GNU Chess Help Index

This index list all GNU Chess help topics

To learn how to use Help choose "Using Help" from the Help menu or press F1.

How to Play

      To move a piece, place the mouse cursor over the piece, click the left mouse button once, move the cursor to the desired square and click again.   To enter a move using the keyboard enter F2.   A dialog box will be displayed.   Enter the move in algebraic notation.   To castle enter o-o, for a queen side castle enter o-o-o.   To promote a pawn onto the last rank enter the move followed by the first letter of the piece to promote to.   (ie q for queen, r for rook, b for bishop, n for knight.) To abort a move or change your mind about what piece to move click on the square the piece was originally at.

      When the computer is calculating its move you can abort the look ahead and force it to immediately take a move by entering Control C.

Commands
      GNU Chess menu commands

Background Information
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      GNU Chess sample match with MACH

GNU Chess Menu Commands

All the commands to control actions of the game are controlled via menus.   Select the specific menu item you require help on.

<u>File</u>	Save and restore a game
<u>Edit</u>	Change board setup
<u>Options</u>	Adjust game options
<u>Skill</u>	Adjust the degree of difficulty of the game
<u>Side</u>	Choose what side to have to computer play
<u>Colors</u>	Sets up screen colors
<u>Hint</u>	Provides a suggested move
Help	Enters the help system

File Menu

The File menu allows the saving and restoring of games.   Specific functions available are:

New   Starts a new game.

Save   Saves an in progress game.   A dialog box will be opened to enter a file
               name

Open   Loads a saved game. A dialog box will be opened to enter a file name

List   Lists the moves of a game in print-out format.   A dialog box will be
               opened to enter a file name.

Exit   Exit the game.

Edit Menu

The Edit menu allows the board setup to be changed and moves to be taken back.

Setup Board Choosing this command places the game into setup mode.   A new board setup is provided.   You adjust the setup by selecting a piece with mouse and placing it on the desired square.   To remove a piece from the board pick it up a blank square and place it on the piece to be removed.

Undo Removes the last played move

Remove Removes the last complete move (Basically 2 undo's)

Force Toggles manual mode.   Lets user enter moves for both sides or allows use by two players as an electronic chess board.

Options Menu

The Options menu allows adjustment of the behavior of the game.

Tone	When checked the computer beeps after taking a move. To make the game silent select this option, the check mark will be removed.
Coordinates	When checked the algebraic notation will be printed along the edge of the board
Search Stats	When checked a status box will display the moves GNU chess is evaluating for use.
Test	This selects a speed test. The numbers presented in the results box can be compared to other versions of GNU chess.
Hash	Enables internal move hashing
Book	When checked GNU chess uses its opening book
Both	Auto Play mode. Choose any square to abort. Sometimes after aborting autoplay the game will perform a bogus move. Use UNDO or REMOVE to cancel.
A Window	Sets an internal move generator value
B Window	Sets an internal move generator value
Contemp	Sets an internal move generator value

Skill Menu

Adjusts playing ability of GNU Chess.

Time	Presents a dialog box to choose the time limits for the game.
Random	This cause GNU chess to randomly select among equally rated moves.
Easy	When checked this enables "easy" mode, where the computer not allowed to think while the user takes a move. To have GNU Chess play a stronger game uncheck this option. The look ahead is aborted when the mouse is clicked.
Depth	Presents a dialog box to set the maximum number of moves to look ahead.

Side Menu

Allows the user to choose which side the computer will play

Reverse	Rotates board 180 degrees.
Switch	Switch sides with the computer. (If computer is black it becomes white)
Black	Computer plays black
White	Computer plays white

Colors Menu

Allows the colors of the screen to be set.   The color settings are saved in the file CHESS.INI in the windows directory.   Choosing "Default Colors" restores color settings to program defaults.

Hint Menu

The Hint menu provides a suggested move.   The hint is based on GNU chess's projection of what move the user will take when calculating its look-ahead.   The quality of the hint is dependent on the amount of time GNU chess has to think.

Background on GNU Chess

GNU Chess
by Stuart Cracraft
Copyright 1987,1988,1989,1990 Stuart Cracraft

GNU Chess is a communal chess program. Contributors donate their time and effort in order to make it a stronger, better, sleeker program. Contributions take many forms: interfaces to high-resolution displays, opening book treatises, speedups of the underlying algorithms, additions of extra heuristics. These contributions are then distributed to the large user-base so that all may enjoy the fruits of our labor. The original and continuing purpose of this project is to permanently end   the rampant hoarding of computer chess software that has been the   case for the past 20 years.

Many people have contributed to GNU Chess. Their contributions have improved the program from being a patzer (weak program) to being a grandpatzer (decently strong program). In its growth since initial release, GNU Chess has gone from approximately class D to strong master strength. It beats the Fidelity Mach 3 (USCF 2265) rather handily when run on a Sparc-1 (RISC). Since these types of RISC chips are becoming fairly common, the age of "master chess in your computer lab" is now a reality. From there, it will be a short hop to master chess in your home with FSF software.

