

# Some examples how to use the endgame database analysis features of Wilhelm

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## What's new in version 1.46?

- Support of the new 6-men 4 vs. 2 men with pawns, like e.g. KRPPKR.
- New search options for the EGTB analysis.
- Recognition of stalemate traps in the optimal line of play.
- Access to the Endgame metrics DTM, DTC, DTC50, DTZ and DTZ50
- Variants and comments are now also fully supported in the EGTB analysis mode.

## What was new in version 1.43?

- Full support of the new EGTB format for all available 6-men.
- Some changes in the Options dialog and the EGTB manager.
- More tolerant when importing PGN format.
- Slight improvements in the evaluation of pawn endgames.
- Calculation of Unique Move Sequences in the EGTB analysis mode.
- Export as PGN of move sequences in EGTB analysis mode.
- New EGTB analysis search options:
  - Unique solution moves with only partly specified squares.
  - Unique solution moves which don't capture when captures would be possible.
  - Unique solution moves with a king maximally going away from the pawns.
- Random book moves are now possible.

## What was new in version 1.40?

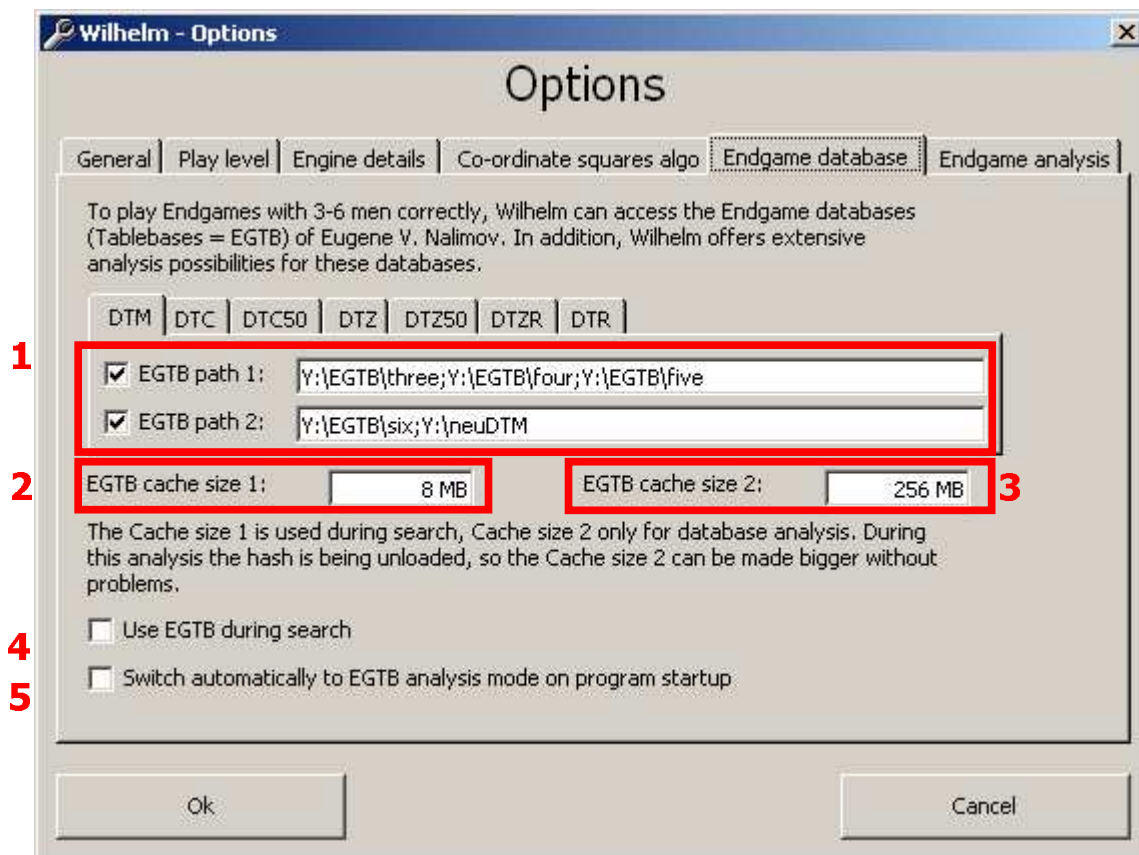
- Support of PGN databases with max. 32768 games.
- Options to paint (frames, hatching, lines and arrows) and write to the chessboard and to export the result as a picture.
- Also the EGTB piece square search statistics can now be exported as a picture.
- New special EGTB search options for searching with the following criteria:
  - side to move not in check
  - side to move not stalemate
  - position with an unique solution move
  - position with a determined unique solution move – with conditions such as coordinates, underpromotions, non-captures etc.
- EGTB manger automatically does a self-check to guarantee proper results.
- Some possibilities for troubleshooting were added.

## What was new in version 1.33?

- It is not necessary anymore to restart Wilhelm after changing the path to the EGTB files.
- There's a completely new feature: the EGTB manager. With this assistant you get a quick and easy overview of the installed EGTB files and you can check if any of the files are defective.
- Changes in the "edit position" dialog with history of previously entered positions and options to shift and mirror the positions.
- In the EGTB analysis mode, you can use now up to six relative piece dependencies.
- For a better visualisation of the mate distance statistics, Wilhelm offers you a diagram.
- Wilhelm is now able to deal with incomplete EGTB both in search and analysis mode.
- Some minor changes in the evaluation function.

## Before you start: configuring Wilhelm properly, 1

- At the first start-up of Wilhelm, you choose your language from a dialog box which gives you the choice between German and English. You can change this also later under the menu "Extras/Language" resp. "Extras/Sprache".
- Then, you should go to the tab "Endgame database" under the menu "Extras/Options..." to change some settings:



1. Enter the correct EGTB path (EGTB = Endgame Tablebases) for all of your Nalimov EGTB directories, separated by semicolons and without any spaces, e.g.: *Y:\EGTB\three;Y:\EGTB\four;Y:\EGTB\five*. Maybe you have some EGTB you do not intend to use always. You can enter them in a separate path (EGTB path 2). Only in the paths with a check will be searched for EGTB files. You can do this separately for each available metric.
2. Set the EGTB cache size 1. This cache size is used during a normal search in game playing mode to avoid repeated disk accesses to the same data. Recommended values are between 4 and 16 MB. Don't forget to indicate the units, otherwise Wilhelm will assume that you gave a value in Bytes!
3. Set the EGTB cache size 2. This cache size is used during the EGTB analysis. To guarantee the fastest possible analysis, you should make this cache size as big as possible. Recommended values are between 1/2 and 2/3 of the physically available RAM. To analyse 5-men-endings, 256 MB are sufficient and a bigger size does not result in any speedup. For 6-men-endings there's no upper limit, but for some technical reasons, you can use at maximum 768 MB.
4. Check the option "Use EGTB during search" if you want Wilhelm to access the EGTB during search. This of course does not affect the use of EGTB during the EGTB analysis.
5. If you are only interested in the EGTB analysis features of Wilhelm, then you may check the last option. This saves some clicks at start-up.
6. Now, click "Ok". Wilhelm will need some seconds to initialise the EGTB files. Then you are ready to start with the EGTB analysis or with a game. It is not necessary to restart Wilhelm after changing the path to the EGTB files.

## Overview of the different metrics

At this time, there are several endgame metrics<sup>1</sup> around, using the EGTB format of Eugene Nalimov, but only those which have been generated by Eugene Nalimov in DTM metric are freely available. Besides DTM, also the metrics DTC, DTC50 [or more general: DTC(n)], DTZ, DTZ50 [or more general: DTZ(n)] exist. So far only in theory, DTR is there too. Wilhelm can access all of these metrics without any problems as long as it is told which file is based on what metric.

### DTM

**DTM** = **D**istance **T**o **M**ate, whereas the distance is measured in moves.

### DTC

**DTC** = **D**istance **T**o **C**onversion, again measured in moves. Conversion means here the transition to another endgame by capturing a men or by pawn promotion, or a direct mate.

### DTZ

**DTZ** = **D**istance **T**o **Z**eroing Move, this means the distance (measured in moves too) to the move which causes the restart of the move counter until a draw by the 50-move rule would occur or until the mate. In pawnless endgames, the draw due to the 50-move rule can only be avoided by capturing a piece, therefore DTC=DTZ for pawnless endgames.

### DTC50, DTZ50. DTC(n) and DTZ(n)

DTC50 and DTZ50 are in principle the same as DTC and DTZ, but with respect to the 50-move rule. This means that all positions which would be drawn according to the 50-move rule are effectively marked as a draw. But note that with DTC50, pawn moves which do not fulfil a DTC criterion are not considered as moves resetting the 50-move counter. DTC(n) and DTZ(n) are the generalisations of DTC50 and DTZ50 for a more general n-move rule.

### DTR

**DTR** = **D**epth **T**o the **R**ule, which means the distance, measured in moves, to a draw due to an n-move rule. DTR is mainly of theoretical interest for the discussion about n-move rules. As long as we have n=50 for chess, there is practically no need to create Databases with the DTR metric.

## Meaning and use of the different metrics

I would like to limit the overview of the use of the different metrics to the essentials. One could think of various strategies to combine different metrics, for games against humans as well as against other computers. Especially if the opponent only has access to some certain metrics, it is possible to create a probability-bases opponent model.

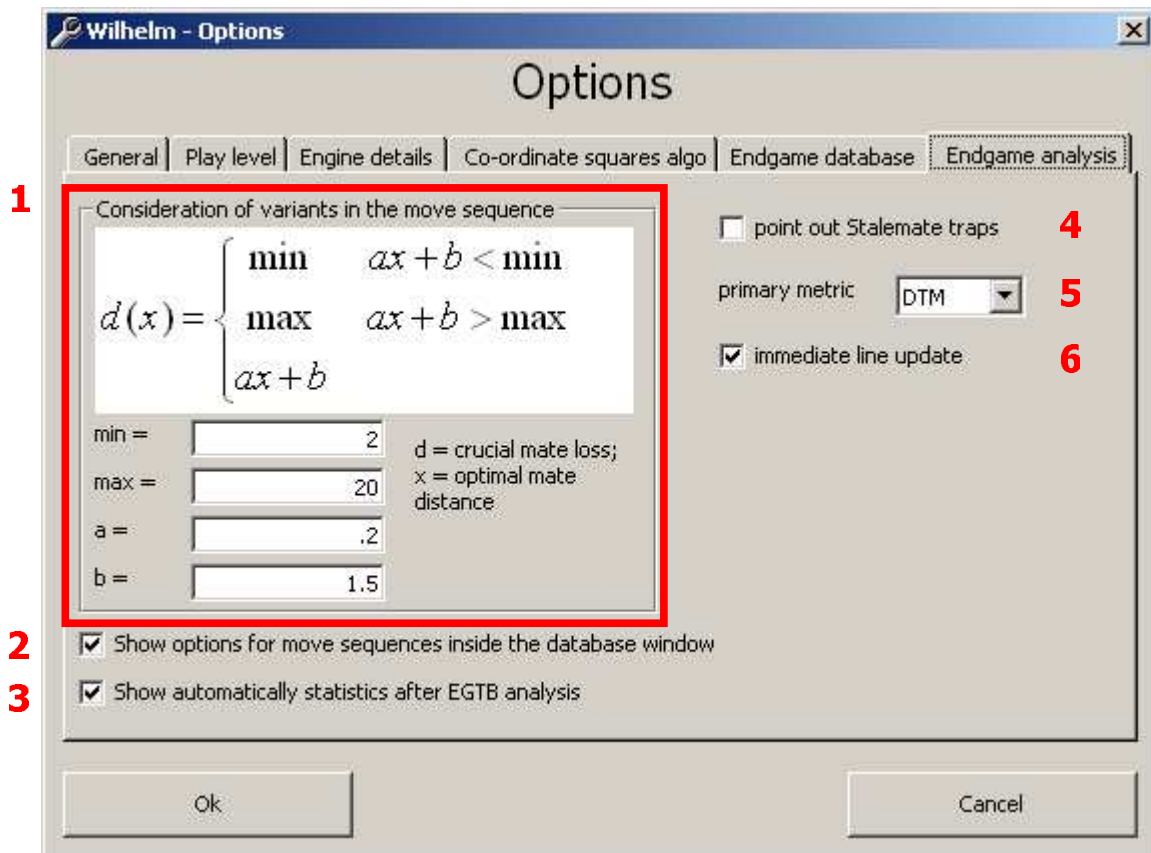
- DTM is mainly of interest for studies and mate problems, because in these cases one is looking for the shortest mate and the 50-move rule does not apply.
- DTC is closest to human play, because it is usually not a direct play for the shortest mate, but for the shortest way to reach a sub-goal, e.g. pawn promotion or capture of a piece.
- DTZ50 as only metric fully respects the 50-move rule and enables to defend optimally in positions influenced by the 50-move rule or shows the way to victory where DTM, DTC, DTC50 and DTZ propose suboptimal moves which could only lead to a draw. Some endgames such as KNNKP can in many cases only be won by playing DTZ50-optimal moves, if the win is possible at all.

