RESULTS OF ACM'S EIGHTEENTH COMPUTER CHESS CHAMPIONSHIP

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CHIPTEST-M, a chess-playing computer program developed by a team of three graduate students at Carnegie-Mellon University, took first place at ACM's 18th North American Computer Chess Championship held at the ACM/IEEE-CS Fall Joint Computer Conference in Dallas, Texas last October. With the strongest field ever assembled for a computer chess event, including current World Champion CRAY BLITZ and former World Champion BELLE, CHIPTEST-M overpowered the field of 12 with a perfect 4-0 performance to capture the $2000 first place prize. En route to winning the championship, the program defeated CRAY BLITZ in the third round and then routinely disposed of SUN PHOENIX in the final fourth round. CRAY BLITZ finished in second place, while SUN PHOENIX settled for third. Both won three games and lost one, but CRAY BLITZ was awarded second place based on tiebreaking points. BELLE withdrew from the tournament after three rounds when a hardware problem surfaced.

CHIPTEST-M was developed by Carnegie-Mellon University graduate students Thomas Anantharamam, Feng-hsiung Hsu, and Murray Campbell. Hsu, the leader, represented the group in Dallas and calmly watched his VLSI marvel waltz through each game. CHIPTEST-M is designed around a VLSI chip that searches chess trees at a rate of approximately 500,000 positions per second, several times faster than any other program to date. On most moves the program was able to carry out an exhaustive alpha-beta search to a depth of nine or ten levels (or plies, or half moves) and deeper along certain important tactical lines. That was at least one level deeper than its opponents searched and apparently too much of an advantage for any of them to overcome. The program is only two years old and has less chess knowledge than its main rivals, but the enormous tree that it searches more than makes up for these shortcomings.

Hsu expects to improve the program over the coming year by introducing parallelism. His chip can be replicated, and with the talent that has created the current version, a parallel version can be anticipated which will be significantly stronger. The program was assigned a 2584 performance rating at the Dallas event by Ken Thompson's rating program. This says that CHIPTEST-M was playing at the level of a Grandmaster in this tournament.

Not participating in the event was HITECH, winner of the ACM's 16th NACCC held in Denver in 1985 and winner of the 1987 Pennsylvania State Championship (for humans!). HITECH, also developed at Carnegie-Mellon University, is playing very strong chess as well, and prior to the Dallas event the two programs played a number of unofficial scrimmages.

CRAY BLITZ, the pre-tournament favorite, was deprived of the Championship when it was defeated by CHIPTEST-M in an exciting third round encounter. CRAY BLITZ polished off its other three opponents and gained second place on tiebreaking points over SUN PHOENIX. CRAY BLITZ, the protege of Robert Hyatt, a graduate student at the University of Alabama, Burt Gower of the University of Southern Mississippi, and Harry Nelson of Lawrence Radiation Laboratories in Livermore, California, ran on a four processor, eight megaword Cray XMP located at Cray Research in Mendota Heights, Minnesota.

SUN PHOENIX, the work of Jonathan Schaeffer and Marius Olaffson of the University of Alberta, along with CHIPTEST-M, were the only two programs to go into the final round of play with perfect 3-0 scores, and thus their pairing was a simple necessity. SUN PHOENIX ran on 14 SUN 4 workstations located at SUN Microsystems in Mountain View, California. Search was divided up among the computers in such a way that a group of them were looking for moves leading to positional advantages while the others were attempting to find moves leading to tactical advantages.

David Levy and Mark Taylor's program CYRUS 68K won the trophy for being the "Best Small Computing System." CYRUS 68K ran on an IBM PC and finished the tournament with an even 2–2 score. NOVAG X (David Kittinger), running on a 6502-based microcomputer, and GNU Chess (Stuart Cracraft, John Stanback, Jay Scott, and Jim Aspnes), running on a VAX 8650, also finished with even scores, but lost to CYRUS 68K on tiebreaking points.

Final standings and information on the participants are listed in the table appearing in this report. It is interesting to note that every program was written either in C or in assembly language. Five of the participating systems were at the site. Four used multiprocessing systems, and three used special chess circuitry.

International Master Mike Valvo served as the Tournament Director. Local assistance was provided by the Dallas Chess Club under the direction of Roger Johnson.

On Tuesday, October 27th before the last round of play, there was a Workshop on Computer Chess organized by Tony Marsland where a number of participants and researchers in the field made 10–15 minute presentations. The diversity of the topics introduced and the discussion which followed provided for one of the more successful workshops in many years.

