ACM International Computer Chess Championship

Hyatt Regency Indianapolis
Indianapolis, Indiana
February 14–17
1993

Sponsored by
The Association for Computing Machinery
The 23rd
ACM
International
Computer Chess
Championship

Indianapolis, Indiana
February 14-17, 1993
A Special Event at the ACM Computer Science Conference

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.....1988 Orlando: DEEP THOUGHT........ 1989 Reno: HITECH and DEEP THOUGHT (Tied for 1st Place)
1990 New York: MEPHISTO and DEEP THOUGHT (Tied for 1st Place) 1991 Albuquerque: DEEP THOUGHT II
Welcome and Overview

For almost a quarter of a century, the annual ACM computer chess tournaments have established landmarks in the development of chess programs. The tournament, initially called the ACM United States Computer Chess Championship, underwent name changes in 1976 when it became the ACM North American Computer Chess Championship, and in 1991 when it was given its current name — the ACM International Computer Chess Championship. These name changes reflected the widening participation of programs from at first North America and later from around the world.

For the first time this year, this event is hosting a World Champion from outside the United States, even from outside the continent of North America. Ed Schröder’s CHESS MACHINE/SCHRÖDER, developed in Holland, won the 1992 World Championship held in Madrid, Spain and has come here for its next major challenge. Most amazing, Schröder’s program runs on a microcomputer! Who would have ever imagined when the ACM tournaments began in 1970 that the world’s best program would run on a microcomputer in 1993. And perhaps even more amazing, the program is written in assembly language!!! Jan Louwman, who has assisted Schröder over the years, has brought the program here for the second year in a row.

It must be pointed out that the previous World Champion DEEP THOUGHT II passed up the Spain Championship and is passing up this Indy Championship for several reasons: their team is currently working full tilt to get their multiprocessor version together to challenge the human world champion in the near future. Further, at the end of February, DEEP THOUGHT II is scheduled to take on several European Grandmasters including GM Larsen of Denmark to test its current strength.

On Sunday morning, from 9:00 AM until 11:30 AM, some of the top younger talent in the Indianapolis area will challenge some of the computers as part of the "ACM Student Computer Chess Challenge. The best players from the fifth and sixth grades at School 107 and from the seventh and eighth grades at Longfellow Junior High School will test their skill against some of the top programs. Betty Hutt, recently retired from School 107, and Len Wallace of Longfellow are providing the local organization of the event which is under the auspices of the United States Chess Federation.

Throughout the tournament, Robert Levinson, of the University of California at Santa Cruz, will demonstrate a chess program that learns. He demonstrated his program for the first time at the 1991 ACM event in Albuquerque. Since then, he has significantly improved the program’s capabilities. His demonstration will be in the tournament hall and run for the length of the championship.

On Tuesday at 3:30 PM, Tony Marsland will serve as the moderator of a panel discussion entitled “Computer Chess: What Remains?” With the defeat of the human world champion just over the horizon, as many think, the interest in activities in this area may change focus. Levinson’s learning program reflects one such direction. The construction of large databases for endgames and openings is another. Whether the techniques used by chess programs have wider applicability is still another.

Mike Valvo will serve as Tournament Director. Mike has served in this capacity for a decade.
As one of America’s leading players, one of its best blindfold players, and as a consultant in the computer field, Mike combines the two areas needed to take command of this event. Danny Kopec will serve as the assistant TD. Danny also has the necessary background; he is currently a professor in the Department of Computer Science at Carleton University in Ottawa. Both Valvo and Kopec are rated over 2400 by the USCF. As the programs get stronger and stronger every year, the chess expertise of Valvo and Kopec becomes more essential to these events.

We would like to thank the ACM’s Computer Science Conference for including us on their program. This is our first year as part of this conference’s program and we look forward to a repeat performance next year at CSC ‘94 in Phoenix, Arizona. Don Nowak and Jim Adams of the ACM deserve a special thanks for their help with the arrangements. Jim, of course, has helped out at all twenty-three tournaments!

We wish all the competitors the best of luck. For the audience, we point out (for the third year running) that those commenting on the games sound more and more like weather forecasters.

Monty Newborn
Chairman
ACM Computer Chess Committee

Hans Berliner
Tony Marsland
Kathe Spracklen
Ken Thompson
Committee Members
Important Times and Places

1. Schedule of Rounds

Round 1: 1:00 PM  Sunday  February 14
Round 2: 7:30 PM  Sunday  February 14
Round 3: 7:00 PM  Monday  February 15
Round 4: 7:00 PM  Tuesday  February 16
Round 5: 3:00 PM  Wednesday February 17

Note: All participants must attend a meeting at 12:00 noon on the 14th at which time the rules will be finalized.