GNU Chess's structure is a hybrid of the Shannon Type-A and Type-B methods. It conducts a full-width search to a fixed-depth and then continues with a quiescence search for many more ply. This quiescence search helps the program find positions which can be safely evaluated and which are not too turbulent. If a terminal position is too turbulent, the evaluation will be highly inaccurate. Additional searching by investigating series of captures, checks, and other potentially imbalance-producing moves is quite helpful.

GNU Chess will sacrifice pieces in order to reach known winning endings. Also, it uses a trade-down bonus to encourage the stronger side to trade off certain types of pieces thus reaching a more simplified and therefore ostensibly "clearer" position.

GNU Chess has certain types of knowledge regarding easier endgames.   This allows it to play these endings somewhat better than might be expected.

GNU Chess has time heuristics that it uses to improve its handling of time-controls and hasten its making of "obvious" moves. It also thinks on the opponent's time.

GNU Chess is interfaced to the SUN Windows and X Windows display protocols and can display its pieces in elaborate format, similar to chess diagrams.

GNU Chess has an opening book which consists of many variations from MCO (Modern Chess Openings), and some from ECO.

For comparison purposes, GNU Chess running on a VAX 8650 is stronger than the famous Chess 4.5 running on a CDC 6400. On a Sparc-1, GNU 1.55 (or later) is probably about 2350-2400 strength (USCF rating estimated).

We wish to acknowledge the contributions of the following individuals: (in alphabetical order) Jim Aspnes, Wayne Christopher, Steve Dougherty, David Goldberg, Richard Greenblatt, Larry Kaufman, David Kittinger, Hans-Erik Sandstrom, Richard Stallman, John Stanback, Ken Thompson.

Contact information: The author may be reached by a variety of methods. Via U.S. mail: Stuart Cracraft, P.O. Box 2841, Laguna Hills, Ca. 92654-2841. Via Email: cracraft@wheaties.ai.mit.edu.   The author may also be contacted via the Free Software Foundation, Inc. 675 Massachusetts Ave.,Cambridge MA 02139.

Article: GNU Chess Experiences Learned with Communal Sharing

GNU Chess: Experiences Learned
with Communal Sharing
by Stuart Cracraft
(and contributors to the GNU Project)

Limited sharing has characterized the computer chess community for the past two decades. Occasional research articles give hints and suggestions for useful features, but rarely reveal the real details of the critically important advances.   We will here describe an effort underway (titled "GNU Chess") to create a more open and friendly environment of sharing.

GNU Chess is part of Project GNU, a large-scale effort in which the philosophical goals are far-reaching. We will not go into any great depth about these goals as they relate to the larger project, because these are described elsewhere [1]. However, we will mention the basic issues and the changes we hope to encourage.

The start of the GNU Chess project was a natural result of the experiences gleaned in writing a chess program. While the author was at a progressive academic location [2], he was able to conceive the idea of a communal chess program only after much heartache. During the period of writing the initial version (which has since undergone many improvements and whole revisions), it became clear that the best features and most useful hints, the very best of the heuristics, were hidden and difficult to find in the literature.

Sprinkled across many books, research papers, magazine articles, accumulated in the community, during the past 25 years, there was literally a void of true, empirical programs. Locating usable programs was difficult. Many programs were the result of academic work in "ivory towers", and hence were inaccessible to the common man. Other programs were sequestered in research think-tanks. Naturally, developers of commercial programs carefully guarded their source in order to protect their investment. On the other hand, a few chess program source listings had actually been published, but these were not really very strong, often written in a non-general language, and frequently more pedantic than practical.

The idea of a reasonably strong communal program solidified. When we refer to a communal program, we do not regard this as public-domain software. Rather, we refer to a program which is under the shared authority of a number of individuals, the principal contributors. These individuals have experienced and realized the positive results of a sharing community and the rapid improvements that come through contributing in such a community. Further, these individuals devote time and energy to coordinating the contributions of other individuals. While they exercise a certain editorial right, this is usually not exercised arbitrarily; instead, a discussion is often undertaken.

Eventually, a working C program that played chess was available. The coordinating institution for Project GNU, accepted our suggestion of inclusion of a chess program in the GNU distribution. Initial distribution of GNU Chess commenced in October of 1986. Interest in the project increased rapidly.

Contributions came in from many places and people. Interfaces to X-windows and SUN-windows were donated, thus allowing very fancy chess fonts on bit-mapped screens. Also, contributions involving large portions of opening books such as MCO and collections of master games were added to the distribution.   Additionally, tree-search modifications and heuristics were provided, and occasionally even entire rewrites.

The program advanced in strength by several USCF class intervals during a period of less than one year. During this time, many unusual features and enhancements were added to the program, usually under the coordination of two or more people, with one working in a distant-advisory capacity to the other. Frequently, graduate students would give up significant time from their thesis work to devote energy to contributing. Their corporate counterparts would often give up project time to make their donation.

Contributors would often enter the project in a very forceful way and then having made their contribution, learn the viability of communal sharing once others had stepped in and contributed to them, thus providing considerable reinforcement. Frequently, contributors would then go into "hibernation" for a long period of time, but most of them remained open to contributing and were helpful when asked to reprogram their particular contribution in a more recent version.

GNU Chess has made great strides in relatively little time.   It has run on many different hardware architectures and has been compiled by a number of C compilers. A sampling of the computers on which the program has run is: National 32032, Vax 11/750, 8550, 8600, 8650, Motorola 68020, CCI 5/32, CCI 6/32 (tahoe), Cray XMP, SUN Sparc-1.