The ACM's 19th North American Computer Chess Championship is scheduled to take place in Orlando, Florida in conjunction with the ACM/IEEE Supercomputer Conference held November 14–17, 1988. For more details, please write to Prof. M. Newborn, School of Computer Science, McGill University, 805 Sherbrooke Street West, Montreal, Quebec, Canada H3A 2K6.

Round 4 ACM's Eighteenth NACCC

CHIPTEST-M (White) versus SUN PHOENIX (Black)

Caro-Kann Defense

This game is yet another demonstration of the power of brute force. Much of the play is under rather equal terms, but the Black chess program is saddled with a small positional weakness on move 20 which ultimately spells its doom. The manner in which this is exploited, however, is noteworthy. White regroups his forces a number of times before embarking on the decisive maneuver. Much of White's play between moves 23 and 33 seems very quiet. White's winning infiltration comes quickly after 34. f5.

1. e4 c6 2. d4 d5 3. Nc3 g6

Black's opening is a cross between a Caro-Kann (characterized by 1. . . . c6 and 2. . . . d5 in answer to 1. e4 and a Modern Defense (characterized by . . . g6, . . . c6 and . . . d6 or . . . d5 and the delay of development of the King's Knight.

4. h3

This move may look unusual here, but in fact it is a standard book move. The idea is to delay e4–e5 and enable Nf3 without having to worry about . . . Bg4. If 4. e5? Black can enjoy a clear strategical buildup based on control of f5 square square, e.g. . . . h5, . . . Nh6 and . . . Nf5.

4. . . . Bg7

Now CHIPTEST-M is already out of its relatively small book. With time, there can be no doubt that such standard developing moves will be added to the expansion of its book.

5. Nf3

The first move out of book for CHIPTEST-M and it devotes six minutes to it, terminating search in the middle of the tenth iteration.

5. . . . Nf6 6. e5 Ne4 7. Nxe4 dxe4 8. Ng5 c5

This move is an important ingredient of Black's effort to gain equality in the Opening by striking at White's advanced central chain before the weak pawn on e4 is captured.

9. dxc5 Qa5+ 10. c3 Qxc5

While this game was being played, Valvo pointed out that he had played the White side of this variation against GM Andrew Soltis and had found it difficult to demonstrate any advantage for White. One worthwhile try here is 11. Bf4. Then on 11. . . .Bxe5? 12. Bxe5 Qxe5 13. Qd8+ Kxd8 14. Nxf7+ wins for White as pointed out by Valvo. However, Black can simply reply with 11. . . . O-O 12. Nxe4 Qc7 when he can be sure to recover his pawn with an equal game. This is SUN PHOENIX's first move out of its book. SUN PHOENIX, running on 14 SUN 3 workstations, assigns a small subset of the 14 to searching in parallel for material gains alone, and they searched to a depth of 10 levels on this move. The remaining computers, which use the usual complex scoring function, searched in parallel to a

depth of eight levels. When the two groups of computers disagree on the move to make, SUN PHOENIX invokes various procedures to resolve their differences. Further, when the endgame is reached (in this game on move 19 according to SUN PHOENIX) SUN PHOENIX stops setting aside a subset of the workstations to look for material gains. The strange mind of the computer can be seen at work here where SUN PHOENIX is predicting that CHIPTEST-M will play 11. e6 anticipating 11. . . . f6 12. Be3 Qc6 13. Nf7 O–O 14. Nh6+ resulting in a negative score for Black of .3 pawns.

11. Qd4 Qxe5 12. Qxe5 Bxe5

From move 13 until move 33, CHIPTEST-M evaluates the game as being very even with neither side ever having more than a quarter-pawn advantage and this is probably a reasonable evaluation.

13. Bc4 O–O 14. O–O Bd7 15. Rd1 Ba4 16. Re1 Nd7 17. Bd5 Nc5 18. Nxe4

Interestingly, the results of CHIPTEST-M's 10-ply searches reveal that there is no need to hurry to recover this pawn (i.e. during the past five moves) since there is no way Black can keep it with impunity. If, for example, 15. . . . Bc6 16. Re1 or 16. Bd5 was possible.