2. ACM Student Computer Chess Challenge: Sunday February 14, 9:00 AM - 11:30 AM, students from School 107 and Longfellow Junior High School under the direction of Betty Hutt and Len Wallace will take on the computers.

3. Experiment in Machine Learning: given by Robert Levinson, beginning Sunday February 14 through Wednesday February 17.

4. ICCA Meeting: Monday February 15, 6:00 PM - 7:00 PM.

5. ACM Computer Chess Committee Meeting: Tuesday February 16, 12:00 PM - 12:45 PM.


7. Awards Ceremony: The following awards will be presented at the ACM Awards Banquet at the Indiana Roof Ballroom, 140 West Washington Street, Wednesday evening after the final round (at approximately 9:00 PM):

   Awards: First Place  $4000 and Trophy
   Second Place  $2000 and Trophy
   Third Place  $1000 and Trophy
   Best Small Computing System  $1000 and Trophy

Tournament Director: Mike Valvo.

Assistant Tournament Director: Danny Kopee

Tournament Officials: Monty Newborn and Tony Marsland.

Note: All activities will take place in the Mountain Suite at the Hyatt Regency Indianapolis. The Mountian Suite is located on the third floor of the hotel.
Information on Participants

BEBE

BP
Robert D. Cullum, PO Box 111, Prospect Heights, Illinois 60070.

B* HITECH

CHESS MACHINE/SCHRÖDER
Ed Schröder, Jan Loumann, c/o JL, Bing Crosby Street #5, 3069 XN, Rotterdam, Netherlands.

CRAY BLITZ
Robert Hyatt, Harry Nelson, Albert Gower, c/o RH, Computer and Information Science Department, Campbell Hall, University of Alabama at Birmingham, Birmingham, Alabama, 35124.

INNOVATION
Jeff Mallett, 1655 20th Avenue Dr NE Apt. 1, Hickory, NC, 28601.

KALLISTO
Bart Westrada, Franz van de Eng, c/o BW, P. O. Box 364, 1520 AG, Wormerueer, Netherlands.

M CHESS PROFESSIONAL
Marty Hirsch, PO Box 9388, San Fafael, California, 94912.

NOW
Mark Lefler, ACG Frankfurt ESC, Unit 25401, APO AE 09213.

SOCRATES II
Don Dailey and Larry Kaufman, c/o Julio Kaplan, Heuristic Software, 2550 Nineth Street, #204, Berkeley, CA 94710.

STARTECH
Bradley Kuszmaul, Charles Leiserson, and Ryan Rifkin, c/o BK, MIT Laboratory for Computer Science, 545 Technology Square, Cambridge, MA 02139.

ZARKOV
## Computing System Information

<table>
<thead>
<tr>
<th>Program</th>
<th>Computing system, language, etc.</th>
<th>Nodes/sec.</th>
<th>Rating estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEBE</td>
<td>SYS-10 Chess Engine, assembler, special-purpose chess circuitry, 64Kb, 16 bits, 8 mips, 3 Meg hash table.*</td>
<td>40000</td>
<td>2100</td>
</tr>
<tr>
<td>BP</td>
<td>486/50 Clone, C &amp; assembler, 28 Mips, 32 Meg, 32 bits, 165K position hash table.*</td>
<td>2400</td>
<td>2260</td>
</tr>
<tr>
<td>B* HITECH</td>
<td>SUN 4 with special chess hardware, microcode + assembler, 1 M hash table, (Carnegie-Mellon University).</td>
<td>100K</td>
<td>2400</td>
</tr>
<tr>
<td>CHESS MACHINE/ SCHRÖDER</td>
<td>Laptop with chess machine, Assembler, 24Mips, 512Kb, 434Kb hash table.*</td>
<td>8K</td>
<td>2495</td>
</tr>
<tr>
<td>CRAY BLITZ</td>
<td>Cray YMP-8, Fortran+C+assembler 1330 Mips, 64 Mw, 64 bits, 8 processors 60 Megaword hash table, (Cray Research Comp Center, Eagen MN).</td>
<td>200K-500K</td>
<td>2200+</td>
</tr>
<tr>
<td>INNOVATION</td>
<td>Macintosh Quadra 700, 68040, 20Meg, 32bit, C, 128K hash table.*</td>
<td>2K</td>
<td>2000</td>
</tr>
<tr>
<td>KALLISTO</td>
<td>IBM PC or clone, 80486</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>M CHESS PROFESSIONAL</td>
<td>IBM PC or clone, 80486, C + Assembler 5 mips, 640Kbytes, 32 bits, 16K position hash table*</td>
<td>5K</td>
<td>2450</td>
</tr>
<tr>
<td>NOW</td>
<td>IBM PC or clone, 80486, C.*</td>
<td>8K</td>
<td>2250</td>
</tr>
<tr>
<td>SOCRATES II</td>
<td>IBM PC or clone, 486 33 Mhz or 50 Mhz 32K hash table.*</td>
<td>NA</td>
<td>2400</td>
</tr>
<tr>
<td>STARTECH</td>
<td>Connection Machine CM-5, 128 processors. (Thinking Machines Corp, Boston)</td>
<td>NA</td>
<td>2100</td>
</tr>
<tr>
<td>ZARKOV</td>
<td>HP 9000/735, C 75 mips, 48 Meg, 32 bits, 64K position hash table (HP, Fort Collins, Colorado)</td>
<td>10K</td>
<td>2400</td>
</tr>
</tbody>
</table>
### Score Table