It is our belief that GNU Chess will stimulate graduate research in computer chess theory and practice. When students are able to easily obtain a state-of-the-art program in order to test out their ideas, they will no longer need to reinvent the wheel. The students will be able to investigate their research areas much more thoroughly, because they will spend more time on the specific research areas they are concerned about. Basically, GNU Chess "frees up" time in order to get on to more fundamental issues.

We also feel that as other researchers gain trust in the GNU Chess project, they will be more likely to release their results directly and rapidly, through journal articles, or directly to the GNU project, and in fact become contributors and join the present list. At the very least, a communal, ever-growing program will encourage the few "closeted" researchers to be somewhat more open in their approach to disseminating advances.

In whatever form it takes, the progress toward elaboration of machine chess is ongoing, and we hope that GNU chess will be helpful to the community. Copies of GNU Chess source and "book", as well as additional experimental code are available from the Free Software Foundation [3] or the author [6].

[1] The GNU Manifesto, Richard Stallman, Free Software Foundation, Inc.

[2] University of Southern California, Information Sciences Institute.

[3] Free Software Foundation, Inc. 675 Massachusetts Ave.,   Cambridge MA 02139.

[4] Stuart Cracraft, P.O. Box 2841, Laguna Hills, California.   92654-2841., cracraft@wheaties.ai.mit.edu.

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GNU Chess Move Generator

This file contains a description of GNU's new move generation algoritm.
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New move Generation algoritm:

Revision: 1989-09-06

Author: Hans Eric Sandstroem.

This algortim is the result of an attempt to make an hardware move generator, but since I newer had the time and resources to build the hardware I wrote a software version and incorporated that one into gnuchess. This was the best way I could think of sharing this algorithm with the computer chess community.

If there is anybody out there with the time and rescources to build a hardware move generator I will be glad to assist.

The general idea behind this algoritm is to pre calculate a lot of data. The data that is pre calculated is every possible move for every piece from every square disregarding any other pieces on the board. This pre calculated data is stored in an array that looks like this:

```
struct sqdata {
   short nextpos;
   short nextdir;
};
struct sqdata posdata[8][64][64];
/* posdata[piecetype][fromsquare][destinationsquare] */
example:
        the first move for a queen at e8 is stored at;
        posdata[queen][e8][e8].nextpos
        suppose this is e7 and e7 is occupied then the next move
        will be found in;
        posdata[queen][e8][e7].nextdir
```

To handle the differeces between white and black pawns (they move in opposite directions) an array ptype has been introduced:

```
static const short ptype[2][8] = {
   no_piece,pawn,knight,bishop,rook,queen,king,no_piece,
   no_piece,bpawn,knight,bishop,rook,queen,king,no_piece};
            ^^^^^
```

And it is used like this:

    piecetype = ptype[side][piece]

When generating moves for pieces that are not black pawns, piece can be used directly in posdata. As in the example above.

Thus the only thing one has to do when generating the moves is to check for collisions with other pieces.   the move generation to do this looks like this: (for non pawns)

```
p = posdata[piece][sq];
u = p[sq].nextpos;
do {
  if (color[u] == neutral) {
    LinkMove(ply,sq,u,xside);
     u = p[u].nextpos;
  }
  else {
    if (color[u] == xside) LinkMove(ply,sq,u,xside);
     u = p[u].nextdir;
  }
} while (u != sq);
```

 - I`nt this just beautiful!

The array posdata is initialized in the routine Initialize_moves. This routine is called just once and it works so no time has been spent on the structure of this code. GenMoves and CaptureList generates the moves but the routines ataks, BRscan, Sqatakd, KingScan and trapped also relies on the move generation algoritm so they have also been rewritten.

GNU Chess heuristics

Heuristic descriptions for CHESS.

Revision: 12-16-87

Copyright (c) 1987 by John Stanback

 Here is a brief description of the heuristics used in the positional evaluator of the GNU Chess program. Many heuristics are functions of the stage of the game which is based on the total non-pawn material remaining for both sides.

PAWNS

 The material value of a pawn is 100 points. Isolated pawns get a penalty depending on which file they occupy: (12,14,16,20,20,16,14,12) for files (a..h). Doubled pawns (which are not also isolated) get a penalty of 12 points. Backward pawns (defined simply as not being defended by a pawn with the square in front also not defended by a a pawn) are penalized 6 points. A 4 point penalty is also invoked for each attack by the opponent to a backward pawn and for a backward pawn on a half-open file. Pawn Advancement in the centre is given a bonus of about 4 points per rank in the opening increasing to about 8 points per rank in the ending. Advancement on the edges is given a lower bonus. Pawns on the e and d files and on the 2nd rank are given a 10 point penalty. An additional penalty of 15 points is invoked if these pawns are also blocked. Pawns within 2 squares of the king are given a 10 point bonus. Passed pawns are given a bonus for increasing rank which is a function of stage of the game and of whether the opponent blocks or attacks one or more squares in front of the pawn or if the opponents king is in the square of the pawn. This bonus ranges from about 15 points for a pawn on the second rank up to about 300 points for a passed pawn on the 7th rank which can't be stopped from queening.

