# Computer Chess at ACM 79:
The Tournament and the Man vs. Man and Machine Match

Ben Mittman, Northwestern University
Monroe Newborn, McGill University

ACM 79 in Detroit marked the tenth consecutive year that the ACM has hosted the North American Computer Chess Championship. This year, the tournament saw continued improvement in the level of play by all participants and a return to the top of the pack by the current world champion program, CHESS 4.9. CHESS 4.9, the work of David Slate and Larry Atkin of Northwestern University and David Cahlander of Control Data Corporation, has now won eight of the ten ACM tournaments. Upset last year by Ken Thompson's BELLE, CHESS 4.9 went into the tournament a slight underdog but won its first three games and then drew with BELLE in the final round to finish with 3½ points. The latter was forced to a draw by CHAOS, the bridesmaid of many past tournaments, and finished second with 3 points. Tom Truscott's DUCHESS also finished with 3 points but lost second place to BELLE on tie breaking points. (Table I on the next page lists the history of the ten ACM tournaments.)

In attendance at the tournament as guests of ACM were Professor John McCarthy of Stanford University, George Koltanowski, former president of the United States Chess Federation and the world's most famous blindfold chess player, and Dr. Max Euwe of Holland, former president of FIDE (the world's chess governing organization) and former World Champion from 1935-1937. David Levy, International Master from London, served as Tournament Director. Dr. McCarthy awarded the trophies at a conference luncheon on Wednesday, October 31, and called for placing greater stress on the experimental aspects of the tournament. He encouraged the tournament organizers to require programs to print out more of the important information leading up to their choice of moves. This would permit a clearer understanding of why the computers play as they do. Koltanowski and Euwe mixed with the participants and from time to time came to the stage to assist David Levy. They commented on the games and dipped into their large reservoir of chess-related stories and jokes. The tournament was organized by Ira Purchis of the Burroughs Corporation, Ben Mittman, and Monroe Newborn. IBM, Burroughs, Anderson Jacob-
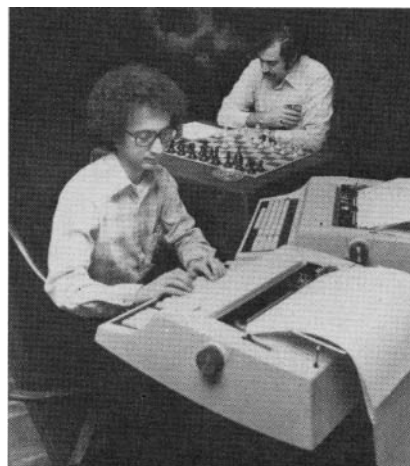
David Slate and Larry Atkin (foreground) working together with the CDC CYBER 176 with opponent being out of sight.

son, GM (General Motors), and Ford provided partial support of the tournament.

In addition to the chess tournament, ACM 79 was the scene of a most unusual event on October 27, 1979. An exhibition chess game was held between David Levy and a unique team consisting of CHESS 4.9 and David Slate. Before we go on with our coverage, we wish to assure you that man won!

The Tournament

Twelve teams participated in the four-round Swiss style tournament held October 28-30. Eight programs were from the United States, three from Canada, and one from The Netherlands. Three microcomputers were in attendance: SARGON 2.5 on a 6502-based SARGON Chess machine, MYCHESS on a Cromenco Z-2D, and RUFUS on an Apple II microcomputer. Three participants brought electronic chessboards: CHESS 4.9, BLITZ 6.9, and SARGON 2.5 (SARGON 2.5 has both board and computer in one package). BELLE's electronic chessboard was left at home in Murray Hill because Ken Thompson was concerned about how one would handle the situation when two electronic boards faced one another. A small time advantage (of several seconds) would be had by the side using the board on which the game officially took place. The rules of the tournament were modified before the tournament began to take this into account.

Table I. History of the ACM Tournaments.