<table>
<thead>
<tr>
<th>Team</th>
<th>Rounds</th>
<th>Total Points</th>
<th>Final Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BEBE</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. BP</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. B'S HITECH</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. CHESS MACHINE/</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCHRÖDER</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. CRAY BLITZ</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. INNOVATION</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. KALLISTO</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. M CHESS PROFESSIONAL</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. NOW</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. SOCRATES II</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. STARTECH</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. ZARKOV</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Number of points
- Number and color of opponent
23rd ACM International Computer Chess Championship
Tournament Rules

1. Each entry is a computing system and one or more human operators. A listing of all chess-related programs running on the system must be available on demand to the TD. Each entry requires at least one full-time operator (i.e., one operator cannot assist with more than one entry).

2. Participants are required to attend an organizational meeting at 12 noon on February 14 for the purpose of officially registering for the tournament. Rules will be finalized at that meeting.

3. The tournament is a five round Swiss style tournament. The first and second rounds will be played Sunday February 14 at 1:00 PM and 7:30 PM respectively. The third round is scheduled for Monday, February 15 at 7:00 PM, the fourth round for Tuesday February 16 at 7:00 PM, and the final round for Wednesday February 17 at 3:00 PM.

4. Trophies and prizes will be awarded to the first three finishers. The order of finish will be determined by the total number of points earned. If two or more teams have an equal number of points, they will be considered as tied, and the trophies and prizes divided accordingly. A prize of $4000 will be awarded to the program which finishes the tournament with the most points, $2000 to the second most, and $1000 to the third most. A trophy and $1000 prize will be awarded to the "Best Small Computing System."

5. Unless otherwise specified, rules of play are identical to those of "human" tournament play. If a point is in question, the TD has the right to make the final decision.

6. Games are played at a speed of 40 moves per player in the first two hours and 20 moves per player per hour thereafter.

7. The TD has the right to adjudicate a game after six hours of total clock time. The adjudication will be made on the premise that perfect chess will be played by both sides from the final position. Every effort will be made by the TD to avoid adjudication. In particular, the second round will not begin until 8:00 p.m. on Sunday, if necessary to avoid adjudicating a first-round game. A game will be adjudicated in the final round after 8 hours of play if it can be established that the result of the game has no bearing on the order of the top three finishers.

10. An operator may ask that the TD stop the clock at most twice during the course of a game because of technical difficulties. The clock must be restarted each time after at most 15 minutes. If an operator using a remote computer can clearly establish that his problems are not in his own computing system but in the communication network, the TD can permit additional time-outs.

11. If a program experiences technical difficulties, the operator can ask the TD for permission to restart the program. When restarting a program after a failure of any kind, the operator must reset all parameters to their values at the time the game was interrupted. An operator error made when starting a game or in the middle of a game can be corrected only with the approval of the TD.

12. If an operator types in an incorrect move, the TD must be immediately notified. Both clocks will be stopped. The game must then be backed up to the point where the error occurred. The TD will back up the clocks to their settings when the error occurred using whatever information is
available. Both sides may adjust program parameters after such an error with the approval of the TD. The TD may not allow certain parameters to be changed, e.g., the contempt factor.

13. Terminals located at the tournament site must communicate directly with remote computers, i.e., there cannot be any human intermediary at the remote location.

14. Each team that uses a terminal must position the terminal on the game table in such a way that the opponent has a good view of it. An operator can only (1) type in moves and (2) respond to request from the computer for clock information. If an operator must type in any other information, it must be approved ahead of time by the TD. (This might happen if there is noise on the communication line and, for example, a CR must be typed to clear the line.) The operator cannot query the system to see if it alive without permission of the TD.

