Premier Division cross-table: six DRR phases, 84 rounds, 336 games.

To judge from the normalised Sonneborn-Berger scores, the winning engines, in decreasing order of dominance in the context of their initial division, were DEFENCHESS (D4, 66.25), JONNY (D2, 63.94), STOCKFISH (DP, 63.69), ANDSACS (D1, 60.55) and FRITZ (D3, 59.56).

6   The TCEC11 Superfinal match: 100 games, tempo 120′+15″/m

And so the stage was set for a two-week Superfinal: STOCKFISH versus HOUDINI, the TCEC Grand Champion of Seasons 6 and 9 versus the TCEC Grand Champion after the last Season and after Seasons 1, 2 and 4. Given the results of the Premier Division (though scarcely conclusive between the two contestants themselves) the news of a STOCKFISH update and the news of no HOUDINI update, prior polling not surprisingly had STOCKFISH as favourite. ELOs were reset at 3546 and 3489, the difference of 57 suggesting a benchmark 52-48 win for Stockfish with 78 draws, albeit with the incorrect assumption that games started from the initial position.

Each pair of games used a different one of fifty openings chosen by Jeroen Noonen: they ranged in length from 3 to 28 ply. Jeroen aimed for a win-rate of at least 20% with aspirations for the 25-26% of previous Superfinals. STOCKFISH played White in odd-numbered games and Black for the following game.

TCEC Superfinal	ELO	Decisive games	Wins after n games				
			20	40	60	80	100
Stockfish 260318	3546	05, 07, 12, 21, 24, 26, 27, 29, 30, 31, 35, 42, 43, 61, 66, 75, 79, 81, 96, 99	3-0	11-1	13-1	17-2	20-2
Houdini 6.03	3489	32, 78					

Fig.11. The Superfinal match of 100 games: the decisive games, Black wins underlined.

Across the 100 games, STOCKFISH scored +20=78-2, an ELO superiority of 63, comparable with its estimated ELO superiority of 57 which predicted four wins for HOUDINI. Given the 15 wins for White and 7 (all to STOCKFISH) for Black, White seems to have an ELO advantage of 28 over Black. The win-rate of 22% fell neatly between Jeroen's minimum goal of 20% and his aspiration of 25-26%.

Given that openings were mandated but played out by the engines from both sides, the match is best thought of as 50 duals of two games each. STOCKFISH scored +18=31-1 in 'dual terms' as it won both games 29 and 30, shared White wins in games 31-32 with HOUDINI, but lost game 78.

The score is the only input to ELO calculations but does not reflect the closeness of the contest. Games were on average some 73.4 moves and 04:08:53 in length despite TCEC's draw rule pre-empting a 3x-repetition or 50-move-rule draw on 32 occasions. The longest game was the drawn g97 at 168m and 5:23:04 while the longest win was g42 at 167m and 5:21:04. There was one 50mr draw in game 45, and one stalemate finish, game 6 being ended abruptly by HOUDINI offering a Queen which Black's King could not refuse. Games 05, 07, 30, 31, 43, 96 and 99 were commentated on by GM_Thechesspuzzler (2018).

7 On the openings and endgames

Again, Nelson Hernandez and Jeroen Noonen are to be congratulated on the variety they introduced into the games through their choice of mandated openings, done without favouring any particular engine because of colour-symmetry. For divisions 4, 3 and 2, the ECO codes in the tables and supplied pgns (Haworth and Hernandez, 2018b) are provided by CHESSBASE and differ in some 20% of cases from the contemporaneous classification given by TCEC which does not consider transpositions.

Surprisingly, some thirteen engines, including ANDSCACS and GINKGO in the Premier Division, did not consult endgame tables at all, while almost all others used the provided set of sub-7-man DTZ_{50}'' EGTs created by Ronald de Man (2018). Despite this, all games reduced to five men were adjudicated by DTM EGTs ignoring the 50-move rule and regardless of whether both sides were using 6-man EGTs or not. Fortunately, no 50mr controversies arose but DTZ_{50}'' EGT adjudication now seems more pragmatic. Given the TCEC win rule and the fact that both engines were using 6-man EGTs, the 43 superfinal games reaching 7-man endgames were, perhaps predictably, all drawn in theory at the 7-man point as they were in practice. The 22 superfinal wins were agreed with 8-18 men on the board.

The runtime statistics revealed further endgame surprises, for at least the first author. Engines often consulted the EGTs really early in the game, and did not necessarily settle for the theoretical result in 6-man positions, instead looking for the 'best' winning or drawing move. With the EGTs on SSD, millions of references to them were often made for just one move, STOCKFISH clocking over one billion such calls at 10-man position 44w of game 47 at a rate of over 1,630,000 positions/sec.

8 Summary and reflection

The list of engines participating in TCEC Season 11 is a testament to the level of activity in the chess programming community and to its international scope. Both are promoted by the whole sequence of events (TCEC, 2018). Contrary to popular belief, computer chess did not stop when IBM's DEEP BLUE edged the second match against Garry Kasparov. It is worth remembering that Garry is still 4-3 up on wins against DEEP BLUE across the two matches. These are now worth revisiting in the context of his mature, frequently reviewed and well received reflection on the subjects of artificial intelligence and 'man and machine' (Kasparov, 2017).

All participating authors are to be congratulated on their achievements and on the many fine TCEC11 games that resulted. It would be interesting to have the first-hand, individual perspectives of some of these authors on the record. All podium placers should be particularly delighted with their results,

especially if they were promoted and, like ANDSCACS, DEFENCHESS, FRITZ, JONNY, LASER, PEDONE and SENPAI, emerged from TCEC11 in a higher division. LASER alone achieved a double promotion, thanks to some urgent development work which also removed bugs revealed to the author during the previous TCEC10 season.

Particular congratulations go to the 'big three' – HOUDINI, KOMODO and STOCKFISH – who remain on the top step. This time, STOCKFISH recovered from its relative failure in TCEC10 to recover the title of TCEC Grand Champion. This is certainly a win which its community of contributing testers and supporters, particularly the leading authors, will and should enjoy. STOCKFISH was also Grand Champion after TCEC Seasons 6 and 9.

The divisional structure of TCEC11 clearly works to advantage and is retained for TCEC12. Complete pgn files, with some decisive games played out to greater clarity, plus detailed results of and runtime data on all the games has been made available (Haworth and Hernandez, 2018b) to facilitate later and more detailed study. TCEC11 is a comprehensive snapshot of the status of computer chess today and will repay that further examination.

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