THE 21st ACM NORTH AMERICAN 
Computer Chess Championship

New York, New York 
November 11–14, 1990

Monty Newborn, McGill University
Danny Kopec, University of Maine

After twenty years of traveling from city to city across the United States, the ACM North American Computer Chess Championship came back to the place of its birth, the New York Hilton Hotel, where the competitions began in 1970. This latest five-round event ended in a two-way tie for first place between MEPHISTO and DEEP THOUGHT/88. Finishing in a two-way tie for third place were HITECH and M CHESS. A total of 10 teams participated, and the level of play was at the low grandmaster level. A special three-round endgame championship was won by MEPHISTO, who also captured the prize for the best Small Computing System. A total of $8000 in prizes was divided up among the winners.

DEEP THOUGHT/88, currently under development at IBM by researchers Feng-Hsiung Hsu, Murray Campbell, and Thomas Anantharaman along with two former associates at Carnegie Mellon University, Peter Jensen and Andreas Nowatzyk, outplayed MEPHISTO in the third round but lost to HITECH in the next round. It entered the final round of play one-half point behind HITECH, who had won all of its games with the exception of a first-round draw with ZARKOV. DEEP THOUGHT/88 defeated ZARKOV in the final round while HITECH lost on time to MEPHISTO in a dead-drawn game.

MEPHISTO won all of its games with the exception of its third-round loss to DEEP THOUGHT/88.

MEPHISTO played solid chess throughout the event, but was fortunate to win its game against HITECH in the final round. MEPHISTO, developed by Richard Lang of Great Britain, is marketed by the German company of Hegener & Glaser A.G. The rules of the tournament required each side to play all of its moves within a two-hour period ensuring that the games would last at most four hours. MEPHISTO played slightly faster than HITECH in the middle game and entered the endgame with approximately five more minutes on its clock. HITECH, who played even with MEPHISTO, was unable to regain the lost time and eventually lost a dead-drawn game on move 145.

The tournament was marred by difficulties. This was the first time the tournament was played during the day, and Bob Hyatt was unable to make the necessary arrangements. DEEP THOUGHT/88 was used by Hsu and company when they found they did not have sufficient time to test out their latest version. ZERKER, a new entry developed by James Testa at the University of California, Berkeley, was forced to withdraw because its SUN computer was damaged on shipping. CRAY BLITZ, a former world champion, had to pass up the event because it was unable to gain access to a CRAY computer.

Ken Thompson’s BELLE rejoined the competition after an absence of several years, but was unable to do better than seventh place. BELLE was the world champion program from 1980 to 1983, and was the first program awarded the title of Master by the United States Chess Federation. This title was formally awarded to BELLE in 1983 at the Fourth World Computer Chess Championship by the USCF on the very evening when it was dethroned by NUCHESS in its bid to repeat as world champion. Thompson has made some improvements to BELLE in recent years, but its seventh-place finish shows just how much stronger the programs are today than...
they were when BELLE was best. Mike Valvo served as Tournament Director after a one-year leave. He will return again as TD when the next championship takes place in Albuquerque, New Mexico on November 17–20, 1991 at Supercomputing '91. For further information on this upcoming event, write to Professor Monty Newborn, Department of Computer Science, McGill University, Montreal, Quebec, CANADA H3A 2A7.

THE MAIN CHAMPIONSHIP

The championship was highlighted by three “heavyweights” in the current world of computer chess: DEEP THOUGHT/88, HITECH, and MEPHISTO. DEEP THOUGHT/88, the reigning World Champion and defending ACM Co-champion, was the favorite with ACM Co-champion HITECH and MEPHISTO, World Microcomputer Champion, closely behind.

