DEEP THOUGHT II coasted through five rounds of play at the 22d Annual ACM International Computer Chess Championship, capturing first place with a perfect 5-0 score. The five round Swiss-style tournament was held in Albuquerque, New Mexico at the Doubletree Hotel. Twelve teams participated with all but two teams playing clearly at the level of chess masters. Finishing in second place with a 4-1 score was M CHESS, which received the award for best small computer; while CRAY BLITZ and MEPHISTO tied for third place with 3-2 scores. $8,000 in prizes were distributed with $4,000 going to the winner.
DEEP THOUGHT II ran on an IBM RS/6000 550 processor connected to 24 specially designed VLSI chess processors. The IBM programming team of Feng-hsiung Hsu and Murray Campbell had used only two processors last year when DEEP THOUGHT/88 managed to tie for first place, but this year, with an additional year of software improvements and much improved hardware, their program clearly dominated the competition. It was carrying out brute-force searches on most moves to a depth of ten levels (five moves for each side) and deeper along tactical lines. During endgame play, it searched even deeper. On average, DEEP THOUGHT II examined 5,000,000 chess positions per second. With moves made at an average rate of 180 seconds per move, 900,000,000 chess positions were searched by the program when making a move.

M CHESS, developed for an IBM PC by Marty Hirsch, lost only to DEEP THOUGHT II in the second round. Its most impressive win was over HITECH in the final round when the latter caused most of its own problems by playing too aggressively with its queen early in the game.

CRAY BLITZ, running on an 8-processor CRAY YMP, and MEPHISTO, running on a Motorola 68030 microprocessor, each won their final-round game to move ahead of HITECH and CHESS MACHINE/SCHROEDER and finish in a tie for second place. CRAY BLITZ, developed by Robert Hyatt of the University of Alabama at Birmingham and Bert Gower of the University of Southern Mississippi, was world champion from 1985 to 1989. MEPHISTO was developed by Richard Lang of the United Kingdom.

The rules for this championship reverted back to the former ones after a one-year experiment with "finite duration games." At the previous championship, the rules of play were changed: each side was given two hours to play. If one side took more time, it lost the game. This format has been tried in the human chess community with considerable success and might eventually be best for computer play also. Currently, however, a human operator is required to make the moves for each computer, giving rise to problems near the end of the game when the speed of play causes the human operator to panic. Further, last year HITECH unfortunately lost a dead-drawn endgame on time because the rules required all games to be played to completion. Thus, the old rules of 40 moves per side in two hours and 20 moves per side per hour thereafter were used.

Jaap van den Herik, editor of the Journal of the International Computer Chess Association, attended the championship as an honored guest. As editor of the Journal, van den Herik has played a leading role in creating the most important publication in the world of chess.

Also attending the championship were the chess teams from two junior high schools: Adam Clayton Powell, Jr. JHS of New York City (coached by Richard Gudonsky) and Julia R. Masterson JHS of Philadelphia (coached by Steven Shutt). They had finished in a tie for the U.S. Junior High School Championship earlier in the year and they came to Albuquerque to play a friendly match to determine an unofficial champion. The unofficial winner was . . . well, since it was unofficial, maybe it's best not to say!

The event was partially supported by the IBM Corporation and the organizers would like to express their thanks. Also to be thanked are members of the Albuquerque Chess Club for their assistance.

The next ACM International Computer Chess Championship is scheduled for Indianapolis in February 1993 at the ACM Computer Science Conference. More information can be obtained by writing: M. Newborn, School of Computer Science, McGill University, Montreal, Quebec, Canada H3A 2A7.

Round 1
All the ranked computers except MEPHISTO won. MEPHISTO dominated SOCRATES throughout the opening and early middle game, but pressed too hard, got overextended and its position came apart at the seams. It is a game worth playing over as there were many interesting tactics.

DEEP THOUGHT II got an advantage out of the opening and kept squeezing until ZARKOV's position fell apart in a game that showed the power of two bishops.

CRAY BLITZ managed to obtain the advantage of two minor pieces against a rook and pawn in its game with BP. On a purely material basis, this is considered equal, but the activity proved too much for the rook to handle.

BEBE seemed to have caught CHESS MACHINE/SCHROEDER unprepared with its own private book, but it did not appreciate the dark-colored bishop's pressure on the g7 square and never could get the kingside developed.

The LACHEX vs. HITECH game seemed equal for a long time, but HITECH dominated in the endgame. LACHEX played the opening too tentatively and allowed Black to equalize easily and even obtain a slight edge.