KNIGHTS

 The material value of a knight is 330 points. The main heuristic for knights is a bonus for proximity to the centre. This varies from 0 points in the corners to 30 points in the centre. Knights are also given a bonus for being within 2 squares of each enemy piece. This bonus is a function of the stage of the game, equalling 4 points in the end game. A penalty of 1 point per square is given for distance from either king. A bonus of up to 8 points (depends on stage) is given for knights which can't be driven away by enemy pawns.

BISHOPS

The material value of a bishop is 330 points. Bishops are given a bonus as material falls off the board equalling 10 points in the end game. Bishops get a bonus for mobility and Xray mobility thru pieces but not pawns. This bonus ranges from -4 points for a totally blocked bishop up to 18 points for a bishop attacking 12 or more squares. Xray attacks on an enemy R,Q,K or any undefended piece are given an 8 point bonus. Bishops are given a bonus of 14 points if they lie on the edge of the board up to 22 points if the lie in the centre. A bishop is given a bonus of up to 5 points for each attack to a square adjacent to the enemy king.

ROOKS

The material value of a rook is 520 points. Rook mobility is handled similiarly to bishops with a bonus of 0 points if blocked up to 20 points if attacking 12 squares or more. A bonus of 8 points for Xray attacks is handled as it is for bishops. Rooks are given a bonus of 10 points for occupying a file with no friendly pawns and a bonus of 4 points if no enemy pawns lie on that file. After the opening Rooks are penalized slightly depending on "taxicab" distance to the enemy king.

QUEENS

The material value of a queen is 980 points. The only heuristic for a queen is that after the opening it is penalized slightly for "taxicab" distance to the enemy king.

KINGS

Kings are given a penalty for proximity to the centre in the opening and a bonus for proximity to the centre in the endgame. The penalty is about 24 points for being in the centre in the opening with a bonus of about 36 points for being in the centre in the endgame. Kings are penalized for lying on an open or half-open file or if the adjacent file closest to the corner is open or half-open. This penalty is up to 23 points in the opening and goes to zero in the end game. The King is penalized up to 8 points if there are no pawns immediately adjacent. A penalty is invoked depending on the number of "safe" checks available by the opponent. This penalty ranges from 6 points for one such check to 50 points for 4 or more. Depending on game stage, Kings are given up to 10 points for castling and a penalty of up to 40 points for moving before castling.

SPECIAL

If more than one piece is "hung" (attacked and not defended or attacked by an enemy piece of lower value) an extra penalty of 10 points is invoked for that side and the search may be extended one ply. Pinned or trapped pieces are treated similarly. A special mating routine is used if one side has only a king and the other has mating material.

GNU Chess Sample Match with MACH

The following is the complete match between GNU Chess 1.55 on Sparc-1 and Fidelity Mach 3. The game header contains the sides with White listed first. The result is listed after the last move of each game. Time control was 60/15. Both sides used transposition tables and thinking on the opponent's time. Opening books were enabled using random openings.
--Stuart Cracraft

P.S. This version of GNU has just been released by FSF.

```
Match Game    GNU_vs_Mach3
1 . e2e4,e7e5    2 . g1f3,b8c6    3 . f1c4,c6d4    4 . f3e5,d4e6    5 . d1h5,g7g6
6 . h5h3,d8g5    7 . e5f3,g5c5    8 . b2b3,f8g7    9 . c2c3,c5c6    10. c4d5,c6b5
11. d2d4,g8f6    12. d5c4,b5a5    13. b3b4,a5b6    14. d4d5,f6e4    15. h3h4,e4c3
16. d5e6,f7e6    17. a2a3,a7a5    18. b4a5,a8a5    19. b1d2,a5h5    20. h4g4,c3e4
21. d2e4,g7a1    22. e1g1,a1g7    23. c1g5,d7d5    24. c4d5,e8g8    25. d5c4,g8h8
26. e4g3,e6e5    27. g4e4,h5g5    28. f3g5,b6f6    29. g5f3,f6e7    30. f1e1,e7c5
31. e4d3,c8g4    32. g3e4,c5a5    33. f3d2,g4f5    34. e1b1,b7b6    35. d3g3,c7c6
36. g3e3,b6b5    37. c4e2,a5d8    38. b1c1,f5d7    39. d2f3,d8e7    40. e3a7,e7f7
41. c1c5,f7e6    42. e2d3,e6b3    43. d3c2,b3e6    44. a3a4,b5a4    45. a7a4,f8b8
46. a4a7,b8b2    47. c2d3,b2b3    48. a7a8,d7e8    49. e4c3,b3b6    50. d3c4,e6e7
51. c5a5,b6b4    52. a5a7,e7f8    53. f3d2,h7h6    54. c3e4,b4b2    55. c4d3,b2b4
56. d2c4,b4b3    57. d3c2,b3b4    58. c4d6,b4e4    59. c2e4,f8d6    60. a8e8,h8h7
61. a7d7,d6f6    62. e8c8,c6c5    63. c8c5,f6f4    64. c5c6,f4g5    65. c6c7,h7h8
66. c7c8,h8h7    67. e4d5,g5c1    68. c8c1,h6h5    69. h2h4,h7h8    70. c1c8,h8h7
71. c8g8,h7h6    72. g8g7 1-0
--------------------------------------------------------------------------------
Match Game    Mach3_vs_GNU
1 . e2e4,e7e5    2 . f2f4,e5f4    3 . g1f3,d7d6    4 . d2d3,g7g5    5 . c1d2,f8g7
6 . d2c3,g7c3    7 . b1c3,g5g4    8 . f3g1,d8h4    9 . e1d2,g8f6    10. d2c1,e8g8
11. d1d2,f6h5    12. c3d5,h5g3    13. d2e1,h4h6    14. h2g3,h6h1    15. d5c7,b8a6
16. e1a5,f7f5    17. a5d5,f8f7    18. c7a8,h1g1    19. c1d2,a6b4    20. d5c4,g1f2
21. f1e2,f2e3    22. d2d1,b4c6    23. a1c1,e3g3    24. e4f5,c8f5    25. c4d5,g3e3
26. c2c3,c6e5    27. d5d6,f4f3    28. g2f3,g4f3    29. e2f1,f3f2    30. d1c2,f5d3
31. f1d3,e5d3    32. d6d8,f7f8    33. d8d3,e3c1    34. c2c1,f2f1    35. d3f1,f8f1
36. c1d2,f1f2    37. d2c1,h7h5    38. a8c7,h5h4    39. c7d5,h4h3    40. d5e7,g8f7
41. e7f5,f2f5    42. c1d2,h3h2    43. d2c2,f5f2    44. c2b3,h2h1    45. a2a3,h1b1
46. b3c4,b1b2    47. a3a4,f2f4    48. c4d3,b2g2    49. a4a5,g2e4    50. d3d2,f4f2
51. d2d1,e4h1 0-1
--------------------------------------------------------------------------------
Match Game    GNU_vs_Mach3
1 . e2e4,c7c5    2 . g1f3,d7d6    3 . d2d4,c5d4    4 . f3d4,g8f6    5 . b1c3,b8c6
6 . d4c6,b7c6    7 . f1c4,a8b8    8 . e4e5,f6d7    9 . e5d6,e7d6    10. e1g1,d6d5
```