The first surprise of the tournament was in Round 1 when ZARKOV drew with HITECH. It was an exceptional case in point where too much opening preparation may have led directly to a program’s difficulties. HITECH entered the fourth round with 2.5/3 trailing DEEP THOUGHT/88 3/3 by a half a point. After four rounds it seemed that rating probabilities had finally caught up in HITECH’s favor. In its previous three head-to-head tournament encounters with DEEP THOUGHT/88, HITECH had lost (Sixth World Computer Chess Championship in Edmonton, 1989, 19th ACM North American Computer Chess Championship in Orlando, 1988, and 20th ACM North American Computer Chess Championship in Reno, 1989) with a rating difference of about 150 points (DEEP THOUGHT 2551, HITECH, 2413). HITECH would be expected to score in approximately one in four games.

When HITECH won its fourth-round game against DEEP THOUGHT/88, taking over sole possession of first place, the stage was set for the final round MEPHISTO-HITECH showdown. The only legitimate result for this game was a draw. However, due to the relative unfamiliarity of the participants, tournament director, and organizers coupled with the sudden death time control (all moves in 2 hours), the game ended bizarrely. During a meeting of the participants and organizers held just before the tournament began, Hans Berliner, the programmer of HITECH, voted in favor of games being played to the end (until a checkmate, draw, or time forfeit occurs) without intervention from the tournament director. In human chess tournaments with sudden death time controls the tournament director is expected to intervene when it is clear that either side’s only hope of winning is on the clock and the chess moves become rather inconsequential.

Thus MEPHISTO finished tied for first with DEEP THOUGHT/88 with 4 points, and HITECH had to settle for a third place tie with M CHESS with 3.5 points.

GAMES FROM THE MAIN EVENT

Round 3, Board 1
White: DEEP THOUGHT/88 vs. Black: MEPHISTO

In Reno (1989) Mephisto was the first program to ever defeat DEEP THOUGHT/88. Here DEEP THOUGHT/88 and MEPHISTO entered the third round as the only programs with perfect scores and DEEP THOUGHT/88 exacted revenge through straightforward positional pressure.

Here MEPHISTO plays 4 ...Nc6? which quickly lands it in trouble. This error, which incidently DEEP THOUGHT/88 is also prone to, breaks the simple heuristic that in Queen Pawn Openings the Queen Knight should not block the Queen Bishop’s Pawn. This error was compounded with 5 ...Bb4+? trading off Black’s theoretically better bishop. Without this move, White’s Queen’s Bishop may become a problem. After 9 ...Na5?! White attained the spatial advantage on the Queenside which was
maintained and exploited throughout the
game. DEEP THOUGHT/88's various posi-
tional probes on the Queenside led no-
where in particular until they were capped
brilliantly with the stroke 32 Nde5+! which
led to the gain of a pawn and a winning
Knight Ending. DEEP THOUGHT/88
played very logically and consistently by
advancing its king to the critical Queenside
sector until the decisive breakthrough there
became feasible. MEPHISTO'S Kingside
pawn advances may have eased DEEP
THOUGHT/88's task.

1 Nf3 d5 2 e3 Nf6 3 c4 e6 4 Be2 Nc6 5 d4

\begin{verbatim}
Bb4+ 6 Bd2 O-O 7 Bxb4 Nxb4 8 a3 Nc6 9
O-O Na5 10 c5 b6 11 b4 Nc6 12 Nc3 bxc5
13 bxc5 Qe7 14 Rc1 Bd7 15 Bb5 Rfb8 16
Qa4 Nbd 17 Bxd7 Nxd 18 Qa5 Rce 19
Nb5 a6 20 Nc3 Qf6 21 Rb1 Qg6 22 Rfb1 f6
23 Rb2 b6 24 Khi Qd3 25 Ne2 Qd1+ 26
Nfg1 Nc6 27 Qa4 Ndb8 28 Nf4 Kh7 29 Nd3
Rh8 30 Rb1 Qd2 31 Nf3 Qa5 32 Nde5+
fxe5 33 Nxe5+ Kf6 34 Qxa5 Nxa5 35
Rxb8 Rxb8 36 Rxb8 Rxb8 37 Nbd 7 Ke7
38 Nxb8 Nc4 39 Nxa6 Kh8 40 a4 Nb2 41
Kg1 Nxa4 42 Kf1 Kd7 43 f3 Nc3 44 Nb8+
Kc7 45 Nce6 Kh7 46 Ne5+ Ke7 47 Ke1 g5
48 Kd2 Nb5 49 Kc2 Kf6 50 Kb3 Na7 51
Kb4 h5 52 Kc5 Nc8 53 g4 hxg4 54 fxg4
\end{verbatim}
Ne7 55 Ka6 Ng8 56 Kb7 Ke7 57 Kxc7 Nf6 58 c6 Ne8 59 Kc8 Kd6 60 Kb7 Black resigns.