DELICATE BRUTE played an interesting pawn sacrifice against M CHESS, but could never convert its temporal advantages into anything concrete. After that, M CHESS was in complete command.

CHESS MACHINE/SCHROEDER vs. BEBE

CRAY BLITZ vs. BP
Computing System Information

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<th>Computing system, language, etc.</th>
<th>Nodes/sec.</th>
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DEEP THOUGHT II vs. ZARKOV


DEEP THOUGHT II finished first with a dominating win over CHESS MACHINE/SCHROEDER. The opening was a "quiet" c3 Sicilian that was met by d5. The black king never escaped from the center and a cute piece sacrifice finished him off.

CHESS and the game seemed quite equal for a long time. Finally, CHESS missed a necessary endgame nuance and the end became clear.

METHISTO must have used one of its nine lives in its game with LACHEX. LACHEX was never programmed for under-promotion and got hit with a knight promotion accompanied by a double check. Bert Wendroff never programmed under-promotion because "... it never came up." Last night he left the game over and was greeted with a phone call: "It came up."

CRAY BLITZ was winning easily after an opening error by SOCRATES. Matters started going downhill, however, and CRAY BLITZ soon had a difficult double rook ending on its hands. A hash table bug resulted in dropping CRAY BLITZ's most dominant pawn and the game was instantly drawn. BEBE got caught in an opening it did not know and soon lost the exchange against BP. DELICATE BRUTE played beautiful chess against ZARKOV, but eventually fell prey to some telltale nuances. Even then, a draw was possible.

Round 2

HITECH missed a necessary endgame nuance and the end became clear. CHESS and the game seemed quite equal for a long time. Finally, CHESS missed a necessary endgame nuance and the end became clear.

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M CHESS vs. DEEP THOUGHT II
(Annotated by IM Mike Valvo)

Although played in the second round, this game proved to be the deciding game of the championship as both of these competitors defeated every other opponent they faced. The game was even most of the way; DEEP THOUGHT II could only claim a slight pawn structure advantage after M CHESS’s 24. f4. A chess point needs to be made here.

Since White moves first, it has a natural advantage in initiative. White’s goal in the opening is to preserve that edge and transform it into something more tangible, while Black’s is to neutralize it and equalize. This particular game followed opening theory so closely that this issue was a significant factor. White followed that theory for fifteen moves and obtained nothing. The resulting situation, however, was so balanced that it was extremely difficult for either side to press for a win. DEEP THOUGHT II paid more attention to development principles and by the twenty-third move was well positioned to exert great pressure on the White setup. M CHESS responded with a slight pawn structure weakening, but did not follow up its aggressive play. It then became clear that DEEP THOUGHT II had a clear edge, but was it going to be enough? Most likely it would not have been, but M CHESS missed a necessary defensive maneuver (38. g5!) and began to crumble.

1. d4 Nf6 2. c4 e6 3. g3

This treatment is known as the “Cat- alan Opening.” It is an unusual hybrid of a classical setup (white pawns on c4 and d4) and the Reti Opening (Nf3,g3,Bg2). White fights for control of the center from the very first move, and the bishop on g2 hinders Black’s queenside development. The so-called “Open” variation of the Cat- alan (which occurs in this game) is typified by the Black capture dxc4 at some point.

1...d5 4. Bg2 Be7 5. Nf3 O-O 6. O-O dxc4 7. Qc2 a6 8. Qxc4 b5 9. Qc2 Bb7...

A word about strategy in this position (from the point of view of humans!): The whole game revolves around whether or not Black can play its pawn from c7 to c5. If that can be safely managed, the position is considered equal for Black. White’s strategy is to do everything to prevent that break and Black’s is to do everything to enhance it. An important secondary goal for White is to occupy the c5 square with a knight. 10. Bd2

The idea behind this move is not only to preserve the bishop from exchange, but to go to a5 and hinder c7-c5. White has other possibilities (for example, 10. Bf4 Nd5 11. Nc3 Nxf4 12. gxf4 Qc8 13. Ne4! which led to victory in Ribli-Karpov, Amsterdam, 1980 or 10. Nbd2 Nbxd7 11. Nb3 Be4 12. Qe4 Nd5! and White must allow Black’s pawn to advance to c5), but 10. Bd2 has always been considered the most dangerous variation for Black.

10 ... Be4 11. Qc1 Bb7 12. Bf4!