18. . . . Nd3 19. Re2 Bc6

CHIPTEST-M expected 19. . . . Nxc1. The text move (19. . . . Bc6) may seem weak, but in fact it was forced sooner or later. For example, after 19. . . . Nxc1, White can continue with 20. Rxc1 Bf4 21. Rce1 Bb5 22. c4 Bc6 or 19. . . . Rb8 20. Nc5 Bc6 is much the same as the game. If instead 19. . . . Bf4!?, White can continue calmly with 20. Be3 with a definite edge in the ensuing complications. In any case, the ensuing exchange of light-squared bishops leaves Black with a slight though long term weakness in the isolated "a" and "c" pawns. The theoretical superiority of bishop over knight is not a significant factor here because the bishop cannot find a secure and active central outpost in this ending. SUN PHOENIX believes it is ahead by approximately one-quarter of a pawn.

20. Bxc6 Nxc1 21. Rxc1 bxc6 22. Nc5 Bf4 23. Rce1 Rfb8

This seems a peculiar move in that the Black queen's rook is stifled. However 23. . . . Rab8?? falls into the fork, 24. Nd7 and if 23. . . . e6 continuations like (a) 24. Nd3 Bd6 25. Ne5 or 25. Re4 (b) 24. Nd7!? Rfd8 25. Rd1 Rab8 26. g3 Bg5 27. h4 Bh6 28. f4 followed by 29. Red2 are two examples of how White might retain a slight but enduring advantage.

24. g3 Bd6 25. Ne4 Bc7 26. f4 Rd8 27. Kg2 Rd5 28. c4 Rd4

It now appears that Black is quite active for he possesses the only open file, the d-file. Yet there appears to be no easy way for him to utilize this feature.

29. c5

A rather blatant advance; this is nonetheless better than 29. b3 when Black may find play with 29. . . . a5 followed by . . . a4.

29. . . . Ba5 30. Rf1 Rad8 31. Rff2

After making its 31st move, CHIPTEST-M's clock shows 42 minutes to make the remaining nine moves to the first time control, almost five minutes a move, while SUN PHOENIX has 31 minutes for 10 moves, or about three minutes per move. Typically searching at least two ply deeper than SUN PHOENIX (10 vs. at most 8) for most moves up to here, coupled with this time advantage, gives CHIPTEST-M a significant advantage.

31. . . . Bb4 32. a3 Ba5 33. Ng5 Re8 (Figure 1)

After SUN PHOENIX played 33. . . . Re8, CHIPTEST-M's score on 34. f5 jumped to the highest level since the opening. It believes it is ahead by about a third of a pawn. SUN PHOENIX's scores concur. Schaeffer blames this move for PHOENIX's loss but after his preferred 33. . . . e6 34. Nf3! R/4d5 35. Ne5! Rc8 (not 35. . . . Rxc5? 36. b4) 36. b4 Bd8 and with a few more ply—ten in total—one can clearly see that Black is worse. On 33. . . . R8/d7, then 34. Nf3! followed by Ne5 is very strong, and on 33. . . . R4/d7, White can simply continue with 34. f5.

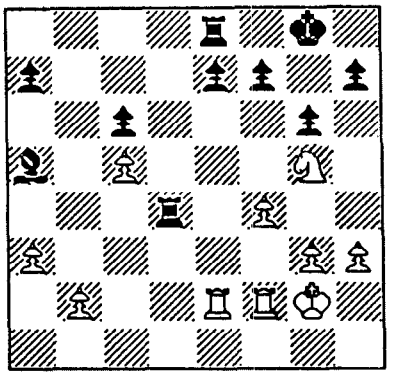

FIGURE 1. Position after Black Plays 33. . . . Re8

34. f5 Rd3

On the alternative 34. . . . gxf5 35. Rxf5 Rd5, after 36. Nxf7! White also wins.

35. fxg6

CHIPTEST-M sees that it wins a pawn with: 35. fxg6 fxg6 36. Nf3 Bc7 37. Re6! Bb8 38. Rd2 Rxd2. (It only printed out the first eight moves of the ten move sequence that it calculated). The game followed this sequence until move 38 when CHIPTEST-M decided to grab the pawn rather than flirt with the rook on d3.

35. . . . fxg6 36. Nf3 Bc7 37. Re6 Bb8 38. Rxc6 Re3 39. g4 e5 40. Ng5

CHIPTEST-M's score jumps to

Final Standings and Computing System Information ACM's Eighteenth Computer Chess Championship