15. A team must receive the approval of the TD to change from one computing system to another.

16. Each game is officially played on a chess board provided by the Tournament Committee. The official clock is also provided by the Tournament Committee.

17. At the end of each game, each team is required to turn in a game listing to the TD.
## History of Major Tournaments

<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
<th>Winner</th>
<th>Runner-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>New York</td>
<td>CHESS 3.0; Slate, Atkin, Gorlen, CDC 6400</td>
<td>DALY CHESS PROGRAM; Daly, King, Varian 620/i</td>
</tr>
<tr>
<td>1971</td>
<td>Chicago</td>
<td>CHESS 3.5; Slate, Atkin, Gorlen, CDC 6400</td>
<td>TECH; Gillogly, PDP 10</td>
</tr>
<tr>
<td>1972</td>
<td>Boston</td>
<td>CHESS 3.6; Slate, Atkin, Gorlen, CDC 6400</td>
<td>OSTRICHT; Arnold, Newborn, DG Supernova</td>
</tr>
<tr>
<td>1973</td>
<td>Atlanta</td>
<td>CHESS 4.0; Slate, Atkin, Gorlen, CDC 6400</td>
<td>TECH II; Baisley, PDP 10</td>
</tr>
<tr>
<td>1974</td>
<td>San Diego</td>
<td>RIBBIT; Hansen, Crook, Parry, H’well 6050</td>
<td>CHESS 4.0; Slate, Atkin, CDC 6400</td>
</tr>
<tr>
<td>1975</td>
<td>Minneapolis</td>
<td>CHESS 4.4; Slate, Atkin, CDC Cyber 175</td>
<td>TREEFROG; Hansen, Calnek, Crook, Honeywell 6080</td>
</tr>
<tr>
<td>1976</td>
<td>Houston</td>
<td>CHESS 4.5; Slate, Atkin, CDC Cyber 176</td>
<td>CHAOS; Swartz, Berman, ALexander Ruben, Toikka, Winograd, Amdahl 470</td>
</tr>
<tr>
<td>1977</td>
<td>Seattle</td>
<td>CHESS 4.6; Slate, Atkin, CDC Cyber 176</td>
<td>DUCHESS; Truscott, Wright, Jensen, IBM 370/168</td>
</tr>
<tr>
<td>1978</td>
<td>Washington</td>
<td>BELLE; Thompson, Condon, PDP 11/70 w/ chess hardware</td>
<td>CHESS 4.7; Slate, Atkin, CDC Cyber 176</td>
</tr>
<tr>
<td>1979</td>
<td>Detroit</td>
<td>CHESS 4.9; Slate, Atkin, CDC Cyber 176</td>
<td>BELLE; Thompson, Condon, PDP 11/70 with chess hardware</td>
</tr>
<tr>
<td>1980</td>
<td>Nashville</td>
<td>BELLE; Thompson, Condon, PDP 11/70 w/ chess hardware</td>
<td>CHAOS; Alexander, O’Keefe, Swartz, Berman, Amdahl 470</td>
</tr>
<tr>
<td>1981</td>
<td>Los Angeles</td>
<td>BELLE; Thompson, Condon, PDP 11/23 w/ chess hardware</td>
<td>NUCHESS; Blanchard, Slate, CDC Cyber 176</td>
</tr>
<tr>
<td>1982</td>
<td>Dallas</td>
<td>BELLE; Thompson, Condon, PDP 11/23 w/ chess hardware</td>
<td>CRAY BLITZ; Hyatt, Gower, Nelson, Cray 1</td>
</tr>
</tbody>
</table>

1983 Not held as the ACM NACCC that year but as the Fourth World Championship. See World Championships.

1984 San Fransisco | CRAY BLITZ; Hyatt, Gower, Nelson, Cray XMP/4 | BEBE; Scherzer, Chess Engine, and FIDELITY EXPERIMENTAL; Sparcklen, Spracklen, Fidelity machine |

1985 Denver | HITECH; Ebeling, Berliner, Goetsch, Paley Campbell, Slomer, SUN w/ chess hardware | BEBE; Scherzer, Chess engine |

1986 Dallas | BELLE; Thompson, Condon, 11/23+c.h. | LACHEX; Wendroff, Cray X-MP |

1987 Dallas | CHIPTEST-M; Anantharaman, Hsu Campbell, SUN 3 with VLSI chip hardware | CRAY BLITZ; Hyatt, Nelson, Gower Cray XMP 4/8 |