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<sup>1</sup> From a mathematical point of view, it is not a metric, but only a semi-norm.

## Before you start: configuring Wilhelm properly, 2

After the first configuration steps, there are also some other options to choose which are less important for the functionality, but nevertheless interesting for power users. Again open the Options dialog via "Extras/Options..." and then click on the tab "Endgame analysis".



- For the sequences with unique solution moves, you can change several settings how Wilhelm should handle variations in the move sequence. As a function of the mate distance of the position, you can determine which difference in mate distance is tolerated for considering the possible continuation as a viable variant.  
The function is called  $d(x)$  where  $x$  is the mate distance of the position before the move. It is basically a linear function of  $x$ , but with a given minimal and maximal value.
- If you want Wilhelm to show additional buttons in the database window for choosing the type of the move sequence and for exporting the variation as PGN, then check this option.
- If this option is checked, Wilhelm displays automatically the statistics after each EGTB analysis.
- Only check this option if you want to be noticed of possible stalemate traps in the optimal EGTB move line. Except for studies, this option is not of much interest.
- Here you can choose the EGTB metric which is used as a standard for analyses. For the search outside the EGTB analysis this does not have any influence, for the search always DTM is being used.
- The option should be checked, except you work with UMS. When displaying longer UMS it makes sense to inactivate this option in order to prevent a continuous recalculation of the moves.

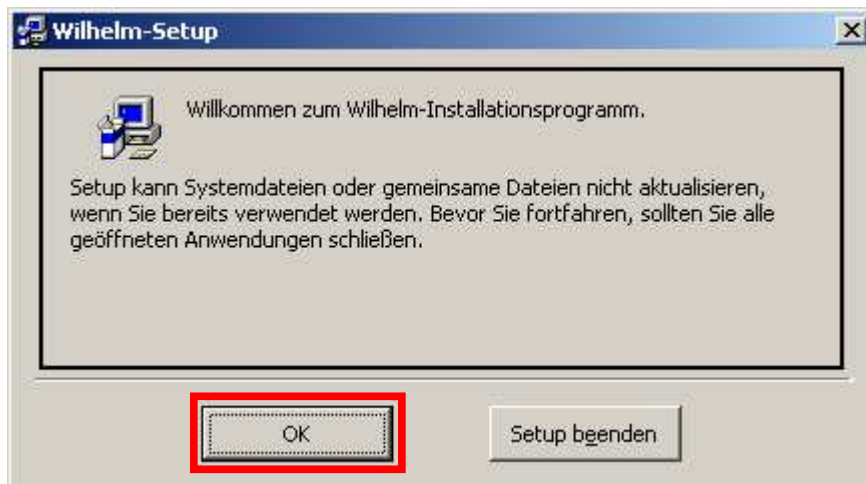
## Troubleshooting

If some crucial options of Wilhelm are changed in a wrong way, it is possible that a start-up of the program needs several minutes or is even impossible in some rare cases. If you change the settings in the way indicated in this manual and according to the descriptions and QuickInfos given by Wilhelm itself, this should not happen. Anyway, here is a list of possible problems and how to solve them:

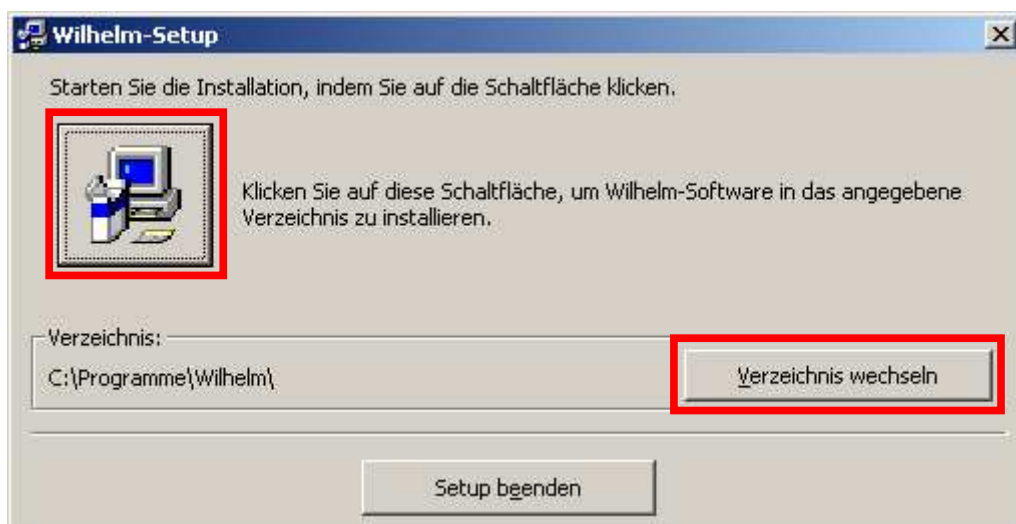
- You have problems understanding the setup routine for Wilhelm which is in German only. Wilhelm itself supports both English and German and the setup is a standard setup routine, so usually, there should not be a problem.

### Explication:

- o Welcome Screen, click "OK"



- o Program directory, click "Verzeichnis wechseln" to change the directory and then click on the big button with the PC icon to start the installation. After changing the directory, the setup asks if you want to create a new directory: "Das Zielverzeichnis ... existiert nicht. Soll das Verzeichnis erstellt werden?".



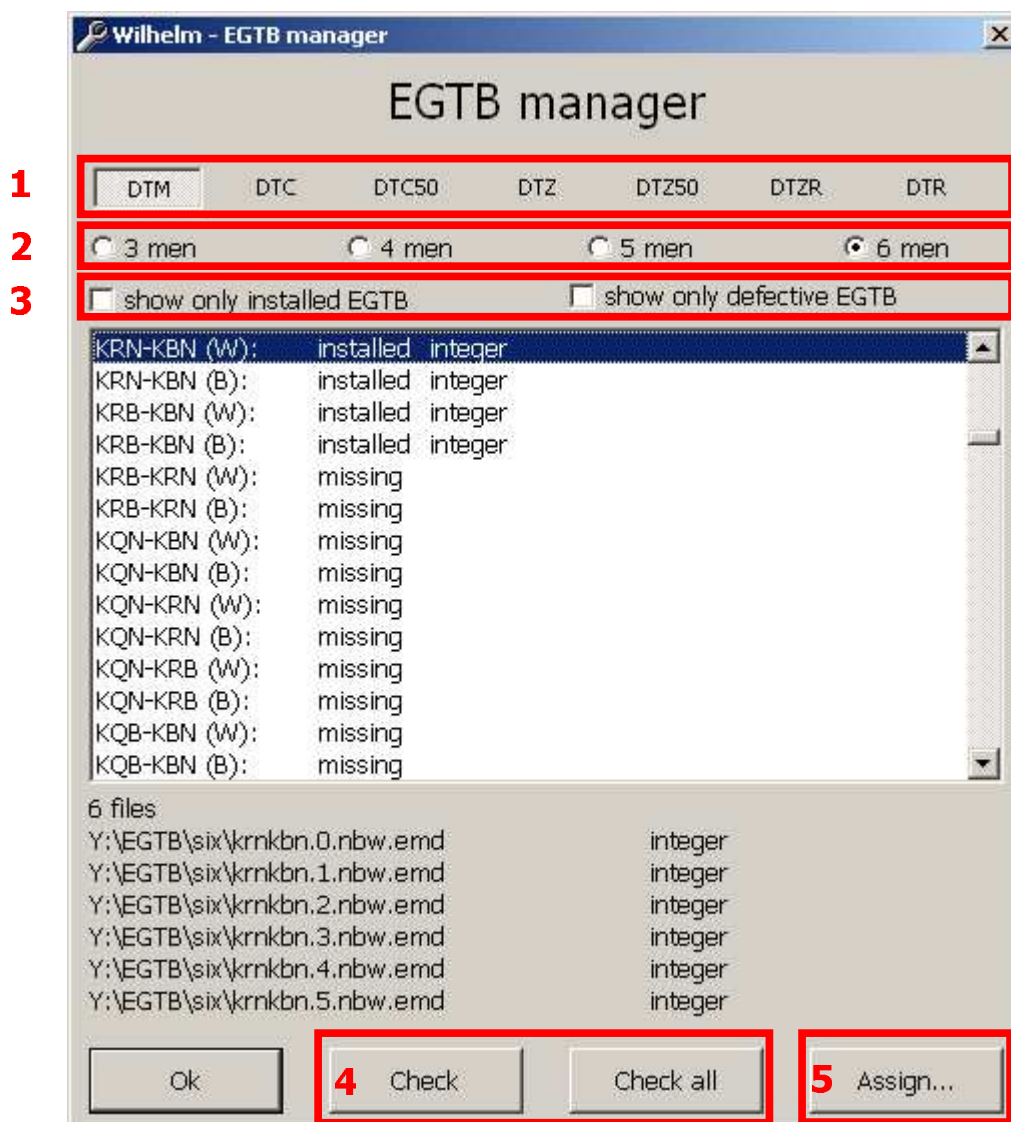
- o The setup will copy the files and at the end, the following success message appears:



- You have changed the EGTB path to a non-existent disk drive, a (removed) CD-ROM drive or a removal drive and until the next start of Wilhelm, you removed the drive/disk. If you are using Windows NT/2000/XP, the start-up needs some more time, but if you are using older Windows versions such as 95/98/ME, it is even possible that Wilhelm hangs. Unfortunately, you don't have the possibility to correct the EGTB path, because you cannot enter the options dialog.  
**Solution: Start Wilhelm with the command line parameter `-noegtb`.** Example (if Wilhelm is installed in the directory C:\programs\Wilhelm\): `C:\programs\Wilhelm\Wilhelm.exe -noegtb`  
Wilhelm will now start without EGTB access and you can correct the EGTB path in the options dialog as described in the previous chapter.
- You have set the Hash size and/or EGTB Cache sizes too high and the start-up of Wilhelm is very slow or impossible because not enough physical RAM is available.  
**Solution: Start Wilhelm with the command line parameter `-reset`.** Example (if Wilhelm is installed in the directory C:\programs\Wilhelm\): `C:\programs\Wilhelm\Wilhelm.exe -reset`  
This option is very radical, all options are reset to the initial values, this includes also the EGTB path. You seem to have entered the EGTB path correctly and you have activated the path by checking the appropriate checkbox, but Wilhelm complains at start-up that no EGTBs had been found.  
**Most probable cause: Illegal characters in the path name.** The path name must not contain any spaces or commas, and semicolons are only allowed to separate the different path names. The use of special characters in path names is not recommended in general.

## The EGTB manger

You can find this tool under the menu "Extras/EGTB manager". Sorted by the number of pieces, it lists all installed EGTB files and marks the others as missing.