This was considered the most topical line until Black’s 14th move put it out of business as a way for White to gain an advantage. White can, of course, “offer” to repeat the position with 12. Qc2. It is not clear what DEEP THOUGHT II would have done than as it must evaluate the position as very slightly better for White. You can bet that DEEP THOUGHT II had been programmed with some kind of “contempt” factor which would cause it to decline a draw even if standing a little worse. In this position, Kasparov’s choice against Kar- pov in the World Championship match in Moscow (1984–85) was 12. Be3. That game continued 12...Nd5 13. Nc3 Nd7 14. Rd1 Re8 15. Nxd5 Bxd5 16. Ne1 c6 17. Nd3 Qb6 18. Qc3 b4 19. Qd2 at 20. Rdc1 and a draw was agreed at this point.

12 ... Nd5 13. Ne3 Nxf4 14. Qxf4 Qd6!

This 1988 innovation has, since then, caused White to look elsewhere for an advantage. DEEP THOUGHT II can no longer be prevented from advancing its pawn to c5 and thereby equalizing. Previously, Black has played 14...c5 15. dxc5 Bxc5 16. Rfd1 Qb6 17. Ne5 with a slight White edge (Vaganian-Anderson, LENINGRAD 1987).

15. Qe3?!

This was Khalifman’s suggestion at the time without giving any continuations. Numerous other ideas have been tried here (15. Ne5 Khalifman- Karpov, USSR Championship in 1988; 15. Rac1 Kaidanov-Goldun 1988) without yielding White any opening advantage.

15... Nd7 16. Ne4

White must try 16. Rfd1 to try to hold down Black’s c5 break with possible continuations of 16...Nf6!? 17. Rac1 or 16...Qb6! intending to recapture on c5 with the bishop.

16...Bxe4 17. Qxe4 c5!=

Black equalizes with this move.

18. Rac1 Rac8 19. dxc5 Rxc5 20. Rcd1

White is in serious trouble if it has to concede the c-file so easily and allow Black to dominate the position. However, after 20. Rfd1, DEEP THOUGHT II has 20...Rfe8! and if 21. Rxd6, than 21...Rc1+ 22. Bf1 Bxd6 23. Qd3 Rc6 etc.

20...Qc7 21. Nc4

The threat here is 22. Nxe6!

21 ... Ne5 22. b3 Bf6 23. e3 Rd8 24. f4!? The alternative was to go completely passive with a move like 24. Kh1. Black has demonstrated that it is slightly better due to control of the c-file and more active placement of its pieces.

24...Ng6 25. Qb7

More consistent is 25. Nc6!? intending Nb4 to harass the only slight Black pawn weakness on the queenside.

DEEP THOUGHT II has squeezed significant winning changes out of the position.

32. a4

Not a pleasant choice because the b3 weakness, but DEEP THOUGHT II would eventually play b5-b4 itself and the weakness would then be on a2.

32...b4

**Diagram**

Position after 33...exd5

Things are getting critical for both sides. The DEEP THOUGHT II team was getting concerned, while this game was being played, that they would be unable to generate winning chances out of this position. It may be that 33...exd5 is a slight error that could have cost DEEP THOUGHT II a full point. Correct is the natural conclusion, although destined to be

32...b4 33. Bxd5 exd5

Now it is a matter of endgame technique which DEEP THOUGHT II displays itself capable of.

33. Ke2 Ra2+ 44. Kd3 g6 45. Rb5 Ra3+ 46. Ke4 b4 47. Kb4 a4 48. Rb7 Kg7 49. Kc3 Ra1 50. Rb4 Re1 51. e4 Re3+ 52. Kc2 Rxb3 53. Rxa4 Rc3 54. g5 h3 55. Ra1 h2 56. Rh1 Rh3 57. Kc1 f6 58. Kb2 fxg5 59. fxg5 Kf7 60. Kbl Ke6 0-1

**Round 3**

This was a very exciting round. ZARKOV polished off MEPHISTO with a pretty piece sacrifice that forced instant resignation. This has not been a good year for the many-year champion of the micros. MEPHISTO played the little-known Pribyl Variation of the PIRC setup and ZARKOV played simple solid moves. The game transposed into a Philidor Defense which was quite satisfactory for Black. The problems started when MEPHISTO opened up the position and had to pay the price for lagging development. The conclusion, although destined to be heard around the world, was merely the merciful end of a nice game.

DELCIATE BRUTE vs. BEBE was a back-and-forth game where DELICATE BRUTE seemingly held the upper hand most of the time. Then, for some strange reason, DELICATE BRUTE refused to play the winning idea of creating a passed queen’s rook pawn and actually helped BEBE create counterplay in the form of a BEBE passed king pawn. After that, BEBE was without mercy.