Year	City	Winning Program	Runner-up
1970	New York	CHESS 3.0; Slate, Atkin, Gorlen, CDC 6400	The Daly Chess Program; Daly, King
1971	Chicago	CHESS 3.5; Slate, Atkin, Gorlen, CDC 6400	TECH; Gillogly, PDP 10
1972	Boston	CHESS 3.6; Slate, Atkin, Gorlen, CDC 6400	OSTRICH; Arnold, Newborn, D.G. Supernova
1973	Atlanta	CHESS 4.0; Slate, Atkin, Gorlen, CDC 6400	TECH II; Baisley, PDP 10
1974	San Diego	RIBBIT; Hansen, Crook, Parry, Honeywell 6050	CHESS 4.0; Slate, Atkin, CDC 6400
1975	Minneapolis	CHESS 4.4; Slate, Atkin, CDC CYBER 175	TREEFROG; Hansen, Calnek, Crook, Honeywell 6080
1976	Houston	CHESS 4.5; Slate, Atkin, CDC CYBER 176	CHAOS; Swartz, Ruben, Winograd, Berman, Toikka, Alexander, Amdahl 470
1977	Seattle*	CHESS 4.6; Slate, Atkin, CDC CYBER 176	DUCHESS; Truscott, Wright, Jensen, IBM 370/168
1978	Washington	BELLE; Thompson, PDP 11/70 with special purpose hardware	CHESS 4.7; Slate, Atkin, CDC CYBER 176
1979	Detroit	CHESS 4.9; Slate, Atkin, Cahlander, CDC CYBER 176	BELLE; Thompson, Condon, PDP 11/70 with special purpose hardware

* Both teams finished with 3½/4 points. The winning trophy was awarded to CHESS 4.6 based on tie-breaking points.

Table II. Final Standings of ACM's Tenth North American Computer Chess Championship.

Program, computer, authors	Initial seeding	Round 1	Round 2	Round 3	Round 4	Total points	Tie breaking* points	Final place
1. CHESS 4.9, CDC CYBER 176, David Slate, Larry Atkin, David Cahlander	2	1_9	1_8	1_3	$1/2_2$	3½	—	1
2. BELLE, PDP 11/70, special hardware, Ken Thompson, Joe Condon	1	1_5	$1/2_4$	1_7	$1/2_1$	3	10	2
3. DUCHESS, IBM 370/168, Tom Truscott, Bruce Wright, Eric Jensen	3	1_{10}	1_7	0_1	1_4	3	9	3
4. CHAOS, Amdahl V/6, Mike Alexander, Fred Swartz, John O'Keefe, Victor Berman	4	1_{12}	$1/2_2$	1_8	0_3	2½	7½	4
5. L'EXCENTRIQUE, Amdahl V/7, Claude Jarry	7	0_2	1_{12}	1_9	$1/2_6$	2½	7	5
6. MYCHESS, Cromenco Z-2D, David Kittinger	12	0_7	1_{10}	1_{11}	$1/2_5$	2½	5½	6
7. SARGON, SARGON Chessboard (6502-based), Dan and Kathy Spracklen	6	1_6	0_3	0_2	$1/2_8$	1½	10	7
8. BLITZ 6.9, UNIVAC 1100/80, Robert Hyatt, Albert Gower	5	1_{11}	0_1	0_4	$1/2_7$	1½	8½	8
9. OSTRICH 80, Nova 3, Monroe Newborn	8	0_1	1_{11}	0_5	$1/2_{10}$	1½	8½	9
10. AWIT, Amdahl V/7, Tony Marsland	9	0_3	0_6	1_{12}	$1/2_9$	1½	7	10
11. BS '66, '76, IBM 370/168, Barend Swets	11	0_8	0_9	0_6	1_{12}	1	—	11
12. RUFUS, Apple II, Charles Sullivan	10	0_4	0_5	0_{10}	0_{11}	0	—	12

* Sum of opponents' points.

Initial seedings of the teams are shown in Table II. The only significant upset of the tournament was CHAOS's draw with BELLE in round 2. This was a surprise to all except maybe the authors of CHAOS who had made improvements in their program and anticipated improved play. Claude Jarry's L'EXCEN-TRIQUE, using an Amdahl V/7 for the first time, played strong chess throughout the tournament and was given the unofficial award of the most improved program. MYCHESS, David Kittinger's program, also did better than expected.

CHESS 4.9's game with BELLE is shown without comments. The game was an exciting battle that ended in a draw by agreement. Each side had a Rook, Pawn, and King (Black had a second Pawn but that was destined to fall on the next move).

Man vs. Man and Computer

This event resulted from an idea suggested by ACM President Dan McCracken. Dan has spoken and written a great deal recently about the exciting possibilities opened up