1. In the list at the top, you can chose the metric for which the EGTB should be displayed.
2. By clicking on the radio buttons beyond, you let Wilhelm list the 3, 4, 5 or 6 men EGTB. There are always two lines per piece configuration, one for White (W) and one for Black (B).
3. To avoid confusion you can chose to list only the installed EGTB. After an integrity check (see also the next page) you can recognize the defective EGTB much faster, if you activate the option to show only the defective EGTB.

If any of the files are marked as missing, you've either not downloaded/installed them or the EGTB path you gave is wrong and Wilhelm can therefore not find them. Note that many chess programs may be unable to win clearly won positions if there are missing EGTB files, e.g. in a won KPK position when KRK and KQK EGTB are missing, they won't promote the pawn. Taking into account pawn promotions and piece captures, you should have all subsequent EGTB. Wilhelm itself won't have any problems with incomplete EGTB, but complete is always better.

When you click at an EGTB in the list, the exact path of the file is showed below the list. With the new EGTB format that Nalimov introduced for the bigger 6 men EGTB, an EGTB can be split into several files. For a better overview, there's still only one line for this EGTB in the list, but below the list, all the files were printed when clicking on the EGTB.



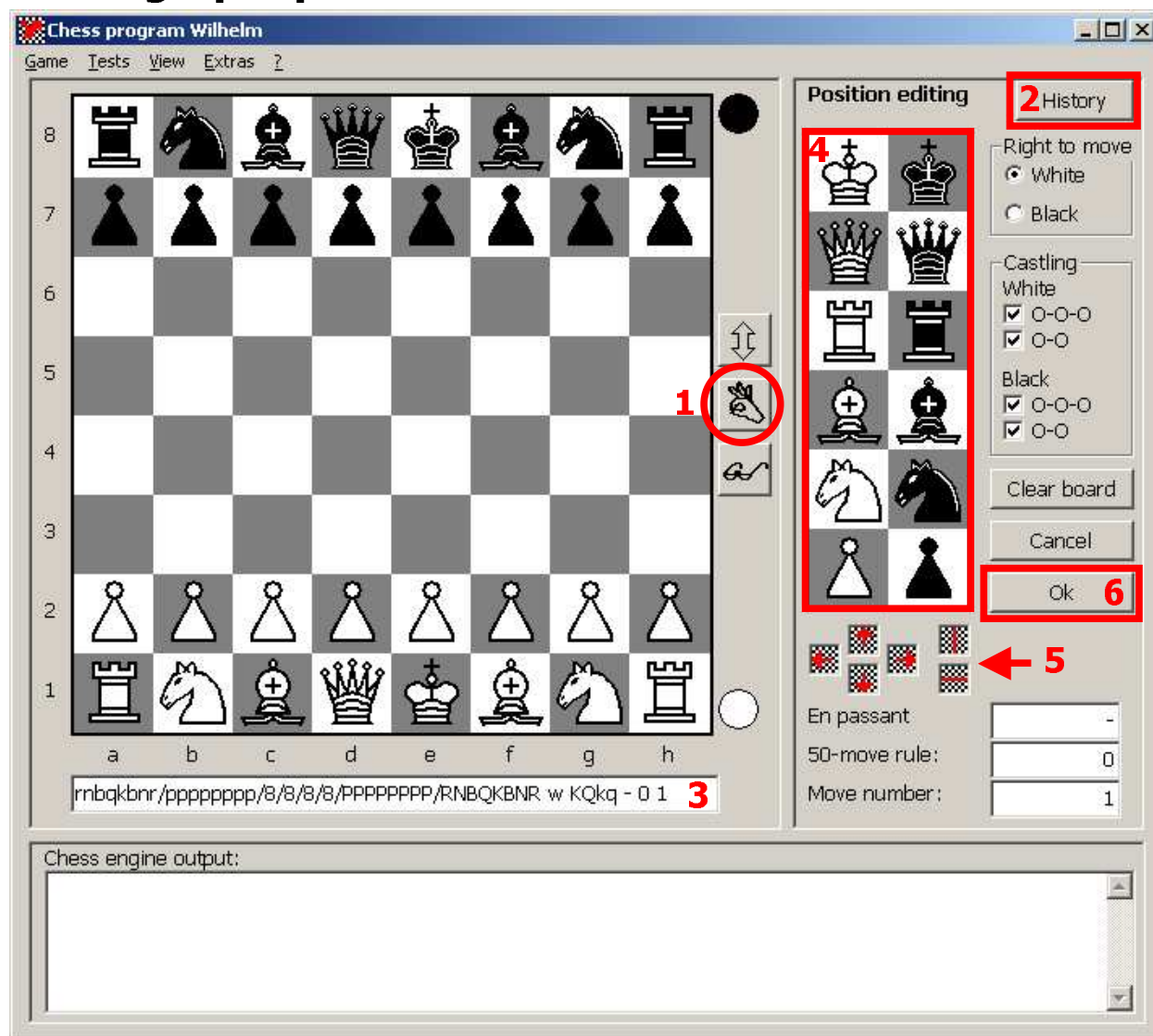
EGTB files concentrate a huge amount of information, they are usually compressed, and by downloading them and/or writing to/reading from CD, errors may happen. In a crucial game and also for the analysis of endgame positions, this may have fatal consequences. To check the data integrity of the EGTB files, so-called MD5-sums have been calculated. It's very unlikely that two (arbitrary chosen) distinct files have the same MD5-sum and even more unlikely that two EGTB files which should be identical, but are different due to an error, have the same MD5-sum. The MD5-sum (something comparable to a crossfoot, but several times more complex) is calculated by an algorithm developed by Ronald L. Rivest; the RSA Data Security Inc. holds the copyright.

4. You can check single files by clicking them in the list box and on the "Check" button. To check all listed files, you can press "Check all". For the 5 and 6 men EGTB, several gigabytes of data have to be checked which may take some minutes, depending on the hardware used. After the check, you see either "integer" or "defective" appended to the lines. You should replace the defective files.

Please note that the integrity check is only available for compressed Nalimov EGTB. To guarantee a safe integrity check, a self-check is performed before any integrity check. If the self-check fails, Wilhelm itself was not downloaded/copied correctly.

5. If there is a greater number of files marked as defective, it is possible that you assigned the wrong metric to them. If you do not know anymore, to which metric the files belong, click the "Assign" button. But if the file in question is really defective, an assignment is not possible anymore.

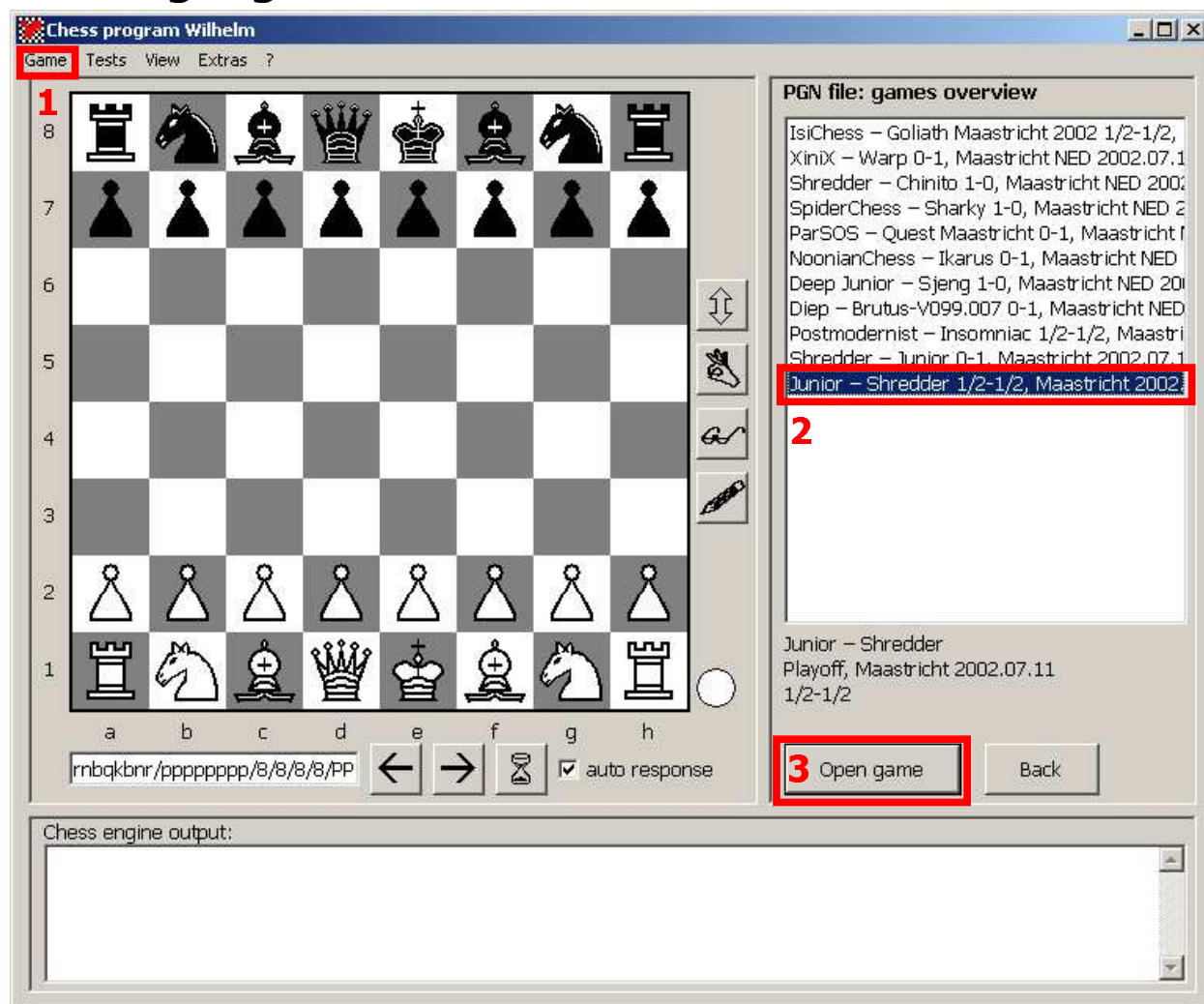
## Setting up a position



1. Click on the button with the "hand" symbol. Now the program is in a "position editing" mode where you can set up a board position. On the right side of the chess board, a toolbar pops up.
2. Maybe you have entered the position before. In this case, click on the "History" button, then you will see a list with FEN strings of previously entered positions. Select one and press enter.
3. Usually, you want to enter a new position; to do this, you have two different possibilities: You can type in a FEN string (or insert it from Clipboard by the shortcuts Ctrl+V or Shift+Insert or using the context menu) below the board. You can do this also by double-clicking on the FEN string without entering the "position editing" mode.
4. The second possibility to set up a position is to place the chess pieces manually on the board by first choosing the piece type you wish from the toolbar and second placing it on a square on the chess board.
5. With the 6 small buttons, you can shift the position and mirror it horizontally or vertically. This is often useful for analysing endgames.
6. After putting the pieces on the right places, you can now change some other properties like the side to move, castling rights or the en passant square (square onto which an en passant capturing pawn would move). To finish, click on the "Ok" button.

If you intend to use the endgame database features, you must set up a position with 3–6 pieces and have installed the appropriate endgame databases, which you can check with the EGTB manager.