Program	Computing system and language, (programmers), book size, nodes/sec. (* indicates computer at site)	Total points	Final place
CHIPTEST-M	SUN 3 plus high speed move generator, C, at Carnegie-Mellon University. (Thomas Anantharamam, Feng-hsiung Hsu, Murray Campbell), .5K, 500K.	4	1
CRAY BLITZ	Cray XMP 4/8, Fortran + assembler, 128Mb, 64 bits, 480 mips, at Cray Research, Mendota Heights, Minn. (Robert Hyatt, Burt Gower, Harry Nelson), 50K, 100K.	3	2
SUN PHOENIX	14 SUN 3 Workstations, C, at SUN Microsystems, Mountain View, Calif. (Jonathan Schaeffer, Marius Olaffson), 8K, 20K.	3	3
LACHEX	Cray XMP 4/16, Fortran and assembler, 16mw, 64 bits, 105 mips, at Cray Research, Chippewa Falls, Wisconsin. (Tony Warnock, Burt Wendroff), 4K, 50K.	2.5	4
CYRUS 68K	68020-based micro*, assembler, (Mark Taylor, David Levy), 16K, 4K.	2	5
BEBE	SYS-10 Chess Engine*, assembler, 65Kb, 16 bits, 10 mips. (Tony Scherzer, Linda Scherzer), 4K, 40K.	2	6
NOVAG X	6502 bit sliced microcomputer*, 6502 assembler, 4Kb RAM, 56 Kb ROM. (David Kittinger), 22K, 4K.	2	7
BELLE	PDP 11/23 with special chess circuitry, C + microcode, at AT&T Bell Laboratories, Murray Hill, N.J. (Ken Thompson, Joe Condon), 400K, 150K.	2	8
WAYCOOL	512 proc. *N*-cube Hypercube, ½ Mb/proc., 1 mips/proc., C, at Cal Tech. (Ed Felton, Steve Otto, Rod Morison, Rob Fatland), NA, NA.	2	9
GNU CHESS	VAX 8650, C, 8Mb, 32 bits, 6 mips, at USC Information Sciences Institute, Marina del Rey, California. (Stuart Cracraft, John Stanback, Jay Scott, Jim Aspnes), 5K, .5–1.0K.	2	10
BP	Compaq 386*, C + assem., 1Mb, 32 bits, 3–4 mips, (Robert Cullum), 8K, .5K.	1.5	11
OSTRICH	1 DG Eclipse S/120, 7 DG Nova's 4's, assem., 64 Kb/proc., 16 bits, 1 mips/proc., at McGill University. (Monty Newborn), 4K, 2K.	1	12
GRECO	AT Clone, C, 16 bits, 1 mips, 640Kb. (David Stafford), 1K, .45K	1	13

almost two pawns after seeing 40. Ng5 Rb3 41. Re6 Rf8 42. Rd2 Kg7 43. h4 Kg8. On move 42, it also sees that after 41. . . . Rxe6 42. Nxe6 h6 43. c6 e4 44. c7 Bxc7 45. Nc7 g5 leads to an advantage of almost four pawns. SUN PHOENIX continues for another three moves until Schaeffer throws in the towel.

40. . . . Rb3 41. Re6 Rxe6 42. Nxe6 h5 43. c6 e4 44. c7 Bxc7 45. Nxc7 Black resigns.

Round 3 ACM's Eighteenth NACCC

CRAY BLITZ (White) versus CHIPTEST-M (Black)

Center Counter

The fireworks in this game start with 12. Ng5. Had White a clue to the vicious central counterplay which Black immediately creates with 12. . . . e5, it would have played 12. Ne5. At the critical juncture before 15. Bxg6?! White could have tried 15. Be6+ Kb8 16. f4 with great complications. Also interesting would have been 18. f4 with the idea 19. f5 and Bf4 amongst others. 20. Bf4 was probably White's last chance to try to demonstrate attacking chances for the imminent loss of the knight on a4. Instead Black's powerful centralization with 20. . . . Nge5 quickly spelled White's doom. A very short game when one considers the calibre of the contestants and the lackluster reputation of Black's opening.

1. e4 d5 2. exd5 Qxd5 3. Nc3 Qa5 4. d4 c6 5. Nf3 Nf6 6. Bc4 Bg4 7. h3 Bh5 8. Qe2 Nbd7 9. Bd2 Qc7 10. g4 Bg6 11. O-O-O O-O-O 12. Ng5 e5 13. Bxf7 exd4 14. Na4 Ne5 15. Bxg6 Nxg6 16. Ne6 Re8 17. Rhe1 Qd6 18. g5 Nd7 19. Qg4 b5 20. Nac5 Nge5 21. Nxf8 Rhxf8 22. Ne4 Qd5 23. Qg2 Re6 24. Kb1 Nf3 25. Qg4 Nxe1 26. Rxe1 Ne5 27. Qd1 Nf3 and White resigns.