1988 Orlando
DEEP THOUGHT 0.02; Hsu Anantharaman, Browne, Campbell, Nowatzyk, SUN 3 w/ VLSI circuitry
CHESS CHALLENGER EXP; Spracklen, Spracklen, Nelson, Fidelity machine with Motorola 68030 microprocessor

1989 Reno
HITECH*; Ebeling, Berliner, Goetsch, Paley, Campbell, Slomer, SUN w/ chess hardware (* denotes 1st-place tie)
DEEP THOUGHT*; Hsu, Anantharaman, Browne, Campbell, Nowatzyk, 3 SUN 4s w/ VLSI chess hardware

1990 New York
DEEP THOUGHT/88; Hsu, Anantharaman, Jensen, Campbell, Nowatzyk, SUN 4 with two special VLSI chess circuits
METHISTO; Lang, 68030 microprocessor METHISTO machine

1991 Albuquerque
DEEP THOUGHT II, Hsu, Campbell, RS/6000 550 + 24 chess processors.
M CHESS; Hirsch, IBM PC Clone/486.

### WORLD CHAMPIONS

<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
<th>Winner</th>
<th>Runner-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>Stockholm</td>
<td>KAISSA; Donskoy, Arlazarov, ICL 4/70</td>
<td>CHESS 4.0; Slate, Atkin, CDC 6600</td>
</tr>
<tr>
<td>1977</td>
<td>Toronto</td>
<td>CHESS 4.6; Slate, Atkin, CDC Cyber 176</td>
<td>DUCHESS; Truscott, Wright, Jensen, IBM 370/165</td>
</tr>
<tr>
<td>1980</td>
<td>Linz</td>
<td>BELLE; Thompson, Condon, PDP 11/23 with chess circuitry</td>
<td>CHAOS; Alexander, Swartz, Berman O'Keefe, Amdahl 470/V8</td>
</tr>
<tr>
<td>1983</td>
<td>New York</td>
<td>CRAY BLITZ; Hyatt, Gower, Nelson, Cray XMP/48</td>
<td>BEBE; Scherzer, Chess engine</td>
</tr>
<tr>
<td>1986</td>
<td>Cologne</td>
<td>CRAY BLITZ; Hyatt, Gower, Nelson, Cray XMP</td>
<td>HITECH; Berliner, et al., SUN workstation with chess circuitry</td>
</tr>
<tr>
<td>1989</td>
<td>Edmonton</td>
<td>DEEP THOUGHT; Hsu, Anantharaman Browne, Campbell, Jansen, Nowatzyk, SUN w/ VLSI chess hardware</td>
<td>BEBE; Scherzer, Scherzer, Chess Engine</td>
</tr>
<tr>
<td>1992</td>
<td>Madrid</td>
<td>CHESS MACHINE/SCHRÖDER, Schröder, ARM2</td>
<td>ZUGZWANG; Feldman, Mysliwietz, Parsytec T-800</td>
</tr>
</tbody>
</table>

### WORLD MICROCOMPUTER CHAMPIONS

<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
<th>Winner</th>
<th>Runner-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>London</td>
<td>CHESS CHALLENGER</td>
<td>BORIS EXPERIMENTAL</td>
</tr>
<tr>
<td>1981</td>
<td>Trondheim</td>
<td>FIDELITY X</td>
<td>CHESS CHAMPION MARK V</td>
</tr>
<tr>
<td>1983</td>
<td>Budapest</td>
<td>ELITE A/S</td>
<td>MEPHISTO X</td>
</tr>
<tr>
<td>1984</td>
<td>Glasgow</td>
<td>Four way tie: ELITE X, MEPHISTO S/X, PRINCHESS, PSION CHESS</td>
<td>MEPHISTO AMSTERDAM II</td>
</tr>
<tr>
<td>1985</td>
<td>Amsterdam</td>
<td>MEPHISTO AMSTERDAM I</td>
<td>MEPHISTO &quot;2533&quot;</td>
</tr>
<tr>
<td>1986</td>
<td>Dallas</td>
<td>MEPHISTO DALLAS 3</td>
<td>FIDELITY 68K</td>
</tr>
<tr>
<td>1987</td>
<td>Rome</td>
<td>MEPHISTO</td>
<td>CYRUS FIDELITY</td>
</tr>
<tr>
<td>1988</td>
<td>Almeria</td>
<td>MEPHISTO</td>
<td>FIDELITY</td>
</tr>
<tr>
<td>1989</td>
<td>Portoroz</td>
<td>MEPHISTO</td>
<td>FIDELITY</td>
</tr>
<tr>
<td>1990</td>
<td>Lyons</td>
<td>MEPHISTO</td>
<td>Tie: ECHEC 1.9 &amp; GIDEON</td>
</tr>
</tbody>
</table>