## Loading a game from a PGN database

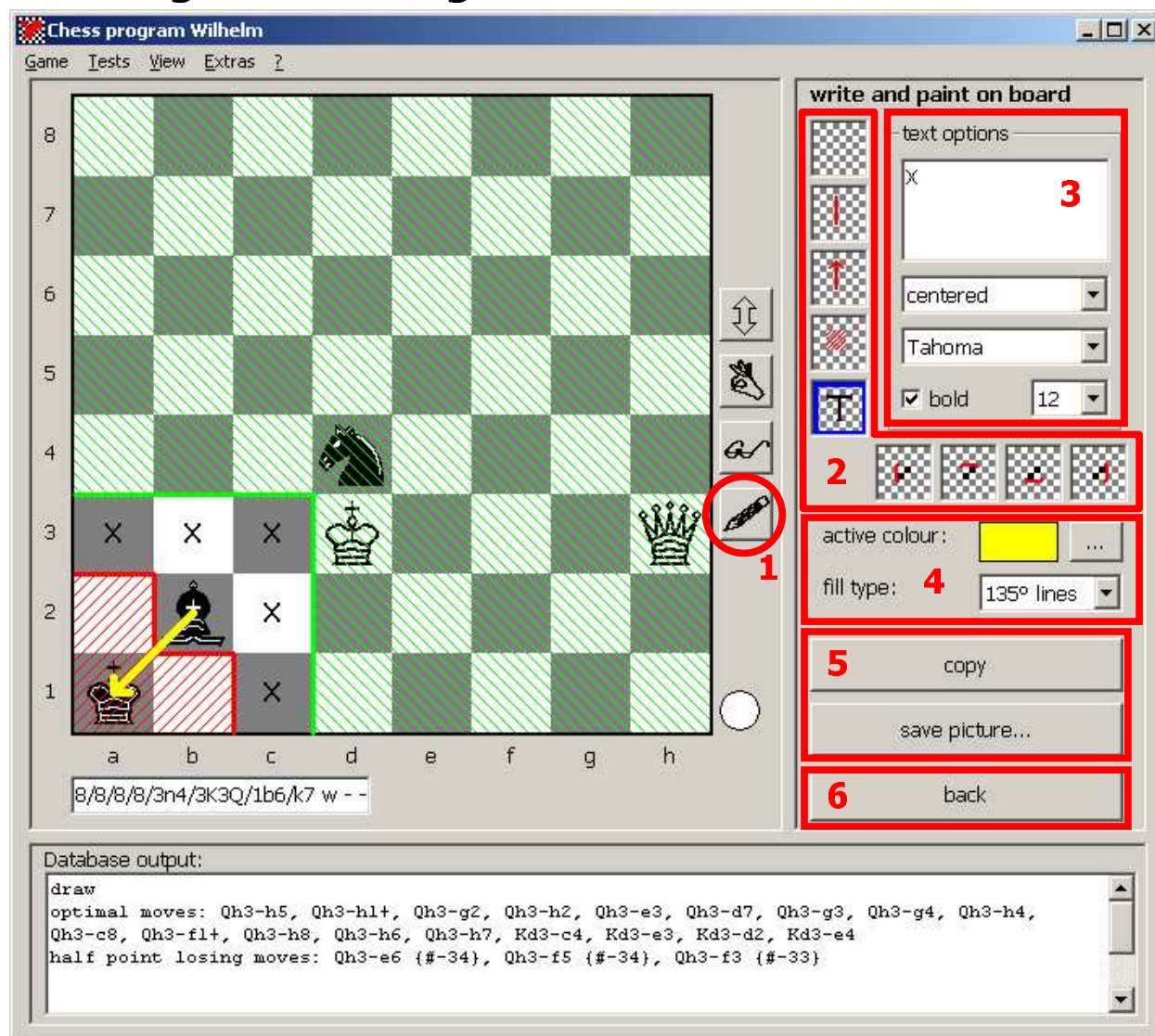


1. Click the menu "Game" and then choose "Open PGN file..."
2. On the right side of the chessboard, a list of the available games in the chosen PGN file pops up. Click on the game you are interested in. Below the list, details about the selected game are displayed.
3. Finally, Click "Open game" to load the PGN file. You can then browse through the game using the arrow buttons below the board or the cursors. Modifications of the loaded game don't affect the file.

There are some technical limits you have to respect: The maximal file size (of a PGN file) is 2 GB, the number of games in a PGN file is limited only by the physical available RAM, but only the first 32768 games are listed and accessible.

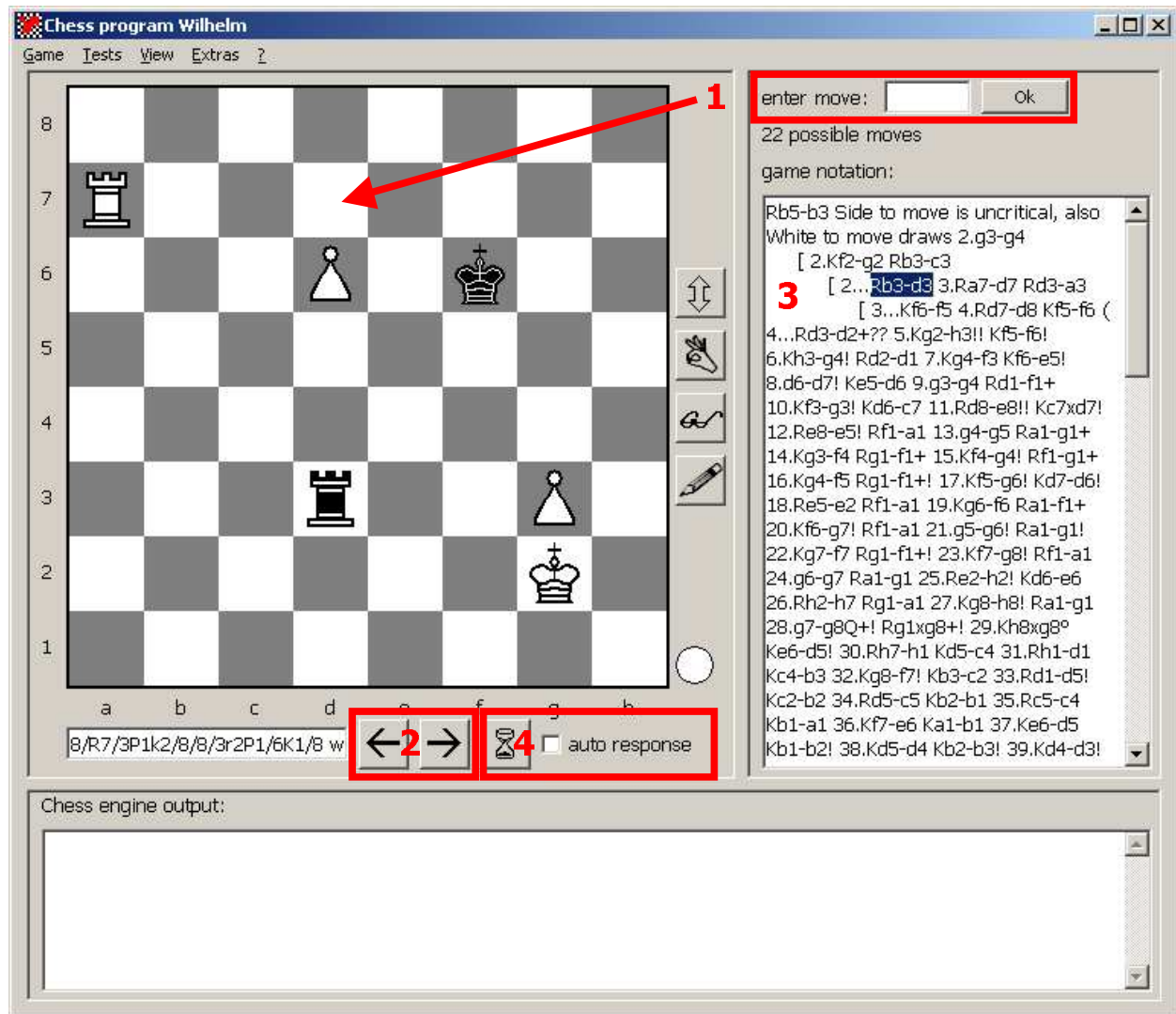
Wilhelm is not intended to be PGN database handling program, i.e. the PGN support is only designed for loading and saving games and nothing more.

## Painting and Writing to the chessboard



1. Click on the button with the picture of a pencil or use the shortcut Ctrl+P to enter the painting mode.
2. A toolbar pops up on the right side of the chessboard. Here you can select the "pencil" type you wish and then apply it to the chessboard. The types are (from top to bottom and from left to right) :
  - a. clear square
  - b. draw line (note: hold the mouse button pressed down when drawing the line)
  - c. draw arrow (note: hold the mouse button pressed down when drawing the arrow)
  - d. colour/hatch square
  - e. print text
  - f. draw frame on the left
  - g. draw frame on the top
  - h. draw frame on the bottom
  - i. draw frame on the right
3. If you want to print text to a square, you have to type in it here before. You can also choose other options like the alignment, the font name, the font size and the boldness. The colour is always black.
4. For any other paintings you can select the colour and – if you want to hatch a square – the fill style.
5. When you have finished the painting, you can use the two buttons to copy it to the Clipboard or to save it as picture (bmp).
6. At the end, click "back" to return to the normal mode.

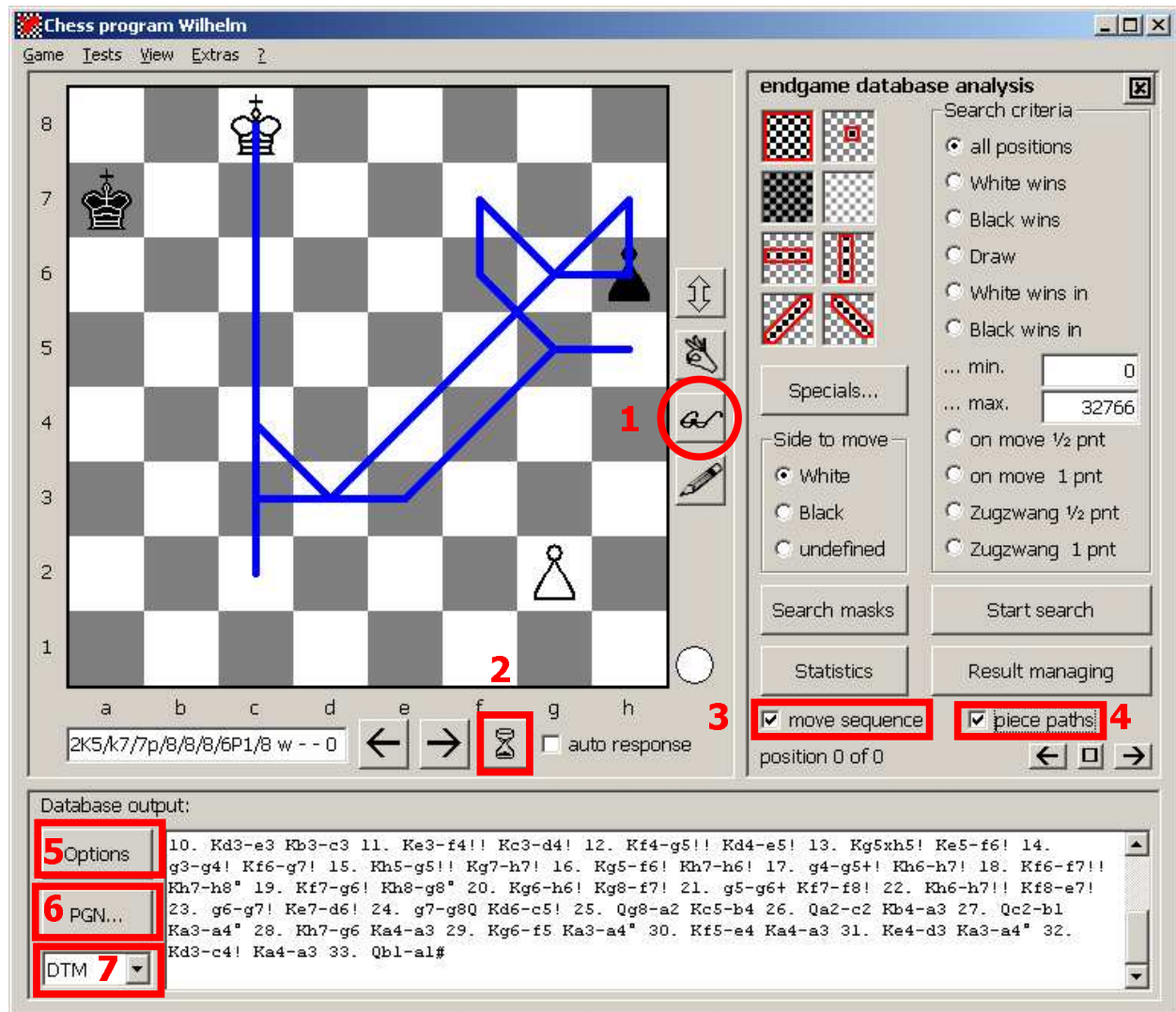
# Play or replay a game



1. You can execute moves by moving the piece from their square to destination square (Drag & Drop) or you can type in the move notation in algebraic notation in "enter move" textbox.
2. You can browse through a game using the cursor keys or using the arrow buttons.
3. You can jump to any position in the game by clicking with the mouse on the move in the game notation. If you press down the Ctrl key at the same time, a popup menu appears which offers options to comment or delete the move.
4. If you want to play a game against Wilhelm, you have to check the "auto response" option, then Wilhelm will automatically respond to your move. You can also manually start and stop the calculation process by clicking on the button with the hourglass symbol.