11. f1e1,f8e7   12. c4d5,b8b6   13. d5f3,e8g8   14. c3a4,b6a6   15. e1e4,f7f5
16. e4d4,c6c5   17. d4f4,a6d6   18. d1e1,e7g5   19. f4c4,d7e5   20. c1g5,e5f3
21. g2f3,d8g5   22. g1h1,c8b7   23. e1e3,g5e3   24. f2e3,b7f3   25. h1g1,d6d2
26. h2h3,f8e8   27. c4c5,e8e3   28. c5f5,d2g2   29. g1f1,g2c2   30. h3h4,f3c6
31. b2b3,e3h3   32. f1e1,h3h4   33. e1d1,h4h2   34. d1e1,c2e2   35. e1d1,e2e6
36. f5f1,c6g2   37. f1f2,h2h1   38. d1c2,h1a1   39. f2g2,a1a2   40. a4b2,h7h5
41. b3b4,g7g6   42. c2b3,a2a6   43. b2d3,e6e3   44. b3c4,g8g7   45. c4d4,a6e6
46. d3c5,e6e7   47. g2a2,e3e1   48. a2g2,g7h6   49. g2a2,h5h4   50. a2h2,g6g5
51. b4b5,h6h5   52. c5d3,e1d1   53. h2h3,g5g4   54. h3e3,e7e3   55. d4e3,d1d3
56. e3d3 0-1

Match Game   Mach3_vs_GNU
1 . e2e4,c7c5   2 . b2b4,c5b4   3 . a2a3,b8c6   4 . g1f3,g8f6   5 . a3b4,f6e4
6 . d2d3,e4f6   7 . b4b5,c6b4   8 . f1e2,d7d6   9 . c1d2,b4d5   10. c2c4,d5b6
11. e1g1,h7h6   12. b1c3,e7e5   13. f1e1,d8c7   14. d1b3,c8e6   15. d2e3,f8e7
16. c3a4,b6a4   17. b3a4,b7b6   18. d3d4,e5e4   19. f3d2,d6d5   20. c4d5,e6d5
21. e1c1,c7d7   22. f2f3,e4f3   23. d2f3,e8g8   24. f3e5,d7b7   25. a4a6,b7a6
26. a1a6,d5b7   27. a6a2,e7d6   28. e2c4,f6d5   29. e3f2,f8c8   30. a2a1,c8c7
31. a1a2,d5b4   32. a2a1,b7e4   33. f2g3,b4c2   34. a1a4,c2e3   35. c1e1,e4c2
36. a4a2,e3c4   37. a2c2,c4a3   38. c2b2,f7f6   39. e5g6,d6g3   40. h2g3,g8f7
41. g6f4,c7c2   42. b2b3,a3c4   43. b3b1,c4d6   44. g1h2,a8e8   45. e1e8,f7e8
46. h2h3,e8f7   47. b1b4,g7g5   48. f4h5,f6f5   49. h3h2,f7g6   50. g3g4,f5g4
51. h5g3,h6h5   52. h2g1,h5h4   53. g3f1,h4h3   54. g2h3,g4h3   55. b4b3,g5g4
56. b3g3,g6h5   57. g3g4,h3h2   58. f1h2,c2h2   59. g4g7,h2a2   60. g7d7,d6f5
61. g1f1,h5h6   62. f1e1,a2b2   63. d7a7,f5d4   64. a7a6,b2b5   65. e1d2,h6g5
66. d2c3,d4c6   67. c3c4,b5c5   68. c4b3,b6b5   69. b3b2,g5f4   70. a6a3,b5b4
71. a3b3,c5c4   72. b3d3,c6d4   73. b2b1,f4e4   74. d3h3,b4b3   75. h3g3,e4d5
76. g3g5,d5d6   77. g5g3,d6c5   78. g3g5,c5b4   79. g5g4,d4b5   80. g4c4,b4c4
81. b1b2,b5d6   82. b2a3,c4c3   83. a3a4,b3b2   84. a4a5,b2b1   85. a5a6,b1b5
86. a6a7,b5b7 0-1