M CHESS and SOCRATES followed recent Kasparov-Karpov play very deeply and SOCRATES obtained an opening edge as Black. However, both sides did not promote their respective play with correct pawn advances in the center (SOC- RATES, Black) and kingside (M CHESS, White), although M CHESS did try. M CHESS, though, kept creating dangerous problems and eventually succeeded with an attack against SOCRATES’s king. M CHESS had problems reducing the game to a technical exercise and SOCRATES created counterchances of its own, despite being a pawn down. The critical situation came about when both sides thought they were better in the queen and bishop vs. queen and knight ending. SOCRATES spurred a forced draw and lost almost immediately.

BP simply had a better Ruy Lopez book than LACHEX and quickly has a 20 minute time advantage. LACHEX conceded some positional weaknesses which BP patiently exploited.

CRAY BLITZ played a strange line against CHESS MACHINE/SCHROEDER’s Open Defense to the Ruy Lopez and seemed to get the worst of the long-term prospects. CHESS MACHINE/SCHROEDER developed technical problems and played weakly in a critical position allowing CRAY BLITZ to obtain a big advantage and snare a pawn (which ironically allowed CHESS MACHINE/SCHROEDER to activate its awkwardly placed pieces). CRAY BLITZ was not able to muster the technique to bring home the full point and eventually the game transposed into a drawn position. At the end, CHESS MACHINE/SCHROEDER even stood a pawn up! We never got to see the torture-ending rook and bishop vs. rook because the game would have been adjudicated after six hours due to CRAY BLITZ’s limited time slot availability.

DEEP THOUGHT II played the positional Tarrasch Variant against HITECH’s French Defense and had little until HITECH played the dubious d5-d4!? The position instantly became critical as White threatened to create black kingside pawn weaknesses. HITECH was unable to counter White’s threats with Qb6 and the game turned into a technical demonstration which DEEP THOUGHT II performed well.

ZARKOV vs. MEPHISTO


DELCRATE BRUTE vs. BEBE

Our game follows this sequence until DEEP THOUGHT II varies on move 15. The problem with 12...d4 is that it restricts the black bishop's mobility while creating a target on its color. These detriments outweigh the space gained by the pawn and the creation of a slightly backward white c-pawn

13.Qd3
A queen is not usually considered the best blockader of weak pawns. However, here she plans to move again to f5 or b5 and readies to meet Qb6 with Qb3. Nonetheless this move was probably still part of DEEP THOUGHT II's book. On the alternative 13.Re1 Qb6 would be a little troublesome.

13...b6 14.Bb4 Re8 15.Rd1 Re8
16.Qf5 Qb6
16...Qc7 17.c3 would win the isolani.

17.Bxf6 Qxf6 18.Qxf6 gxf6
In a nutshell, Black's doubled and isolated pawns must ultimately spell defeat. The activity he enjoys on the c and e-files will be gradually neutralized and only weaknesses will remain.

19.Kf1 f5
HITECH chooses among evils. Without this move the f5 square will likely become blockaded by the white knight via h4. The text clears a patch for the black king.

20.Rad1
An excellent defensive move, which now threatens the Black d-pawn.

20...Rcd8 21.Rd3 Rd6 22.a3 a5
Although this is not an easy pawn to attack, Black exacerbates his vertical and horizontal pawn weaknesses.

23.Rb3 b6 24.Ne1!

COMMUNICATIONS OF THE ACM/November 1992/Vol.35, No.11
An excellent move which is part of plan to start attacking Black's weak pawns. The next phase of play is highlighted by White's manoeuvres with his rooks and knight to start attacking the weak black pawns.

24. ...Re6 25. Rb5 Kg7 26. Nf3 Rd8 27. Ne5 Rc7 28. Nxd5 a6 29. Re1 Bf8 30. Re2 Bc5 31. g3 Rd8 32. Re5 f6 33. Rd5 Re7 34. c3! A move which is at first hard to fathom. Why should White trade off its c-pawn for Black's weak d-pawn and weaken its other queenside pawns? The crux of the move is the variation: 34. ...dxc3 35.Nxc5 c2 36.Nd3 Ne5 37.Kf1 Rd7 38.Qe2 Qd8 39.Nc7 Rb7 40.Qxe5 Rxb5 41.Rd2 Qxe5 42.Qxb5+ Kf6 43.Kf5 Rb2 wins.

The first fruits of DEEP THOUGHT II's labor. The rest is a fairly easy win for White. The crux of the move is the plan to start attacking Black's weak pawns. The next phase of play is highlighted by White's manoeuvres with his rooks and knight to start attacking the weak black pawns.