Under Extras/Options you can change several options to influence the playing strength of Wilhelm, especially by varying the time/depth per move.

# Example 1: examining an endgame position, 1



1. After setting up a position with 3–6 men, you can enter the EGTB analysis mode by clicking on the button with the image of the glasses on the right side of the chess board.
2. To see the information stored in the EGTB about the position, you just click on the hour glass below the board. In the "Database output" window, the following information is displayed:
  - who wins and in how many moves or if it is a draw
  - other stuff if the side to move is half point critical or how many move this shortens the mate
  - the optimal move for the shortest mate or to preserve the draw
  - suboptimal moves and half or full point losing moves
  - the complete principal variation with annotated moves until the mate or a regular draw:
    - ! means only optimal move for shortest mate
    - !! means only move to preserve the theoretical outcome of the game
3. To display this information always automatically, select the option "move sequence"
4. To show graphically the path of a piece inside the principal variation, select the option "piece paths" and move the mouse cursor over the piece you are interested in.
5. To copy the EGTB optimal line of play into the current game, click "Options" and then "add move sequence" or use the shortcut Ctrl+Z.
6. Click on the button "PGN..." on the left side of the database output text to export the principal variation as PGN file. If you cannot see this button, go to Extras/Options and check "Show Options..." in the "Endgame analysis" tab.
7. Here you can chose the different metrics, of course only if the appropriate files are installed.

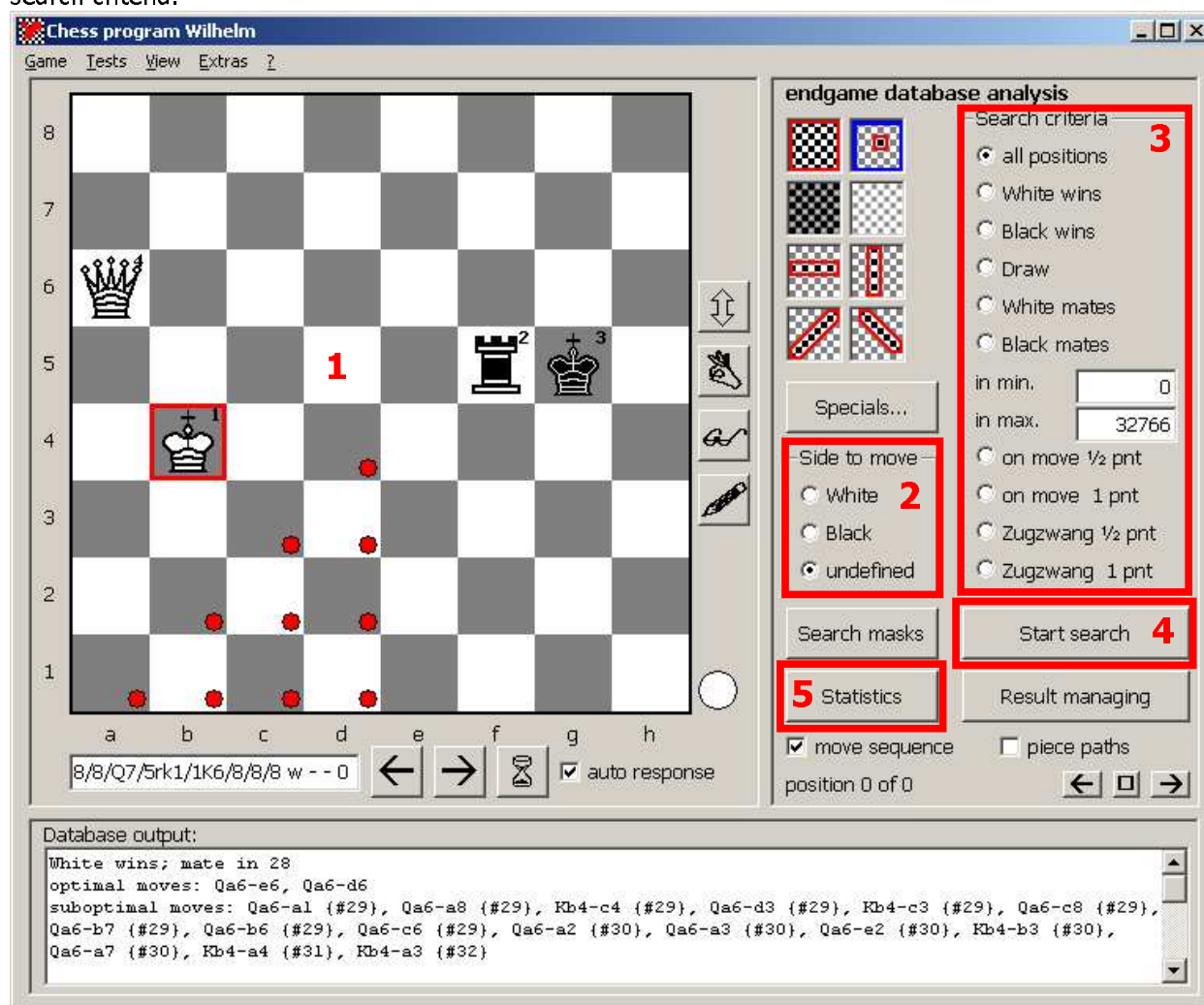
## Example 2: examining an endgame position, 2

The screenshot shows the 'Chess program Wilhelm' interface. The main window displays a chessboard with a black king on c6, a black pawn on b6, and white pawns on a2 and b2. The white king is on a1. The 'endgame database analysis' panel on the right includes search criteria (all positions, White wins, Black wins, Draw, White mates, Black mates), search limits (30 to 32766), and search masks. The 'Database output' window at the bottom shows the analysis results, including the mate distance (34) and a list of moves. The 'Options' button and 'PGN...' button are highlighted in red. A red box around the hourglass icon in the board controls indicates the 'auto response' feature.

1. Enter again the EGTB analysis mode and please set up the position above.
2. In the database output window, click the "Options" button and choose "unique moves" from the Pop-up menu. Now Wilhelm calculates the longest possible sequence of unique solution moves in a row, called shortly **UMS** (=Unique Move Sequence). The calculation is in this case easy, but it may take up to some hours in more complex EGTB positions. You can interrupt the calculation at any time by clicking on the hourglass symbol.
3. For this position, the UMS has length 6 which is displayed in the database window, just after the mate distance. The move sequence has additional annotations:
  - a. If Blacks makes a metric suboptimal move to force a unique reply by White, a comment with the loss of mate distance is added – in the example above 3... a6-a5! shortens the mate by 1 and 5... a5-a4 shortens the mate by 5. These moves are suboptimal, but force White to play accurately and therefore they get a !? mark.
  - b. If Black has several alternatives with similar mate distances, the number of variations is displayed – in the example above this means that Black has 8 other continuations at move 1... and 7 other continuations at move 2.... To determine which moves can be considered as viable alternatives, adjust the parameters in the Options dialog.

## Example 3: winning chances in KQ-KR

After setting up a random legal position with a white queen, a black rook and of course two kings of different colour, you enter the "endgame database analysis" mode (as described in example 1). To get statistical information about the winning/drawing chances for both sides in this kind of endgame, you need to perform a little search which will take some seconds. Before starting, you must indicate the search criteria.



1. For the search, you can constrain pieces to some squares i.e. give them a "board range". Since we are interested in statistics for all positions of that endgame, we do not want any limitation. But there are also some symmetries in this kind of endgame and we are not interested in all physically distinct but only logically distinct positions. To make life easier, there's a shortcut Ctrl+Shift+A which sets the board range for all pieces to all squares and constrains only the one of the white king in that way, that only logically distinct positions are searched, in our case to the triangle a1-d1-d4. This limit makes also sense in view of the time needed for the search which is proportional to the possible positions i.e. to the allowed squares of the pieces
2. Set the side to move to "undefined" because we want to include all positions.
3. Under search criteria, choose the first option, "all positions".
4. Click "Start search" (shortcut F3) to perform the search. For this endgame, the search will end quickly, but during the search, the button changes its colour to red to indicate that something is going on. If you recognize that you have forgotten something, just click again on the button to stop the search. During the search, Wilhelm informs you about the progress and the estimated time needed to finish.
5. After the search, a window with statistical information will pop up. You can deactivate the automatic pop up under the options, in this case you will get a success message instead. Then you need to click on the "statistics" button (shortcut Ctrl+S)



## Additional information about how to constrain pieces to certain squares

1. Right click on the piece you want to constrain to some squares. Also do this if you want to allow it for all squares, because it is initially constrained to one square, its current showed location.
2. Choose from the toolbar on the right side a "marker" you find useful or click on one of the three directly active buttons in the toolbar to mark
  - a. the complete board
  - b. all white squares
  - c. all black squares
3. Left click on the squares you want to include/exclude. Allowed squares are marked with a flag.
4. Choose another piece by right clicking. The flags of the other piece will disappear but are memorized, as you can see, when you right click again on the piece.

mark the full chess board

mark the black squares

mark a rank

mark a 45° diagonal



mark a single square

mark the white squares

mark a file

mark a 135° diagonal

Tip: If you investigate endings with bishops, it's often useful to restrict the bishop to one colour. For the endgame king + 2 bishops vs. king, it makes sense to restrict one bishop to the white squares and the other one to the black squares.