Round 4, Board 1
White: HITECH vs. Black: DEEP THOUGHT/88
Hitec.h’s victory in the fourth round against DEEP THOUGHT/88 was a truly magnificent example of fine positional play converted to an explosive tactical finish.

1 e4 c5 2 Nf3 Nc6 3 Bb5
The Rossolimo Variation against the Sicilian Defense avoids most popular and complex lines of the Sicilian.

3 ...g6, O-O Bg7 5 c3 Nf6 6 Rel O-O
7 d4 cxd4 8 cxd4 d5 9 e5
Ne4 10 Nc3 Nxc3 11 bxc3
This is all considered “book” to this point and no doubt these moves were part of both program’s Opening libraries. White has a big center but Black has two bishops and sufficient chances for counterplay.

12 h3 Bf5
This seems a quite playable idea, namely to retain the two bishops and to make it difficult for White to challenge the b-file in the event of the likely Bxc6, bxc6, etc. Normal is 12 ...Bxf3 13 Qxf3 Qa5! when 14 Qxd5 or 14 Qd3 can both be met strongly by Nxd4.

13 Bxc6 bxc6 14 Ba3 Rb8 15 Bc5
White’s bishop is annoying because it has a target (P/e7) and cannot be contested. The Black plan ...e6, ...Bf8 is virtually impossible to organize with impunity.

15 ...Qc7 16 Qc1 Rb7 17 Nh4!
HITECH does very well to recognize that the only way to utilize its Kingside space advantage is by the pawn storm f4-f5.

17 ...Be4 18 Qe3 Rfb8 19 f3 Bc2 20 Rec1 Ba4?
It is imperative that Black obtain some relief through the simplifications which follow from 20 ...Rb1. Now this bishop becomes a mere spectator.

21 f4 Bb5 22 f5!
White’s attack has gained full steam.

22 ...Kh8 23 e6!
Black’s K-side is demolished!

23 ...Bf6 24 exf7 Kg7
Now if 24 ...Bxh4 25 Qh6 Qd8 (to stop f8 = Q+ and mate follows) 26 fxg6 wins.

<table>
<thead>
<tr>
<th>#</th>
<th>Program</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
<th>Round 4</th>
<th>Round 5</th>
<th>Total Points</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DEEP THOUGHTS</td>
<td>6W 1</td>
<td>7B 2</td>
<td>2W 3</td>
<td>3B 3</td>
<td>5W 5</td>
<td>4 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MEPHISTO</td>
<td>9W 1</td>
<td>4B 2</td>
<td>1B 2</td>
<td>5W 3</td>
<td>3W 4</td>
<td>4 1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>HITECH</td>
<td>5B ½</td>
<td>8W 1½</td>
<td>7B 2½</td>
<td>1W 3½</td>
<td>2B 3½</td>
<td>3 3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>M CHESS</td>
<td>10B 12W</td>
<td>18B</td>
<td>27W</td>
<td>36B 3½</td>
<td>3½</td>
<td>3 3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>ZARKOV</td>
<td>3W ½</td>
<td>9B 1½</td>
<td>6W 2½</td>
<td>3B 2½</td>
<td>1B 2½</td>
<td>2½</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BEBE</td>
<td>1B 4</td>
<td>10W 1</td>
<td>5B 9</td>
<td>9W 2</td>
<td>4W 4½</td>
<td>2½</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BELLE</td>
<td>38 1</td>
<td>1W 1</td>
<td>3W 1</td>
<td>4B 1</td>
<td>Bye 2</td>
<td>2 7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NIGHTMARE</td>
<td>4W 0</td>
<td>3B 0</td>
<td>4W 0</td>
<td>Bye 1</td>
<td>9B 2</td>
<td>2 7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NOW</td>
<td>2B 0</td>
<td>5W 0</td>
<td>Bye 1</td>
<td>8B 1</td>
<td>8W 1</td>
<td>1 9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ZERKER</td>
<td>4W 0</td>
<td>6B 0</td>
<td>Withdraw</td>
<td>0 10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Each entry in the “Round” column denotes the opponent, the color played, and the cumulative points earned.
25 Nf3 gxf5 26 Re1
26 Ng5! forcing Bxg5 27 Qxg5+ Kxf7 28 Qxf5+ also looked very attractive.