1991 Vancouver Tie: MEPHISTO & GIDEON
1992 Not held in 1992. The next championship is scheduled to take place in Germany in the autumn of 1993.
Morph: An Experience-Based Adaptive Chess System

Robert Levinson
University of California
Santa Cruz, CA 95064
levinson@cse.ucsc.edu
(408)459-2087

The best chess computers and the best humans play chess at the master or grandmaster levels but that is where the similarity ends. Chess computers have been built to search millions or even billions of positions per second relying on superficial numerical assessments of each position that when combined properly lead to good moves.

In contrast, psychological evidence indicates that human chess players consider very few positions, and base their positional assessments on a rich set of structural/perceptual patterns that have been learned through experience. Morph is a computer chess program that has been developed to be more consistent the cognitive models.

The current model of computer chess programming was largely developed in the 1960s and has been refined ever since. The main characteristic of the model is the use of brute-force alpha-beta minimax search with selective extensions for special situations such as forcing variations. This has been further enhanced by special purpose hardware (as in Deep Thought). This model has been so successful that little else has been tried outside this paradigm.

The few alternative approaches from the Artificial Intelligence community have fared poorly due to the expense in applying the "knowledge" that had been supplied to the system. In recent years, the few times chess has been applied as a testbed only a small sub-domain of the game was used in the research thus glossing over the fundamental efficiency issues that AI researchers must ultimately grapple with.

However, there is a third approach that neither relies mainly on search nor the symbolic computation approach of knowledge-oriented AI: what we shall call the "pattern-oriented approach". In this approach configurations of interaction between squares and pieces are stored along with their significance. A uniform method is used to combine the significances in a given position to reach a final evaluation for that position. That such an approach is possible is evidenced by psychological models of human chess play that have determined that human masters consider only about 10-100 positions in determining where to move and that their evaluations are based on (approximately) 50,000-100,000 patterns culled from experience.

It is not conceivable that the detailed knowledge required to evaluate positions in this way could be supplied directly to a machine, thus learning is required. A learning mechanism has been developed that combines recently developed machine learning methods in weight-updating, genetic, and temporal-difference learning modules to create, delete, generalize and evaluate graph patterns. A sophisticated associative pattern retrieval system for semantic network patterns (graphs) organizes the database for efficient processing. Morph has been developed based on the pattern-oriented approach. Morph differs from most of today's neural networks in that it manipulates structured symbolic data as opposed to numerical or relational. Also, the contents of Morph's learned knowledge is transparent to an observer of its database.
To strengthen the connections with the cognitive model, Morph's knowledge is restricted to come from its own playing experience, no sets of pre-classified examples are given and beyond a graph pattern representation scheme (that shows the interactions between pieces and squares) little chess knowledge such as the fact that having pieces is valuable (leave alone their values) or the rules(!) or the goal has been provided to the system. Morph is told however which moves it can chose from a given position and whether it wins or loses.

Further, the system has been limited to using only 1- ply of search. This year, however, we added a "selective" searching mechanism to Morph that allows it to consider (based on its experience) up to 100 positions from the root position in determining what move to make. This guided search mechanism brings Morph even closer to the cognitive model.

Results with Morph have been encouraging yet challenging! The system has learned the relative values of the pieces and many structural patterns that are recognizable by good chess players. Further, it gives most patterns appropriate values. The system plays reasonable opening moves, developing pieces, castling and attempting to control the center. When Morph has been limited to 1- ply search it is able to draw its arch rival and trainer GnuChess (a fairly strong traditional program) once every thousand games, and has two victories in its career of many thousands of games. Most important to us in this stage of the research is that Morph demonstrates a consistently growing learning curve in its ability to win and retain material and to prolong the game. It is hoped that the addition of selective searching as well as more sophisticated pattern addition and retrieval strategies will soon make Morph competitive with its trainer and other tournament players. We feel that each step taken in improving the power of Morph's learning mechanism (which is not really dependent on chess) brings us that much closer to achieving a true computational model of intelligence and its development.

In the demonstration in the tournament hall, Morph will start with an empty database and will be in a "training cycle": it will play a game with GnuChess, learn from the game and repeat. This cycle will continue throughout the duration of the tournament. Each of Morph's games will be displayed as they are being played and spectators will have the opportunity to join the cycle and play Morph themselves. The level of improvement of Morph's, initially random play, to its level after 4 days of training should be significant.
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 1983 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 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, JH 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.