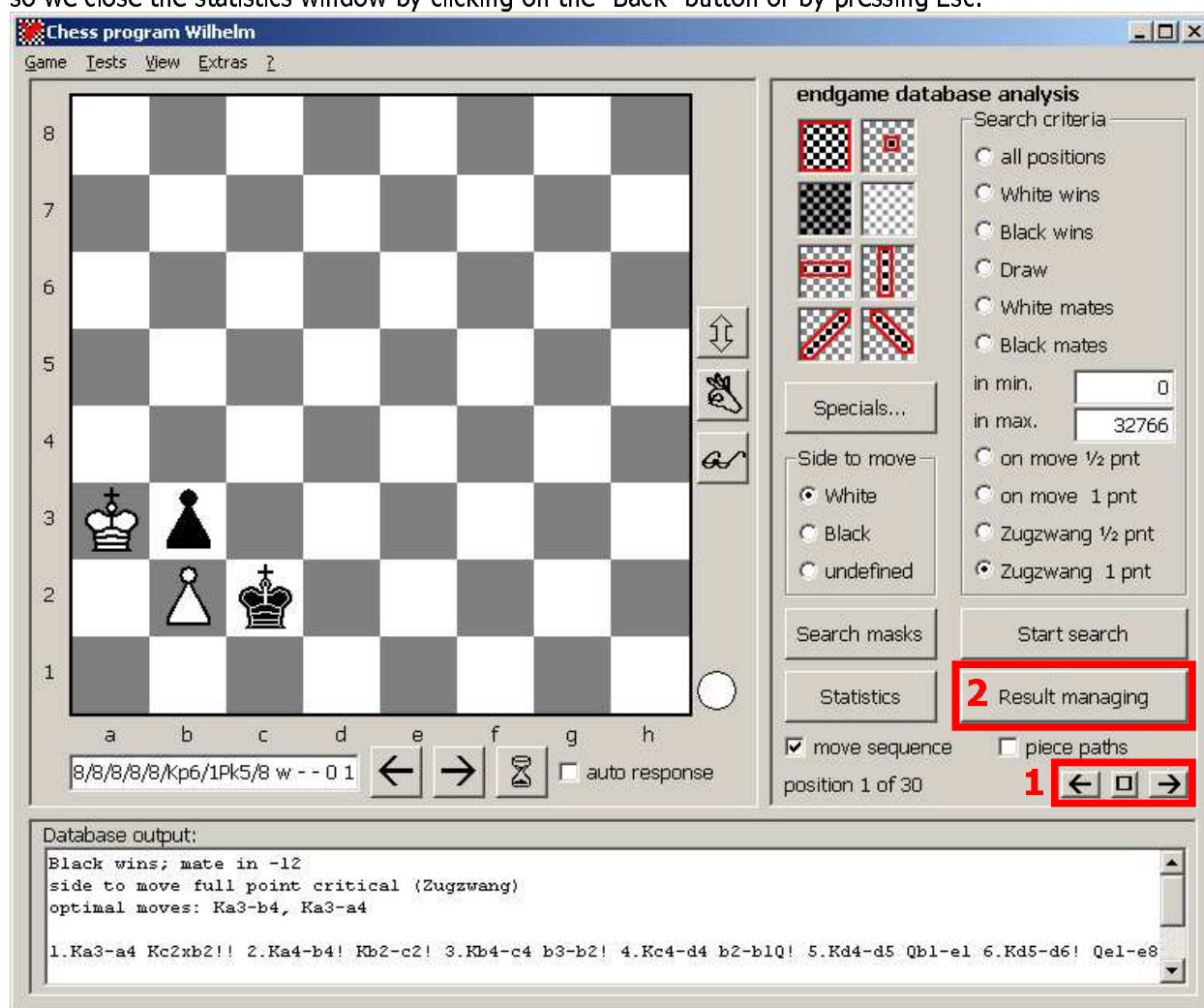
## Example 4: mutual Zugzwang positions in KP-KP

Set up a random KP-KP position and give all pieces the full board range as described in example 3. In this case here, there are less symmetries because of the nature of the pawns, so the white king is not constrained to a triangle but to the left half of the chess board. Under search criteria, click on "Zugzwang 1 pt" or "Zugzwang 1/2 pt" depending on what you are interested in:

- "Zugzwang 1/2 pt" gives you all positions with mutual Zugzwang deciding about half a point from game theoretical point of view, i.e. positions with White to move and loose whereas Black to move would draw, White to move and draw whereas Black to move would lead to win for White and the same with reversed results for Black to move.
- "Zugzwang 1 pt" gives you all positions with mutual Zugzwang deciding about a full point from game theoretical point of view, i.e. positions where both sides loose when they are to move.

For this example, let us choose the second option and then click on the "start search" button. The side to move is not important, since this kind of positions are Zugzwang positions regardless of the side to move. Therefore the program will ignore the "side to move" criterion and simply show the Zugzwang positions found with White to move.

After the search, we are this time not that much interested in statistics but rather in the positions itself, so we close the statistics window by clicking on the "Back" button or by pressing Esc.



1. Now you can browse through the positions found by clicking on the small arrows on the right side. Instead of clicking wildly on these buttons with the mouse, you can use the PgUp and PgDn buttons on the keyboard with the same effect. To go directly to a position, click the button between the two arrows and enter its number.
2. Now you may want to store the results of this search for later use. Click on the "Result managing" button and click on "Save result..." in the menu popping up. In the following dialog you can indicate a filename to store the positions found and the statistical information. The positions are also stored in the EPD format in a separate epd file of the same name, which you can import in nearly all chess programs.

## Example 5: draw zones in KQ-KP

It is known that a black pawn on rank 2 can hold a draw against the opponent queen if some conditions are fulfilled, i.e. it depends on the position of the two kings: the black one needs to be near enough by its pawn to support the promotion threat and the white one needs to be too far away to support its queen to separate the two opponent men and to capture the pawn. Set up the positions shown in the screen shot below.

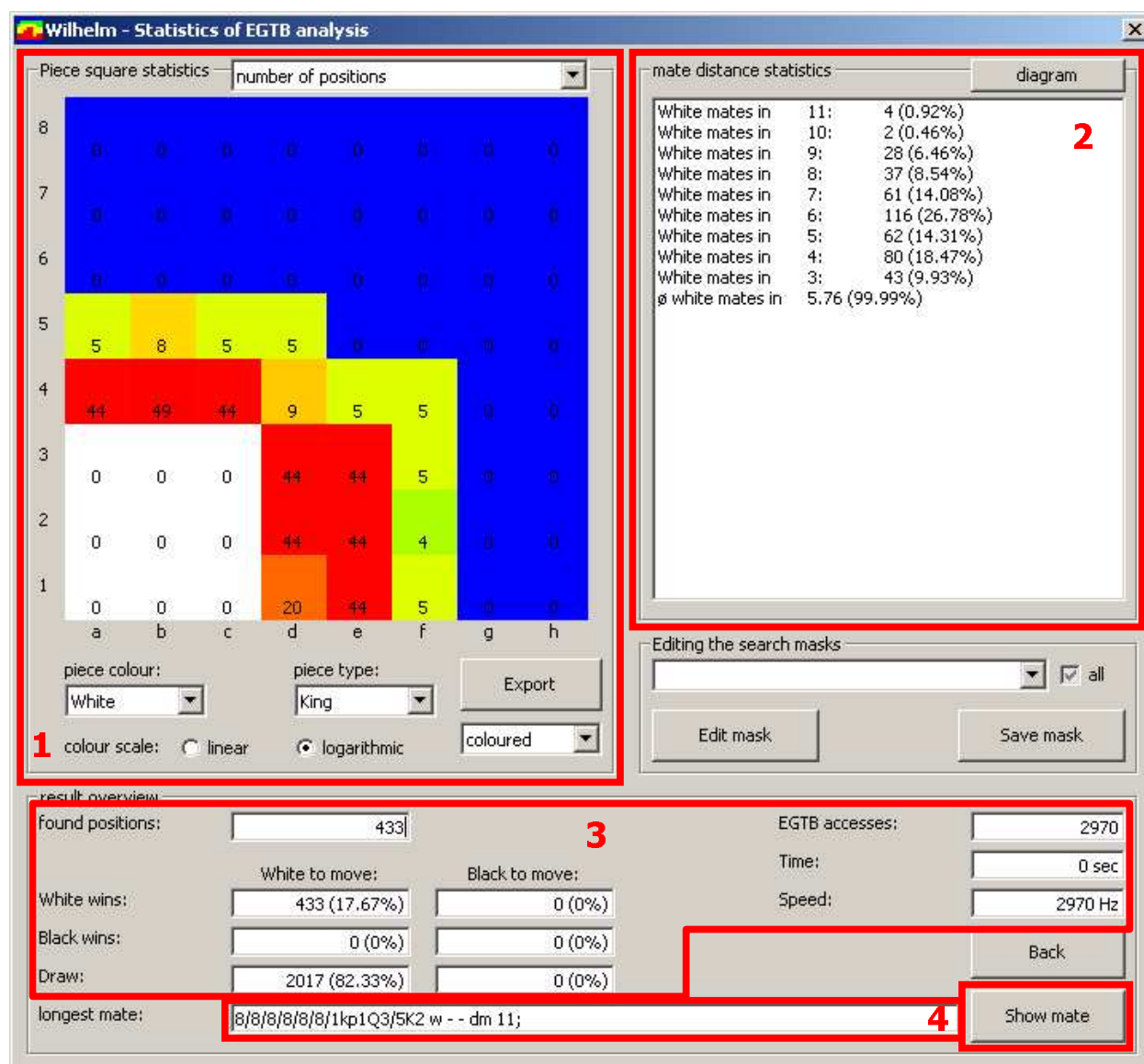
The screenshot shows the 'Chess program Wilhelm' interface. The chessboard has a white king on e6, a black king on b2, and a black pawn on c2. The search criteria are set to 'White wins' and 'Side to move' is 'White'. A search mask is applied to the white king, showing a green square at e6 labeled '1' and a red square at d7 labeled '2'. The search results show 'draw' and a list of optimal moves for the white king.

Database output:

```
draw
optimal moves: Qd7-c7, Qd7-d2, Qd7-d3, Qd7-h3, Qd7-a4, Qd7-d4+, Qd7-g4, Qd7-b5+, Qd7-d5, Qd7-f5,
Qd7-c6, Qd7-d6, Qd7-e6, Qd7-a7, Qd7-b7+, Kf6-e5, Qd7-e7, Qd7-f7, Qd7-g7, Qd7-h7, Qd7-c8, Qd7-d8,
Qd7-e8, Kf6-f5, Kf6-g5, Kf6-e6, Kf6-g6, Kf6-e7, Kf6-f7, Kf6-g7
half point losing moves: Qd7-d1 (#-10)
```

Then, let the board range of the black pieces be limited to one square and extend the one of the white pieces to the full board by

1. right clicking on the piece and then
2. left clicking on the icon for "full board" on the toolbar.
3. Now you will see flags on each square which is allowed for selected piece. By left clicking on the squares you could change the board range as described in the appendix of example 3. But for this search we do not want to constrain the white pieces in any way.
4. Don't forget to do the same not only for the white king but also for the white queen
5. Set the search criteria to "White wins" and the side to move to "White to move".
6. Click "Start search".
7. Look at the wonderful coloured piece square statistics for the white king, where you can recognize the draw zone – that's where the zeros are, i.e. for this positions, no queen position forcing a white win exists, so white can surely not win. (picture on next page)



There are several statistics available:

1. The piece square statistics where you can see how many positions were found for each square and piece. It's also possible to display percentages instead of the numbers or the mate values. You can choose a linear or logarithmic colour scale for the picture. It depends on the distribution of the values which one is better. By clicking the button "diagram" you can easily visualise the mate distances.
2. In the mate distance statistic, you can see how many positions with a certain mate distance were found.
3. In the general result overview, the number and percentage of won/lost/drawn **searched** (and not the found ones only) positions are displayed.
4. One of the longest mates is displayed as EPD. Click on the button "Show mate" or use the shortcut Ctrl+M to go back to the main chessboard and let Wilhelm show you this position.

## Example 6: Closer look at the drawing zones

Here, we continue with the result of example 5.

**mate distance statistics**

White mates in 11:	4 (0.92%)
White mates in 10:	2 (0.46%)
White mates in 9:	26 (6.46%)
White mates in 8:	37 (8.54%)
White mates in 7:	61 (14.08%)
White mates in 6:	116 (26.78%)
White mates in 5:	62 (14.31%)
White mates in 4:	80 (18.47%)
White mates in 3:	43 (9.93%)
Ø white mates in	5.76 (99.99%)

**result overview**

found positions: 433

White to move: 433 (17.67%)

Black to move: 0 (0%)

White wins: 433 (17.67%)

Black wins: 0 (0%)

Draw: 2017 (82.33%)

longest mate: 8/8/8/8/8/8/1kp1Q3/5K2 w - - dm 11;

EGTB accesses: 2970

Time: 0 sec

Speed: 2970 Hz

It's obvious that there are three different zones:

- a clear drawing zone (blue)
- an almost sure winning zone (red)
- and a zone where White only wins sometimes (yellow)

Beside the white king, there's only one other parameter, the queen. So we restrict the king now to this yellow zone, do another search and look at the positions of the queen in these cases. Instead of remembering the yellow zone, going back to the main chessboard and making the necessary changes, you can do this directly in the statistics window:

1. Choose the piece of which you want to edit from the popup list in the field "Editing the search masks", in this case the white king.
2. Click on the button "edit mask". Now, on each square a checkbox appears. Its state refers to the flags on the main chessboard.
3. To check/uncheck all checkboxes, use the checkbox "all".
4. Set the checkboxes in the yellow zone, as the image above shows.
5. Click on the "Save mask" button – else, none of the changes made will be applied.
6. Click on the "Back" button and re-search with the modified search masks. If you look then again at the statistics, you will discover what influence the position of the queen has.