Match Game   GNU_vs_Mach3
1 . e2e4,c7c6   2 . d2d4,d7d5   3 . e4e5,c8f5   4 . f1d3,f5d3   5 . d1d3,b8a6
6 . d3b3,d8a5   7 . c1d2,a5b6   8 . b3b6,a7b6   9 . g1f3,e7e6   10. e1g1,f8e7
11. c2c3,g8h6   12. d2h6,g7h6   13. b1d2,h8g8   14. g1h1,a6c7   15. f1g1,e8d7
16. c3c4,d7c8   17. c4d5,c7d5   18. g1c1,d5b4   19. d2c4,c8b8   20. a2a3,b4d3
21. c1c2,a8a6   22. a1d1,d3f4   23. c4e3,f7f5   24. g2g3,f4h5   25. e3c4,f5f4
26. c2c3,g8d8   27. g3g4,h5g7   28. b2b4,g7e8   29. h2h4,e8c7   30. h1g2,c7d5
31. c3c2,a6a4   32. d1d3,a4a7   33. c2c1,b6b5   34. c4d2,d8g8   35. g2h3,a7a6
36. d2e4,d5c7   37. e4c5,a6a7   38. c1b1,b8a8   39. b1g1,g8d8   40. g1d1,a8b8
41. h3h2,b7b6   42. c5e4,d8g8   43. h2h3,c7d5   44. d1e1,a7d7   45. e1c1,b8c7
46. e4c3,g8a8   47. c3d5,d7d5   48. d3c3,c7d7   49. h4h5,d7e8   50. c3c6,a8a3
51. h3g2,e8f7   52. c6c7,d5d8   53. c1c6,d8g8   54. f3h2,a3d3   55. c6b6,d3d4
56. b6b5,f7e8   57. b5b8,d4d8   58. b8b6,e8f7   59. b6b7,g8e8   60. c7c4,d8b8
61. c4f4,f7g8   62. b7d7,e8f8   63. f4f8,g8f8   64. f2f4,f8e8   65. d7c7,b8b4
66. g2f3,b4b3   67. f3e4,b3b4   68. e4e3,b4b3   69. e3f2,e8d8   70. c7c4,e7h4
71. f2g2,b3b2   72. g2h3,h4e1   73. h2f3,b2b3   74. h3g2,b3b2   75. g2f1,e1g3
76. f3d4,d8d7   77. d4e2,g3h4   78. c4a4,h4e7   79. a4a7,d7e8   80. a7a6,b2b1
81. f1g2,b1b2   82. g2f3,b2b3   83. f3e4,b3b4   84. e4d3,b4b3   85. d3c2,b3e3
86. c2d2,e3a3   87. a6e6,e8d8   88. e6h6,e7b4   89. d2c2,a3e3   90. e2d4,e3c3
91. c2b2,c3c4   92. d4c6,d8d7   93. b2b3,c4c6   94. h6c6,d7c6   95. b3b4,c6d7
96. f4f5,d7e7   97. e5e6,e7f6   98. g4g5,f6e7   99. g5g6,h7g6   100. h5g6,e7f6
101. b4b5,f6f5   102. e6e7,f5g6   103. e7e8,g6f5   104. e8e3,f5g4   105. e3e4,g4g5
106. e4f3,g5h6   107. f3g4,h6h7   108. g4g5,h7h8   109. b5c5,h8h7   110. c5d5,h7h8
111. d5e5,h8h7   112. e5f6,h7h8   113. g5g7 1-0

```
-------------------------------------------------------------------------------
Match Game      Mach3_vs_GNU
1 . d2d4,g8f6    2 . c2c4,g7g6     3 . g2g3,f8g7    4 . f1g2,e8g8    5 . b1c3,d7d6
6 . e2e3,b8d7    7 . g1e2,c7c5     8 . e1g1,d7b6    9 . b2b3,d8c7    10. c3b5,c7d7
11. c1b2,a7a6    12. b5c3,c5d4     13. d1d4,d7c7    14. e2f4,f6h5    15. f4d5,b6d5
16. d4d5,h5f6    17. d5d3,c8f5     18. e3e4,f5d7    19. a1e1,f8e8    20. b2a1,f6g4
21. c3d5,c7a5    22. a1g7,g8g7     23. d3d4,e7e5    24. d4b6,a5b6    25. d5b6,a8d8
26. b6d7,d8d7    27. g2h3,f7f5     28. f2f3,g4h6    29. e1d1,d7d8    30. d1d3,f5e4
31. f3e4,h6f7    32. h3g2,f7g5     33. h2h4,g5e6    34. g1h2,e6d4    35. d3d2,e8f8
36. d2f2,b7b6    37. h2h3,f8f2     38. f1f2,d8d7    39. g2f1,d7f7    40. f2f7,g7f7
41. f1d3,f7e6    42. h3g4,h7h6     43. h4h5,g6g5    44. d3b1,e6d7    45. g4h3,d7c6
46. b3b4,a6a5    47. b4a5,b6a5     48. b1d3,c6c5    49. a2a3,d4b3    50. h3g4,c5d4