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

CHESS MACHINE/SCHROEDER vs. BEBE


CRAY BLITZ vs. BP


LACHEX vs. HITECH

DELICATE BRUTE vs. M CHESS

SOCRATES vs. MEPHISTO
1.e4 c5 2. Nf3 d6 3. Be3 Be6 4. O-O cxd4 5. cxd4 Bd7 6. Nf3 O-O 7. Nbd2 Nf6 8. Bg5 Ne4 9. Nxe4 Qc8 10. Bd2 Qe6 11. Bxe4 c6 12. Nf3 Nc6 13. Ne5 Nxe5 14. Bxe5 Qe7 15. Nxe7+ Kxe7 16. Bg5 Qe8 17. Bh4+ Kf8 18. Bf3 Qe7 19. Bd5 Qf7 20. Bxe6 Qxe6 21. Qxe6+ Kxe6 22. Bc4+ Kf7 23. Be2+ Kf6 24. Kh1 g6 25. Kg1 Kf7 26. f4 Kf6 27. Kg1 Ke7 28. Bf3 Kf7 29. Kg1 Ke8 30. Bh5 Kf8 31. Kg1 Ke7 32. Kg1 Ke8 33. Kg1 Ke7 34. Kg1 Ke8 35. Kg1 Ke7 36. Kg1 Ke6 37. Kg1 Ke5 38. Kg1 Ke4 39. Kg1 Ke3 40. Kg1 Ke2 41. Kg1 Ke1 42. Kg1 Ke2 43. Kg1 Ke1 44. Kg1 Ke2 45. Kg1 Ke1 46. Kg1 Ke2 47. Kg1 Ke1 48. Kg1 Ke2 49. Kg1 Ke1 50. Kg1 Ke2 51. Kg1 Ke1 52. Kg1 Ke2 53. Kg1 Ke1 54. Kg1 Ke2 55. Kg1 Ke1 56. Kg1 Ke2 57. Kg1 Ke1 58. Kg1 Ke2 59. Kg1 Ke1 60. Kg1 Ke2 61. Kg1 Ke1 62. Kg1 Ke2 63. Kg1 Ke1 64. Kg1 Ke2 65. Kg1 Ke1 66. Kg1 Ke2 67. Kg1 Ke1 68. Kg1 Ke2 69. Kg1 Ke1 70. Kg1 Ke2 71. Kg1 Ke1 72. Kg1 Ke2 73. Kg1 Ke1 74. Kg1 Ke2 75. Kg1 Ke1 76. Kg1 Ke2 77. Kg1 Ke1 78. Kg1 Ke2 79. Kg1 Ke1 80. Kg1 Ke2 81. Kg1 Ke1 82. Kg1 Ke2 83. Kg1 Ke1 84. Kg1 Ke2 85. Kg1 Ke1 86. Kg1 Ke2 87. Kg1 Ke1 88. Kg1 Ke2 89. Kg1 Ke1 90. Kg1 Ke2 91. Kg1 Ke1 92. Kg1 Ke2 93. Kg1 Ke1 94. Kg1 Ke2 95. Kg1 Ke1 96. Kg1 Ke2 97. Kg1 Ke1 98. Kg1 Ke2 99. Kg1 Ke1 100. Kg1 Ke2 101. Kg1 Ke1 102. Kg1 Ke2 103. Kg1 Ke1

SOCRTES vs. CRAY BLITZ


Round 2

HITECH finished first with a domi-

ZARKOV vs. DELICATE BRUTE


MEPHISTO vs. LACHEX


of its nine lives in its game with LACHEX. LACHEX was never pro-

DEEP THOUGHT II vs. ZARKOV


MEPHISTO vs. LACHEX


of its nine lives in its game with LACHEX. LACHEX was never pro-

DEEP THOUGHT II had a hard time gaining an advantage against M CHESS and the game seemed quite equal for a long time. Finally, M CHESS missed a necessary endgame nuance and the end became clear. MEPHISTO must have used one
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 Catalan (which occurs in this game) is typified by the Black capture dxc4 at some point.


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. Ne1! which led to victory in Ribli-Karpov, Amsterdam, 1980 or 10. Nbd2 Nbd7 11. Nbd3 Be4 12. Qc3 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 after 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...Nd5 13. Ne3 Nd7 14. Rd1 Re8 15. Nxd5 Bxd5 16. Ne1 c6 17. Nbd3 Qb4 18. Qc3 b4 19. Qd2 at 20. Rd1 and a draw was agreed at this point.