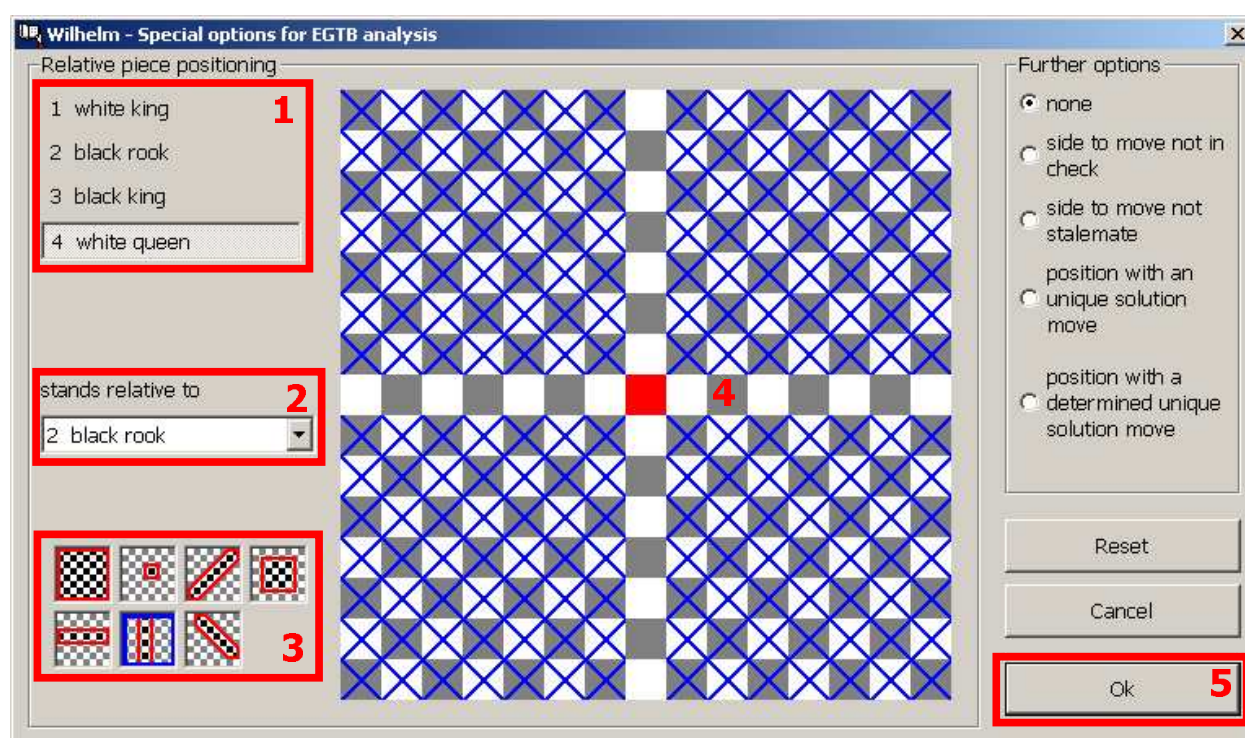
## Example 7: statistics of KQ-KR again

If we look closer at the statistics for the endgame KQ-KR from example 3, we note that Black has a winning probability of 0.2% when it's White to move, but 28.67 % when it's Black to move. We suspect that this has to do with the possibility to capture the queen with the rook or with the king.

	White to move:	Black to move:
White wins:	1385461 (99.01%)	1102789 (65.51%)
Black wins:	2765 (0.2%)	482555 (28.67%)
Draw:	11123 (0.79%)	98052 (5.82%)

To get a better overview of this ending, we want to exclude the capturing possibilities of the white queen with a black rook. Wilhelm offers a way to do this: we can constrain pieces not only absolutely but also relative to other pieces!

Click on the "Specials" button and open this dialog box:

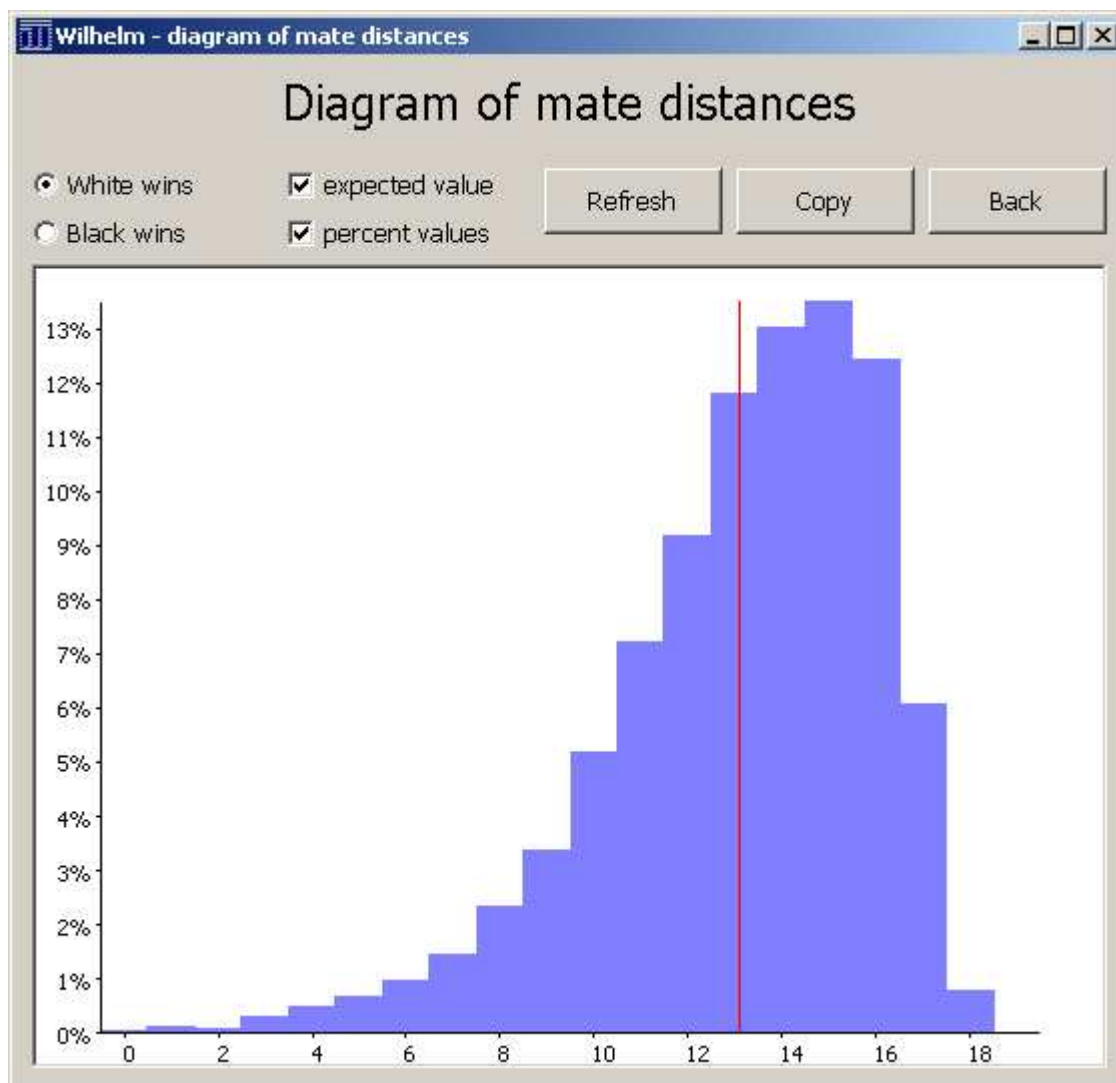


1. Choose the piece which should be constrained relative to another one. For each of the pieces listed this can be done independently. In this example, we choose the white queen.  
Note that the numbers of the pieces correspond to the numbers displayed on the main chessboard right above of each piece.
2. Choose the piece to which the first selected is constrained. Here, it is the black rook.
3. Choose the markers from the toolbar, they work as the other ones in the main window.
4. Set the allowed squares on the 15x15 board using the markers. A cross signifies an allowed square for the dependent piece. The red square in the centre is the square of the piece of which the other is dependent. Please set the crosses according to the screen shot above.
5. After doing all this, click "Ok". Be sure that you did not any changes in the "Further options".
6. Start the search and look at the statistics again. Now, the winning probability of black has clearly decreased.

## Example 8: distribution of mate distances

Sometimes it is interesting to have a look at the distribution of mate distances. Here we take an easy example, the endgame king + bishop pair vs. a lone king.

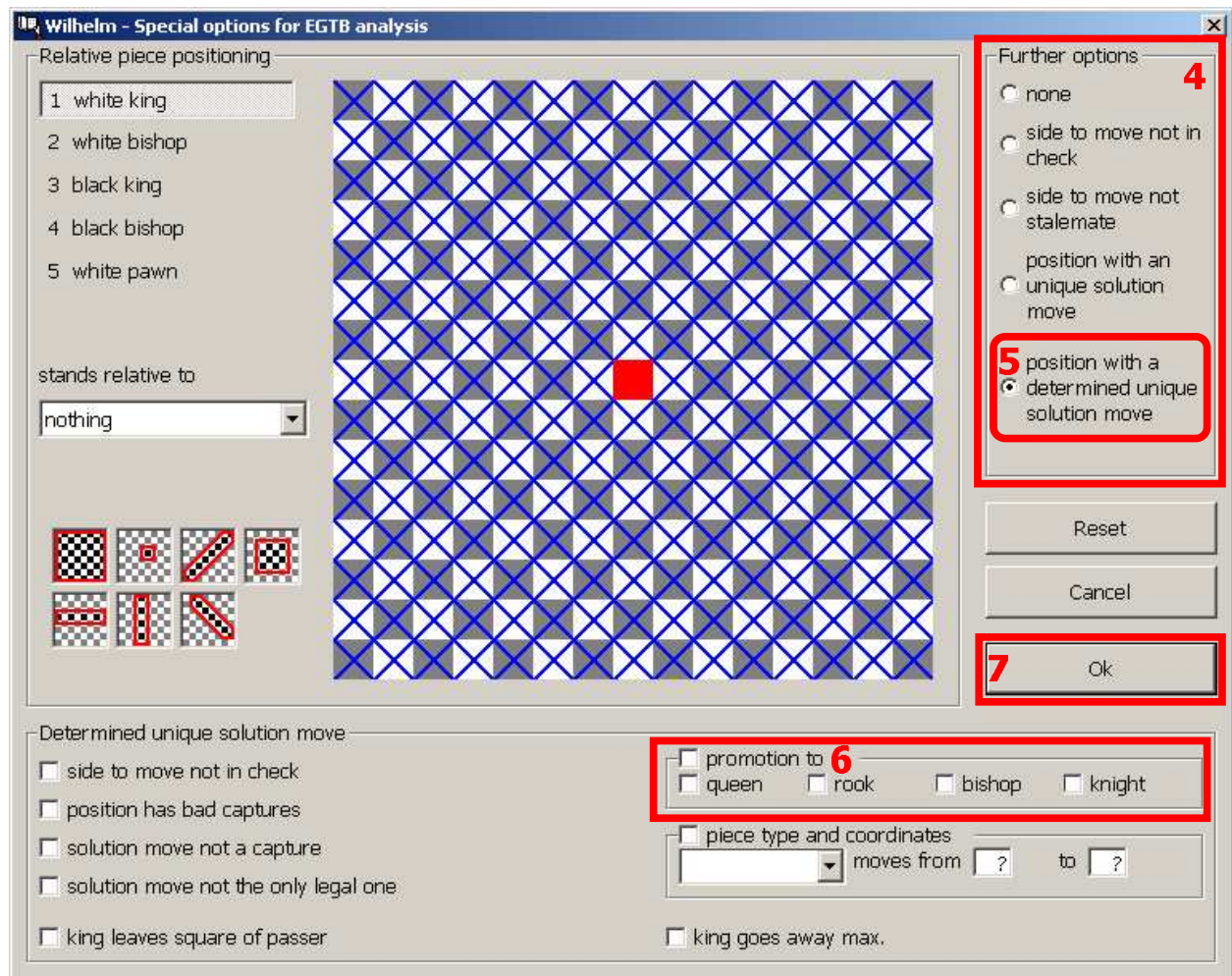
- It should hopefully now be clear how to set up the parameters correctly, otherwise please have again a look at the appendix to example 3 ("additional information").
- After performing the search, looking at the mate distance statistics in the statistics window is not very helpful to get an idea how the values are distributed.
- But above the listing of mate distances, there's a button "diagram". Click on it and Wilhelm presents you the following diagram:



- The red line signifies the expected value of the mate distances. If you don't want to have this line in the diagram, uncheck the appropriate checkbox.
- By clicking on the button "Copy" you can copy the image to the clipboard.
- If you prefer to generate such diagrams with external programs, you can export the data using the "Export" button in the statistics window.