	WHITE : BELLE					
1	P-Q4	N-KB3	22	B-K1	N-B5	
2	P-QB4	P-B4	23	K-R1	P-R3	
3	P-Q5	P-K3	24	B-KN3	P-N4	
4	N-QB3	PxP	25	PxP	PxP	
5	PxP	P-Q3	26	RxR	RxR	
6	P-K4	P-KN3	27	B-B1	P-QN5	
7	N-B3	B-N2	28	N-K2	P-N6	
8	B-K2	0-0	29	Q-N1	N-R4	
9	0-0	R-K1	30	B-B2	N-B5	
10	N-Q2	N-R3	31	N-B4	NxN	
11	P-B3	N-B2	32	BxN	B-N4	
12	P-QR4	P-N3	33	B-N3	R-R5	
13	N-B4	B-QR3	34	Q-B1	B-B1	
14	B-N5	P-R3	35	R-Q2	Q-Q1	
15	B-R4	P-KN4	36	Q-KB1	P-R4	
16	B-B2	N-R4	37	K-N1	P-R5	
17	N-K3	B-QB1	38	B-B2	B-N2	
18	Q-B2	N-B5	39	N-K3	BxB	
19	B-B4	B-Q2	40	QxB	R-R8+	
20	R/B1-Q1	Q-B3	41	R-Q1	R-R7	
21	B-KN3	N-R4	42	Q-Q3	RxP	

43	N-B4	R-B7
44	P-K5	BxP
45	NxB	PxN
46	QxP	R-K7
47	K-B1	P-B5
48	Q-N7	R-R7
49	B-N6	P-R6
50	QxN	Q-B3
51	Q-Q8+	QxQ
52	BxQ	RxP
53	R-K1	P-B6
54	RxP	P-B7
55	R-K8+	K-N2
56	BxP	RxB
57	R-QB8	R-N7
58	P-Q6	RxP
59	P-Q7	R-Q7
60	K-N1	RxP
61	RxP	R-Q6
62	R-KB2	K-B3
63	K-R2	Drawn by agreement

by man/computer interaction in complex problem solving situations (see [1]). He urged the organizers of the ACM tournament to try and set up an experiment to see what gain in playing strength there may be when man and machine cooperated in the area of computer chess.

The difficulties were considerable. David Levy agreed to cooperate, although he pointed out the inconclusiveness of a single game as an indicator of validity in such an experiment. The man/computer half of the competition was even more difficult to arrange. For this part we needed a program of sufficient playing strength to make the contest interesting. We also needed a player of strength equivalent to the program who could interact and cooperate with it in trying to choose the best moves against their opponent. CHESS 4.9 and David Slate met these qualifications. Slate was as skeptical as Levy of basing any conclusion upon the outcome of a single game. Nevertheless, he agreed to play, mostly for the curiosity and fun of it. Both Levy and Slate felt that they knew the inevitable outcome, but one never knows for sure.

CHESS 4.9, running on a Control Data Cyber 176, has a U.S. Chess Federation rating of within 50 points of 2000. Slate's USCF rating is about the same. Levy's USCF rating would be about 2350. Given such a spread in rating points, your

second author has conjectured that statistically, in a 20-game match, Slate playing alone would win no more than two games and, perhaps, draw another five.

The problem which was to face Slate was how to work with his program as a team to improve their chances of winning against Levy. He would need to modify CHESS 4.9 so that certain information such as principal variations and estimated valuations could be printed out at a terminal on request and he would need to be able to interrupt the program's computations at any time to input a "trial balloon" move and request the program's "opinion." And all of this had to be done within the time constraints of an average of three minutes per move. Slate called upon the co-author of CHESS 4.9, Larry Atkin, and their long-time collaborator, Dr. David Cahlander of Control Data Corporation, to make the necessary program changes.

Another problem to overcome was the logistics of the match itself. It was clear that Levy and Slate must be physically separated so that the unavoidable hubbub of Slate's interaction with the computer would not disturb Levy's play. Slate decided that he needed an operator to handle terminal interaction so that he could concentrate on his play. Atkin volunteered to serve that role. Moves made by each side were transmitted from one location to the other over

a computer terminal link, with Cahlander making Slate's moves on Levy's board.

Then there was the audience to consider. They would be in a third location with a display chessboard, closed-circut TV monitors to view the two (three?) contestants, a terminal to pick up the moves made, and expert commentary to make the match enjoyable. Euwe and Koltanowski agreed to do this and they were outstanding.

So, the stage was set. The CDC Cyber 176 was in Arden Hills, Minnesota, and the contestants, guests, and audience were in Detroit. The match began at 2:30 P.M. What follows is the game score with comments made by Dr. Euwe during the game, and Levy and Slate after the game.

White: Slate/CHESS 4.9   Black: Levy
Bird's Opening
1. P-KB4   ...

Levy has seen this before in Minneapolis in 1975 and at that time he won very quickly after making a sacrifice.

1.	...	P-Q4
2.	N-KB3	N-KB3
3.	P-K3	B-N5

White's idea in Bird's opening is to take control of the square K5 and maybe to occupy this square with his Knight. Black's strategy in this game is to exchange off the Knight so that

it will be Black who controls this vital square.