12 ... Nd5 13. Ne3 Nxf4 14. Qxf4 Q6d6!

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. Rd1 Qb6 17. Ne5 with a slight White edge (Vaganian-Anderson, Lenin- grad 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- dfe 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...Nfd6! 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-line so easily and allow Black to dominate the position. However, after 20. Rd1, DEEP THOUGHT II has 20...Rfc8! and if 21. Rxd6, than 21 ...Rc1+ 22. Bf1 Bxd6 23. Qd3 Rc6 etc.

20...Qc7 21. Nd4

The threat here is 22. Nxe6! 21 ... Ne5 22. b3 Bf6 23. e3 Rd8 24. Bf4?!

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, but DEEP THOUGHT II would eventually play b5-b4 itself and the weakness would then be on a2.

32...b4 33. Bxd5 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 chances out of this position. It may be unable to generate winning this game was being played, that they team was getting concerned, while sides. The DEEP THOUGHT II plan would be to first improve its focus on the b3 weakness. Black's weakness would then be on a2.

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.

DELICATE 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 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. SOCRATES, 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 12. 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


Position after 33...exd5
40. Nbd3 Ke4 41. g3 Ke3 42. Nel Kf2
4l. Bxb6 axb6 12. Bb5+ Nc6
Qb6 17. Qe2 Qxb2 18. Nxd5 Ra7
THE ADVANTAGE OF THE MOVE IS IN
avoiding the exchange of light-
squared bishops, based on the gen-
eral view that the more pieces on the
board, the better for Black in view of
his ability to cope with the isolated
queenside with varied success.
5. Ng3 Nf6
More mainstream here is 5. Nc6.
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. How-
ever she plans to move again to
f5 or b5 and readies to meet Qb6
with Qxb3. Nonetheless this move was
probably still part of DEEP
THOUGHT II's book. On the alter-
native 13.Re1 Qb6 would be a little
troublesome.
13. ...b6 14. Bb4 Re8 15. Rfd1 Re8
16. Qf5 Qb6
If 16. ...Re6 17.c3 would win the
isolani.
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 neu-
ralized and only weaknesses will
remain.
19. Kf1 f5
HITECH chooses among evils. With-
out 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. Rac1!
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. Nel!
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. ...Rx6 25. Rx5 Kg7 26. Nf3 Rd8 27. Ne5 Rc7 28. Nd3 a9 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 his more active rook will soon fathom. Why should White trade off his more active rook will soon

36. ...bxc5 37. bxc3 and White will soon pick off Black's more exposed pawns.

38. Rb4 Rd8 38. Rxa4 38 ...Rx6 39. Rb4 Rd8 38. Rxa4 38. Kg2 and White wins; amazing, pick off Black's more exposed pawns.

33. Rd4 37. Bxd4 37. Rb4 Rd8 38. Rxa4 38. ...Rc7 39. Rb4 Rd8 38. Rxa4 38. Kg2 and White wins; amazing,

Variation: 34. ...dxc3 35. Nxc5 c2

36. Qa5 Rxa6 37. Qa6 bxc3 38. bxc3 and White will win a pawn or two. Finally on 35. ...

...Rh6+ followed by 37. Rxh6 wins.

Position after 33...c3


BP vs. LACHEX


M CHESS vs. SOCRATES


The first fruits of DEEP THOUGHT II's labor.


The rest is a fairly easy win for White.

45. h4 Be7 46. h5 Ba5 47. f4 f6 48. Nb2 Bb4 49. Ne4 Bc5 50. Kf3 Bf8 51. Ne3+ Kc5 52. Nxf5 Kxh5 53. Ke4 Kc5 54. Ne3 Kb4 55. Kf5 1-0

CRAY BLITZ vs. DEEP THOUGHT II seemed to be an even struggle in most of the early going, but one had to prefer the black pawn structure. 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.

CHESS MACHINE/SCHROEDER played a Spassky specialty to thwart the well-known MEPHISTO opening preparations, but that backfired as the game followed lines well-known to MEPHISTO.
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.

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.

MEPHISTO vs. BEBE

CRAY BLITZ vs. DEEP THOUGHT II

M CHESS/SCHROEDER vs. SOCRATES

MEPHISTO vs. BEBE

CHESS MACHINE/SCHROEDER vs. SOCRATES

BP vs. M CHESS

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</table>
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. 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


M CHESS vs. HITECH


The first and third authors of this article served as assistant tournament director and tournament director, respectively. The second author served as organizer and also serves as the chairman of the ACM Computer Chess Committee.