26 ...Kxf7 27 Qh6
A most natural attacking move which also offers excellent prospects in an ending after the h-pawn goes if White's attack does not prove decisive. However 27 Ng5+ also deserved great scrutiny, e.g. 27 ...Bxg5 28 Qxg5 e6 29 Rxe6! Kxe6 30 Re1+ Kf7 (or 30 ...Be2?! 31 Rxe2+ Kf7 32 Re5 Rb1+ 33 Kf2 Rbb2+ 34 Kf3 etc.) 31 Re5, but 31 ...Bd3 seems to refute White's attack. Then on 32 Re7+ Qxe7 33 Bxe7 Rxe7 Black has more than enough for the queen.

27 ...Qg3
The best chance.

28 Qxh7+ Ke8 29 Qxf5 Qg7
At this point there are a number of decisive ways for White to proceed including 31 Rae1 or 31 Ne5. This second extra pawn is like tax-free money in the bank! Momentarily one thinks that HITECH does not have a "tactical eye" for a flashy finish, but ...

29 Qh5+ Kd8 30 Bxd6 Bb5 31 Ne5
This was Black's best chance for longest survival. However, the rest of the game is of little interest as White has a decisive material edge.

35 Qxe5 Bxc6 36 Qe6 Rb1+ 37 Rxb1
Rxb1+ 38 Kh2 Rb6 39 g4 Bb7 40 Qg8+ Kc7 41 Qf7 Bc6 42 Qxe7+ Bxd7 43 Qe5+ Rc6 44 Qxd5 Re6 45 Kg3 Re1 46 c4 Re2 47 Qa5+ Kb7 48 Qb4+ Kc8 49 Qa3 Kb8 50 d5 Re4 51 c5 Bxc5 Black resigns.

There are few humans who would not be proud of producing a game like this.
with each side taking turns as Black and White. A total of twenty minutes per game was given to each participant.

The three positions were selected based on involving play from well-known, documented, and top grandmaster competition. All three positions were theoretically drawn according to published sources. Therefore the expected score for each program in the tournament (with correct play by both sides) was 3/6 (six draws). However, even from this small sample it was possible to confirm that there are great differences among the programs' endgame abilities, which correspond to their overall rating differences. The participants were MEPHISTO, M CHESS, ZARKOV, and NOW.

**ROUND 1**: The test position in Round 1 was from Game 1 of Fischer-Spassky, Reykjavik, 1972. Fischer played ...Bxh2 around move 30 in this dead even Bishop Ending and lost. Much subsequent analysis by many people indicated that with very accurate play Fischer might still have been able to salvage a draw.

MEPHISTO is the only program which does not bite on h2. MEPHISTO wins from both sides of this position as does M CHESS against NOW.