42. Ke2 b5

Desperation in a hopeless position

43. Rxb5+ Rxb5 44. axb5 Bb6

The rest is a fairly easy win for White.

45. h4 Bc7 46. h5 Ba5 47. f4 f6 48. Nb2 Bb4 49. Nc4 Bc5 50. Kf3 Ba6 51. Ne5+ Ke6 52. Nxf5 Kxb5 53.

Ke4 Kc5 54. Ne3 Kb4 55. Kf5 1-0

BP vs. LACHEX

White has a winning advantage. DEEP THOUGHT II was able to eventually win a pawn on the queenside and soon thereafter made a sham sacrifice of the exchange to gain another pawn. DEEP THOUGHT II concluded brilliantly with an endgame piece sacrifice that quickly forced resignation.

HITECH sprang an opening innovation on ZARKOV that seemed to backfire. ZARKOV did not play the direct road to equality and weaknesses in the White position increasingly pointed to a Black advantage. ZARKOV won a pawn and then started to go downhill. HITECH made the most of its queenside opportunities despite the fact its king was in the area. Everyone anticipated a potential rook and bishop verses rook endgame and queries buzzed about whether the 50 or 75 move rule would apply (75 would). Alas, HITECH was unwilling to part with a pawn that was necessary to set up the envisioned endgame and the machines were content to move back and forth for a draw.

MEPHISTO smashed BEBE quite easily in less than 20 moves. BEBE had its book turned off in an attempt to thwart the well-known MEPHISTO opening preparations, but that backfired as the game followed lines well-known to MEPHISTO.

CRAY BLITZ vs. CHESS MACHINE/SCHROEDER played a Spassky specialty to quickly gain an advantage against SOCRATES. CHESS MACHINE/SCHROEDER's play was brutal once
it smelled blood.

LACHEX vs. DELICATE BRUTE

was interesting in that White had nearly all its pawns advanced and all its pieces on the first rank at one point. DELICATE BRUTE was unable to cope with all these goings on and was mated in less than 30 moves.

CRAY BLITZ vs. DEEP THOUGHT II

M CHESS defended a Petroff Defense against BP and quickly obtained an attack against the white king. Around move 35, this attack netted a piece and the game was effectively over.

CHESS MACHINE/SCHROEDER vs. SOCRATES

CHESS MACHINE/SCHROEDER got the better of the opening against DEEP THOUGHT II, but rashly attacked on the kingside giving...

Hitech vs. ZARKOV

Hitech got blown away in the opening against M CHESS. An early queen sortie seemed to be the source of the problem and cost HITECH a full piece.

Final Standings:

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COMMUNICATIONS OF THE ACM/November 1992/Vol.35, No.11
ing away its edge plus a pawn. DEEP THOUGHT II eventually won another pawn. DEEP THOUGHT II had difficulty in making progress in the rook and pawn endgame, but eventually the program figured it out and went on to win the game and the championship.

BEBE did well in the opening, but got into trouble in the middle game and had to give up the exchange. LACHEX simply pushed the h-pawn down to make a new queen and the game was over.

MEPHISTO played well to defeat BP out of an unclear Queen's Gambit Accepted. Its 41.Ra5! was especially pretty.

CRAY BLITZ defended ZARKOV's Ruy Lopez with a risky line, but survived the opening. CRAY BLITZ gained a small advantage but was unable to do anything with it. Finally, ZARKOV went wrong in a difficult endgame and collapsed.

SOCRATES vs. DELICATE BRUTE

1.e4 e5 2.Nf3 Nc6 3.Bb5 a6 4.Ba4

BEBE vs. LACHEX

1.e4 e5 2.Nf3 Nc6 3.Bb5 a6 4.Ba4

M CHESS vs. HITECH

1.e4 e5 2.Nf3 Nc6 3.Bb5 a6 4.Ba4

DEEP THOUGHT II vs. CHESS MACHINE/SCHROEDER

Nominations are being solicited for the ACM/IEEE Eckert-Mauchly Award which is presented annually to an outstanding computer architect for significant contributions to the field of computer architecture.

Nominations for the award, to be presented at the annual International Symposium on Computer Architecture next May, should be submitted by November 24 to: Yale Patt, Chair, Eckert-Mauchly Award Committee, EECS Department, University of Michigan, Ann Arbor, MI 48109-2122.

Questions regarding the award or the nomination process can be directed to the same address, or preferably via e-mail to patt@eecs.umich.edu.