51. d3c2,b3d2    52. g4f5,d2c4     53. f5g6,c4a3    54. c2a4,d4e4    55. a4c6,e4d3
56. g6h6,e5e4    57. h6g5,e4e3     58. c6f3,e3e2    59. f3e2,d3e2    60. h5h6,a3c4
61. h6h7,c4e5    62. g5f6,e2f3     63. h7h8,f3g3 1-0
-------------------------------------------------------------------------------
Match Game      GNU_vs_Mach3
1 . d2d4,e7e6    2 . e2e4,d7d5     3 . b1d2,c7c5    4 . g1f3,b8c6    5 . f1b5,c5d4
6 . f3d4,c8d7    7 . b5c6,b7c6     8 . e1g1,a8b8    9 . e4d5,c6d5    10. f1e1,g8f6
11. d2b3,d8c7    12. h2h3,f8d6     13. d4f5,d6h2    14. g1h1,f6e4    15. e1e4,d5e4
16. f5g7,e8e7    17. g2g3,h2g3     18. f2g3,c7g3    19. d1g4,g3g4    20. h3g4,h8g8
21. c1h6,e4e3    22. a1e1,b8b4     23. g4g5,d7c6    24. h1h2,b4h4    25. h2g3,h4e4
26. g7h5,g8d8    27. h5f6,e4c4     28. b3a5,c4c2    29. a5c6,c2c6    30. e1e3,c6a6
31. e3c3,e7d6    32. a2a3,a6c6     33. c3d3,d6c7    34. d3d8,c7d8    35. f6h7,a7a5
36. h6g7,a5a4    37. g3f4,c6c2     38. g7c3,d8e7    39. h7f6,c2f2    40. f4e3,f2h2
41. f6e4,h2h3    42. e3f4,h3h4     43. f4f3,e7f8    44. e4c5,f8g8    45. f3g3,h4c4
46. c3b4,c4d4    47. c5a4,g8h7    48. a4b6,h7g6    49. b4c3,d4d1    50. c3f6,g6h5
51. b6c4,d1a1    52. b2b4,a1h1    53. g3f3,h1h3    54. f3e4,h3b3    55. f6e7,b3c3
56. e4d4,c3f3    57. b4b5,f3f4    58. d4c5,f4f5    59. c5c6,f5f4    60. c4d6,f4f3
61. a3a4,f3a3    62. b5b6,a3c3    63. c6d7,c3b3    64. d6b5,b3b2    65. b6b7,b2a2
66. b7b8,a2a4    67. b8h2,a4h4    68. h2h4,h5h4    69. g5g6,h4h5    70. g6f7,e6e5
71. f7f8,h5g4    72. d7e6,e5e4    73. f8f5,g4g3    74. f5f1,e4e3    75. e6f5,e3e2
76. e7d6,g3h4    77. f1h1 1-0
-------------------------------------------------------------------------------
Match Game      Mach3_vs_GNU
1 . d2d4,g8f6    2 . c1g5,f6e4     3 . g5h4,g7g5    4 . f2f3,g5h4    5 . f3e4,c7c5
6 . e2e3,d8b6    7 . g1f3,b6b2     8 . b1d2,f8g7    9 . d2b3,h4h3    10. b3c5,h3g2
11. f1g2,b2c3    12. e1e2,h8g8     13. g2h3,b7b6    14. c5d3,c8a6    15. h1g1,b8c6
16. h3f5,e8f8    17. d1d2,c3d2     18. e2d2,d7d6    19. f5h7,g8h8    20. h7f5,e7e6
21. f5g4,c6a5    22. a1b1,a5c4     23. d2e2,g7h6    24. d3b4,a6b7    25. e2d3,c4e3
26. d4d5,e6d5    27. e4d5,f7f5     28. g4h5,e3d5    29. b4d5,b7d5    30. f3h4,d5e4
31. d3e2,h8h7    32. b1f1,h6e3     33. h5g6,h7h4    34. e2e3,f8e7    35. g6f5,e4f5
36. f1f5,h4h2    37. e3d3,e7e6     38. g1f1,a7a6    39. a2a4,h2h3    40. d3d4,h3h4
41. f1f4,h4f4    42. f5f4,a8c8     43. c2c4,c8c5    44. f4f3,d6d5    45. c4d5,c5d5
46. d4c4,d5c5    47. c4b3,c5e5     48. f3d3,e5e4    49. d3d8,e4e3    50. b3b4,a6a5
51. b4b5,e3b3    52. b5c6,b3b4     53. d8d6,e6e7    54. d6d7,e7f6    55. d7d2,f6f5
56. d2d5,f5e4    57. d5b5,b4a4     58. c6b6,e4d4    59. b5a5,a4c4    draw
-------------------------------------------------------------------------------