## Example 9: Looking for unique solution moves

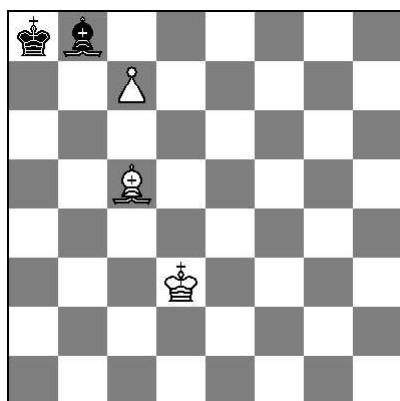
For study composers, positions with unique solution moves are candidates for a study. Wilhelm helps finding these candidate positions with a variety of options. Here, we will look at a very easy example: find in the endgame KBPKB all unique moves which are underpromotions.



1. Set up a random KBPKB position and enter the EGTB analysis mode. Press Ctrl+Shift+A to mark all squares for all pieces.
2. Since we are only interested in underpromotions, restrict the board range of the white pawn to the 7<sup>th</sup> rank. Also set the other search options appropriate, i.e. "White to move" and "White wins".
3. Then, click the "Specials" button and the dialog above gets displayed.
4. Under further options, we can see several interesting options:
  - a. "side to move not in check"
  - b. "side to move not stalemate"
  - c. "position with an **unique solution move**"
  - d. "position with a **determined unique solution move**"
5. While options a and b are interesting for theoretical investigations, c and d are more interesting for studies, and we select d. Now, the dialog changes and other options are displayed.
6. There are again plenty of details we can adjust, such as coordinates, non-capture moves etc. But for this example here, we are interested in underpromotions. Please set the checkboxes according to the picture above.
7. Click "Ok" and start the search by clicking "Start search" in the main window.
8. When the search is finished – which will need clearly more time (say 3–4 minutes on new hardware), because move generation and much more disk accesses are necessary – the mate distance statistics has some new information: there are 412 underpromotions to a rook, 14 underpromotions to a bishop and 82 underpromotions to knight. We can now browse through the found positions and see if there are any interesting ones.



As it was to be expected, the underpromotions are a result of stalemate resources and in most of the cases, an underpromotion to a rook solves the problem; some examples of found positions:



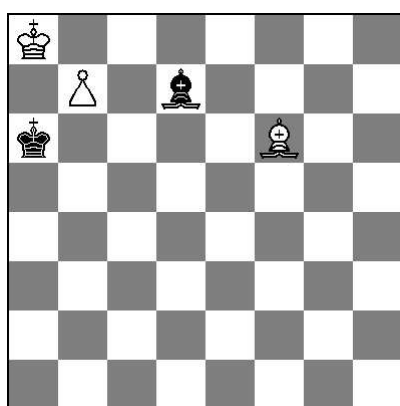
White wins; mate in 13

side to move half point critical

optimal moves: c7-c8R

half point losing moves: Bc5-d4, c7-c8B, c7-c8N, c7xb8Q+, c7xb8R+, c7xb8B, c7xb8N, Bc5-g1, Bc5-f2, Bc5-a3, Bc5-e3, Bc5-b4, c7-c8Q, Bc5-b6, Bc5-d6, Bc5-a7, Bc5-e7, Bc5-f8, Kd3-c2, Kd3-d2, Kd3-e2, Kd3-c3, Kd3-e3, Kd3-c4, Kd3-d4, Kd3-e4

1.c7-c8R!! Ka8-b7! 2.Rc8-g8! Bb8-h2 3.Rg8-g6 Bh2-f4 4.Kd3-c4 Bf4-c1 5.Bc5-b6 Bc1-b2 6.Kc4-b5! Bb2-a1 7.Rg6-d6 Ba1-b2 8.Rd6-d7+! Kb7-a8! 9.Rd7-a7+ Ka8-b8! 10.Kb5-c6! Bb2-c1 11.Ra7-a4 Bc1-b2 12.Bb6-c7+! Kb8-c8! 13.Ra4-a8#!



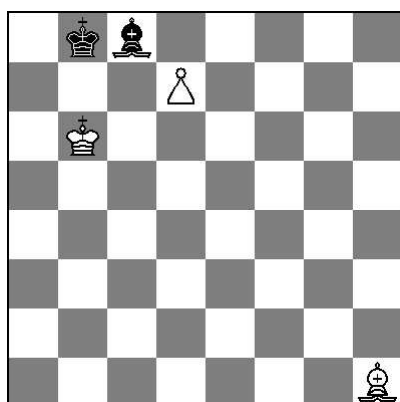
White wins; mate in 34

side to move half point critical

optimal moves: b7-b8N+

half point losing moves: b7-b8R, Bf6-h4, Bf6-e5, Bf6-a1, Bf6-b2, Bf6-c3, Bf6-d4, b7-b8Q, Bf6-g5, Bf6-e7, Bf6-g7, Bf6-d8, Bf6-h8, Ka8-b8  
full point losing moves: b7-b8B {#-1}

1.b7-b8N+!! Ka6-b5 2.Nb8xd7!! Kb5-c6! 3.Nd7-e5+ Kc6-d5 4.Ne5-f3 Kd5-c4 5.Nf3-g1 Kc4-c5 6.Ng1-e2 Kc5-d5! 7.Ne2-g3! Kd5-c6! 8.Bf6-b2 Kc6-b5 9.Ng3-e2 Kb5-c5 10.Ne2-f4! Kc5-b6 11.Bb2-d4+ Kb6-c7! 12.Ka8-a7! Kc7-c6! 13.Ka7-b8! Kc6-b5! 14.Kb8-b7 Kb5-c4! 15.Bd4-g1 Kc4-b5! 16.Bg1-f2 Kb5-a4 17.Kb7-a6 Ka4-b4! 18.Ka6-b6! Kb4-c4! 19.Kb6-a5! Kc4-b3! 20.Ka5-b5! Kb3-c3! 21.Kb5-c5! Kc3-b2 22.Bf2-e1 Kb2-b1 23.Nf4-g2 Kb1-c2! 24.Kc5-c4! Kc2-d1! 25.Kc4-d3! Kd1-c1! 26.Be1-c3! Kc1-b1 27.Kd3-c4! Kb1-c1 28.Ng2-e3! Kc1-b1! 29.Kc4-b3! Kb1-c1! 30.Bc3-e1 Kc1-b1! 31.Be1-d2! Kb1-a1! 32.Ne3-c2+ Ka1-b1! 33.Nc2-a3+! Kb1-a1! 34.Bd2-c3#!



White wins; mate in 17

side to move half point critical

optimal moves: d7-d8B

half point losing moves: d7-d8R, Bh1-f3, d7-d8N, d7xc8Q+, d7xc8R+, d7xc8B, d7xc8N, Bh1-g2, d7-d8Q, Bh1-e4, Bh1-d5, Bh1-c6, Bh1-b7, Bh1-a8, Kb6-a5, Kb6-b5, Kb6-c5, Kb6-c6

1.d7-d8B!! Bc8-a6 2.Kb6xa6 Kb8-c8! 3.Bd8-f6! Kc8-c7 4.Bh1-d5! Kc7-d6! 5.Bd5-a2 Kd6-c5 6.Ba2-f7! Kc5-b4 7.Ka6-b6! Kb4-a3 8.Kb6-c5! Ka3-a4! 9.Bf6-b2! Ka4-a5! 10.Bf7-b3! Ka5-a6! 11.Kc5-c6! Ka6-a5 12.Bb2-a3 Ka5-a6! 13.Ba3-b4! Ka6-a7! 14.Kc6-c7! Ka7-a6 15.Bb3-c4+! Ka6-a7! 16.Bb4-c5+! Ka7-a8! 17.Bc4-d5#!

## More about unique solution moves

Determined unique solution move	
1	<input type="checkbox"/> side to move not in check
2	<input type="checkbox"/> position has bad captures
3	<input type="checkbox"/> solution move not a capture
4	<input type="checkbox"/> solution move not the only legal one
5	<input type="checkbox"/> king leaves square of passer
7	<input type="checkbox"/> promotion to <input type="checkbox"/> queen <input type="checkbox"/> rook <input type="checkbox"/> bishop <input type="checkbox"/> knight
8	<input type="checkbox"/> piece type and coordinates <div style="border: 1px solid black; padding: 2px;"> <span style="border: 1px solid black; display: inline-block; width: 50px; height: 15px;"></span> moves from <input type="text" value="?"/> to <input type="text" value="?"/> </div>
6	<input type="checkbox"/> king goes away max.

A detailed description of the options:

1. Side to move not in check – should be self-explaining.
2. This means that the player could make captures, but all these captures would lead to a loss of at least half a point. The option may be useful when looking for a position with traps and where the only solution move is a silent move. This does not exclude the possibility that the solution move itself is a capture. If this is also intended, then you need to check also the next option.
3. Solution move not a capture – should be self-explaining too. Interesting to combine with the previous option.
4. With this option it is possible to exclude many "boring" positions where only one legal move is possible.
5. The king has to leave the so-called square of the passer, i.e. the pawn cannot be stopped anymore by other pawns or the king.
6. The idea of this option is to find positions where the solution move is a king move which enlarges the distance of the king to the pawns. It is therefore only applicable if there is at least one pawn. The following things are done when using this option:
  - a. The position must have an unique solution move by the king.
  - b. The centre of gravity of the pawns is calculated.
  - c. The distance to the centre of gravity is calculated for all pseudo-legal king moves and the current king position.
  - d. Only if the destination square of the solution move matches the square with the longest distance, the criterion is fulfilled.
7. The move must be a pawn promotion to certain pieces which can be selected.
8. The move must be done by a certain piece type and specified start and destination squares. The squares can be left undefined by setting a question mark instead of algebraic coordinates.

# Shortcut overview

## Main window, in EGTB analysis mode

Ctrl+E	Edit position
Ctrl+P	Paint and write to the board
Ctrl+Z	Add the EGTB optimal line of play to the game.
Left	Go back a half move
Right	Go forward a half move
Up	Go back 5 moves
Down	Go forward 5 moves
Ctrl+T	Switch to/from EGTB analysis mode
PgUp, PpDn	Previous/next EGTB analysis result position
Ctrl+PgUp/PgDn	Step backward/forward in the result positions with a step size of 10
Alt+PgUp/PgDn	Step backward/forward in the result positions with a step size of 100
Ctrl+Alt+PgUp/PgDn	Step backward/forward in the result positions with a step size of 1000
Ctrl+X	Specials (special analysis options)
Ctrl+S	Show statistics
F3	Start searching the EGTB analysis
Ctrl+A	Mark all squares for the active piece
Ctrl+Shift+A	Mark all squares for all pieces and constrain the king using symmetry

## EGTB statistics window

Esc	Close statistics window
Ctrl+M	Show longest mate on the main chess board
T	Piece square statistics: change the <b>type</b> of the statistics (number, percentage)
C	Piece square statistics: change the piece <b>colour</b>
P	Piece square statistics: change the <b>piece</b>
S	Piece square statistics: change the <b>style</b> (coloured, grey, chess board like)