---

**THE ENDGAME CHAMPIONSHIP**

The special Endgame Championship directed by Danny Kopec had four participants: MEPHISTO, M CHESS, ZARKOV and NOW. For many years there has been a general consensus among those observing computer chess progress that endgame play was rather weak. This special event was put together in an effort to shed some light on this issue. Time only permitted three rounds. Each round consisted of two games.
ROUND 2: This is a famous endgame in which Capablanca beat Yates twice (!) over a short period of time (Hastings 1930-31). It almost led endgame theorists to mistakenly believe that this ending (Rook + 4 pawns vs. Rook + 3 pawns) is a win for White. Knowledge of Rook and Pawn endgame theory is critical to the correct play in this position. Basic theory is that after Black plays ...h5 it should be a draw because White cannot try to make progress without trading into drawn Rook and 3 Pawns vs. Rook and 2 Pawn endings. However, the correct defense still poses a number of hurdles for Black to overcome.

ROUND 3: This double-edged position occurred in Flohr-Keres, Semmering-Baden, 1937. The game ended in a draw after Ng6 which, Fine praises (BCE #456). It seems that the programs' choice of 1 Ba4 steers the ending in White's favor.
Here both sides seem to squeeze the most out of the position.

**MCHESS-ZARKOV:** 1 Ba4 c5 2 Nxd5+ Ka5 3 Bb3 cxd4 4 exd4 h5 5 Kf3 h4 6 Kg2 h3+ 7 Kh2 Rh4 8 f3 Kb5 9 Ne3+ Kb4 10 Ne2 Ka3 11 d5 Kb4 12 d6 Kc5 13 d7 Rh8 14 Be6 Kd6 15 Bxh3 g4 16 fxg4 Kxd7 17 g5+ Kd6 18 Kg3 Re8 19 Nh4 Re3+ 20 Kg4 Ra3 21 g6 Kf7 22 Kg5 Ra6 23 Be6 Ra5+ 24 Bd5 Ra3 25 g7 Rh3+ 26 Kh6 a5 1:0

**Brief observations:** Patterns like the trapped bishop (1 ...Bxh2??) in Position 1 are particularly difficult for computers to comprehend. The fact that the bishop is trapped can be clouded with the horizon effect and a program often requires very deep search to see that the piece is or is not trapped. Where theory is established in certain endings, for example Position 2, there seems to be plenty for programs to learn from human experience. In more complex tactical endgames, i.e., Position 3, expect new contributions from programs. It can be said that MEPHISTO and M CHESS play the endgame quite well in general.

---

**Announcing DIMACS:**

Series in Discrete Mathematics and Theoretical Computer Science

A series of workshop publications supported by the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS), an NSF Science and Technology Center

**Volume I:**
*Polyhedral Combinatorics:*
*Workshop June 12-16, 1989*
William Cook & Paul D. Seymour, eds.
ACM Order# 222914
Nonmembers $51.00 ACM Members $31.00

**Volume II:**
*Distributed Computing and Cryptography:*
*Workshop Oct. 4-6, 1989*
Joan Feigenbaum & Michael Merritt, eds.
ACM Order# 222910
Nonmembers $51.00 ACM Members $31.00

Forthcoming! **Volume III:**
*Computer Aided Verification, '90*
*Workshop June 18-21, 1990*
R.P. Kurshan & E.M. Clarke, eds.
ACM Order# 222913
Nonmembers $51.00 ACM Members $31.00

Forthcoming! **Volume IV:**
*Applied Geometry and Discrete Mathematics:*
The Victor Klee Festschrift
Peter Gritzmann & Bernd Sturmfels, eds.
ACM Order# 222911
Nonmembers $51.00 ACM Members $31.00

Forthcoming! **Volume V:**
*Reliability of Computer and Communication Networks*
*Workshop December 2-4, 1989*
Fred Roberts, Frank Hwang, and Clyde Monma, eds.
ACM Order# 222912
Nonmembers $51.00 ACM Members $31.00

*These publications are available to ACM members through ACM.*