Match Game      GNU_vs_Mach3
1 . e2e4,c7c5    2 . g1f3,d7d6     3 . d2d4,c5d4    4 . f3d4,g8f6    5 . b1c3,a7a6
6 . f1c4,g7g6    7 . c1g5,f8g7     8 . e1g1,e8g8    9 . a1c1,d8b6    10. c4b3,b8c6
11. d4c6,b7c6    12. d1d2,c8b7     13. c1e1,c6c5    14. e4e5,d6e5    15. d2e3,h7h6
16. g5h4,b6b4    17. h4g3,f6g4     18. e3e2,a8d8    19. a2a3,b4b6    20. e2g4,d8d4
21. g4e2,c5c4    22. b3c4,b6c6     23. c4f7,f8f7    24. f2f3,c6b6    25. e2e3,e5e4
26. c3e4,b7e4    27. f3e4,f7f1     28. g1f1,b6b2    29. e3b3,b2b3    30. c2b3,d4d3
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31. e1b1,d3e3   32. g3f2,e3e4   33. b1c1,e4f4   34. f1e2,g8f7   35. c1c6,f4f6
36. c6c4,f6e6   37. f2e3,g6g5   38. e2d3,e6d6   39. d3e4,g7b2   40. a3a4,d6e6
41. e4f3,b2e5   42. h2h4,g5h4   43. c4h4,e5g7   44. g2g4,e6f6   45. f3e4,f6g6
46. b3b4,g6e6   47. e4d3,e6d6   48. d3c4,d6c6   49. c4d5,c6e6   50. e3c1,e6d6
51. d5c5,g7d4   52. c5c4,d4f6   53. h4h5,d6d4   54. c4b3,d4g4   55. h5h6,g4g3
56. b3a2,g3g1   57. c1a3,g1g2   58. a2b1,e7e5   59. b4b5,a6b5   60. a4b5,e5e4
61. b5b6,e4e3   62. b6b7,e3e2   63. a3b4,f6e5   64. h6h5,e5d6   65. h5h7,f7g6
66. h7h1,g2f2   67. h1c1,f2f1   68. b4d2,f1f7   69. c1g1,g6f6   70. g1g2,f7b7
71. b1c2,b7e7   72. d2e1,d6f4   73. g2f2,f6f5   74. c2d3,e7e3   75. d3d2,e3h3
76. d2e2,f5e4   77. e1d2,f4e5   78. f2g2,e5d4   79. g2g4,e4d5   80. g4g5,d5c4
81. g5g4,h3h2   82. e2d1 draw
--------------------------------------------------------------------------------
Match Game    Mach3_vs_GNU
1 . g2g3,g8f6   2 . f1g2,d7d5   3 . g1f3,b8c6   4 . d2d4,e7e6   5 . e1g1,h7h6
6 . b1c3,f8b4   7 . c1f4,b4c3   8 . b2c3,f6e4   9 . d1d3,g7g5   10. f4c1,e8g8
11. c1a3,f8e8   12. f3e5,c6e5   13. d4e5,c7c5   14. g2e4,d5e4   15. d3e4,d8a5
16. a3b2,e8d8   17. f1b1,d8d2   18. a2a3,a5a6   19. c3c4,c8d7   20. b2c3,d7c6
21. e4e3,d2c2   22. e3d3,a6a4   23. b1b2,c2b2   24. c3b2,b7b6   25. f2f3,a7a6
26. e2e4,a8a7   27. d3d6,a7d7   28. d6b8,g8g7   29. a1f1,a4b3   30. f1f2,d7d1
31. g1g2,c6a4   32. b8c8,d1b1   33. b2c3,b3c3   34. c8d8,c3e5   35. d8a8,a6a5
36. a8d8,e5c3   37. e4e5,c3e5   38. d8d3,b1b3   39. d3d8,e5d4   40. f2d2,d4d8
41. d2d8,a4c6   42. d8d6,b3b2   43. g2g1,c6f3   44. a3a4,g5g4   45. g1f1,g7f6
46. f1e1,f6e5   47. d6d2,b2b4   48. d2a2,f7f5   49. a2a3,e5e4   50. e1d2,e6e5
51. h2h3,h6h5   52. h3g4,h5g4   53. a3e3,e4d4   54. e3a3,f3c6   55. a3d3,d4c4
56. d3d6,c6a4   57. d6f6,b4b2   58. d2c1,b2c2   59. c1b1,c2c3   60. b1b2,c3b3
61. b2a2,a4d7   62. f6d6,d7c8 6  3. d6c6,c8b7   64. c6e6,e5e4   65. e6e7,b7d5
66. e7e5,b3f3   67. a2b2,e4e3   68. b2c2,d5e4   69. c2d1,f3g3   70. e5e4,f5e4
71. d1e2,g3f3   72. e2d1,f3f2   73. d1c1,g4g3   74. c1d1,g3g2   75. d1c1,g2g1  0-1
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