4.	P-QN3	QN-Q2
5.	B-N2	P-B3
6.	B-K2	BxN
7.	BxB	Q-B2
8.	N-B3	P-K4

Having prepared the move carefully, Black stakes a first claim in the center of the board.

| 9. | PxP | NxP |
| 10. | Q-K2 | ... |

Slate picked this move, overriding the computer's decision to castle Kingside, because he anticipated Levy would continued B-Q3 followed by P-KR4 and N/K4-N5 with a very strong attack.

| 10. | ... | B-Q3 |
| 11. | P-N3 | Q-K2 |

A waiting move. Black did not wish to castle until he had seen where White was going to put his own King. Black wanted to castle on opposite sides and then launch an attack against the White King.

| 12. | 0-0-0 | ... |

Better was B-N2 leaving Black with the question once again.

12.	...	0-0
13.	B-N2	B-R6
14.	K-N1	BxB
15.	KxB	P-QN4
16.	R/Q1-KB1	N/B3-Q2!

This move does two things. It prevents a possible exchange sacrifice by White on KB6 and it prepares to bring the King's Knight into the attack on the Queenside.

| 17. | P-Q4?? | ... |

After this move White is always in very serious trouble, probably even lost. Perhaps White might consider R-B4 followed by KR-KB1 though Black still has the better attacking chances.

| 17. | ... | N-B5+! |
| 18. | PxN | ... |

If 18. K-R1, then the simplest way to win is 18. ... QxP.

18.	...	Q-N5+
19.	K-B1	QxN
20.	PxNP	PxP
21.	BxP	N-N3
22.	B-N3	...

If 22. BxR N-B5! and White must give up his Queen in order to prevent mate.

| 22. | ... | N-B5 |
| 23. | BxN | PxB |

This was the position Levy had in mind when playing 17. ... N-B5+. Black is a Pawn down but can pick up the QRP at will. The decisive factor is the exposed position of White's King which must eventually prove fatal.

24.	Q-K1	Q-R6+
25.	K-Q2	QR-N1
26.	K-K2	R-N7
27.	Q-Q2	RxRP
28.	R-QN1	Q-K2!

Black maintains pressure on the Queen's side where he has a passed Rook Pawn and simultaneously prepares to open up a second front on the King's side where White's King is trying to find a haven.

| 29. | R-R1 | Q-K5 |
| 30. | KR-QB1 | ... |

If 30. RxR, then Q-N7+ 31. K-Q1 QxR+ 32. Q-K1 Q-N2, with a similar position to that arrived at in a few moves.

30.	...	RxR
31.	RxR	Q-N7+
32.	K-Q1	Q-R8+
33.	Q-K1	Q-N2
34.	K-K2	R-N1
35.	R-R4	...

Euwe observed that K-B2 offered more resistance though after 35. ... P-KR4! Black must still maintain excellent winning chances.

35.	...	R-QB1
36.	R-R5	Q-K5
37.	RxP	QxBP+

Levy discussing his game with the audience following its completion.

The beginning of the end. Black now has a strong passed Pawn in addition to his attack on the White King.

| 38. | Q-K2 | Q-K5 |
| 39. | Q-K1 | ... |

Passive but if 39. R-R3 P-R4! and Black will still have a good attack on the King's side.

| 39. | ... | P-B6 |
| 40. | K-B2 | P-R4 |

Eliminating the possibility of a black rank mate and launching the final attack on the Black King.

41.	R-R5	P-R5
42.	R-R1	P-R6
43.	Q-R1	Q-B7+
44.	K-B3	R-B3

The CDC/Cyber 176 became unavailable to Slate and he chose to continue on his own.

45.	Q-QN1	R-B3+
46.	K-N4	Q-K7+
47.	K-R4	R-R3+
48.	K-N5	Q-R4+
49.	K-B4	R-KB3+
50.	Resigns	

Slate observed after the game was over that he did not want to get into the kind of game that was played. He had hoped to steer the game along more active lines. He also observed in restrospect that he had put too much faith in the moves recommended by his computer and that if he had to do it again, he would have overridden the computer's suggestions more often. Slate said he felt comfortable following the advice of his companion when it showed that he was in no tactical danger.

Both Slate and Levy were very excited about repeating the experiment. Slate said that there was considerable room for improving the interactive features in CHESS 4.9, that he often wanted "partial results" and they were not available.

Dan McCracken awarded the winning trophy to Levy and then announced that he was the first to take a $1,000 slice of Levy's new wager. Levy has bet that no unaided computer program will beat him in a multigame match any time before January 1, 1984. We wish both of them good luck!

Reference
1. McCracken, Daniel J. Man + computer: A new symbiosis. *Comm. ACM 22*, 11 (November 1979), 587-588.