

NOTES ON THE PACKAGES "ZUG3456" AND "SQZ..."

John Beasley, January 2010

General description

The packages comprise five zipped files containing in turn:

- all the reciprocal zugzwang positions with up to six men;
- all the squeeze positions with up to five men;
- all the squeeze positions with two men against four;
- all the squeeze positions with three men against three;
- all the squeeze positions with four men against two.

A reciprocal zugzwang position, for present purposes, is a position which is won for White with Black to move but not with White to move. A "squeeze" position, again for present purposes, is won for White with or without the move, but the best-play win with White to move takes at least three moves longer than that with Black to move.

Each file, when unzipped, should deliver the following:

- a PGN file containing the positions;
- a statistics file giving the numbers of positions with each combination of material;
- a copy of this "readme" file.

This "readme" file and the statistics files are designed for printing or display using a fixed-pitch font.

The numbers of positions and approximate sizes of the files (in millions of bytes) are as follows:

File	Number of positions	Approximate size of file	
		ZIP	PGN
ZUG3456	932,789	16 mB	183 mB
SQZ345	122,233	2 mB	22 mB
SQZ2v4	615,975	11 mB	115 mB
SQZ3v3	1,746,363	30 mB	325 mB
SQZ4v2	1,878,694	31 mB	349 mB

The 932,789 reciprocal zugzwang positions represent 927,063 half-point zugzwangs (White to move can draw but cannot win) and 2,866 full-point zugzwangs (White to move loses), all but six of the latter appearing twice as described below.

Presentation

The PGN files have been designed for use and display by ChessBase and similar programs. As displayed in a ChessBase List, the White and Black men involved are shown under Players, the depths to win under Tournament, and the result with White to move in a column towards the right (so "1-0" in this column denotes a squeeze position, "½-½" a half-point reciprocal zugzwang, and "0-1" a full-point reciprocal zugzwang). Thus the first position in file SQZ345 displays as

Kc7 Pb5 - Ka8 DTM 10 with BTM, +5 WTM 1-0

to indicate that the depth to mate is 10 moves with Black to move (in other words, a best-play line takes 10 Black moves and 10 White) and 5 moves longer with White to move (15 White moves and 14 Black), and the first position in file ZUG3456 as

Ka6 Pb7 - Kb8 DTM 9 with BTM, draw WTM ½-½

to indicate that the depth to mate is 9 moves with Black to move and that Black can draw with White to move. The first full-point reciprocal zugzwang in file ZUG3456 displays as

Ka7 Pb6 - Kc6 Pb7 DTM 13 with BTM, 14 WTM 0-1

to indicate that the depth to mate is 13 moves with Black to move and the depth to mate by Black is 14 moves with White to move, and the corresponding position with colours reversed appears as

Kc3 Pb2 - Ka2 Pb3 DTM 14 with BTM, 13 WTM 0-1

later in the file. Each full-point reciprocal zugzwang appears twice in this way unless the White men reflect the Black either on the file (three cases typified by White Kb1, Pa6/c6 against Black Kb8, Pa3/c3) or diametrically (again three cases, this time typified by White Kg1, Pa6/c6 against Black Kb8, Pf3/h3). In these six cases, flipping or turning the board and reversing the colours gives a position which is identical to the original, and so does not appear separately.

The depth to win normally gives the number of White moves needed to force mate (DTM), but in the case of the five-against-one zugzwangs it gives the number of White moves needed to force mate, winning capture by White, losing capture by Black, or promotion (DTC). There is no significance in this distinction, which merely reflects the data that were available. Note that while DTM is necessarily positive, DTC may be zero (signifying a position where Black's only available moves are captures and each of his possible captures gives a lost ending with fewer men).

When a particular position is displayed by ChessBase, a single pass move "1.--" appears in the "moves" window. When a Fritz or other engine offered within ChessBase is used to analyse the position, the presence of this move allows the user to flip between "White to move" and "Black to move" analyses by using the left and right arrow keys.

Sequencing and orientation =====

The positions are grouped by material, and are presented in a natural QRBNP sequence (in the case of the reciprocal zugzwangs, KP-K, KR-KB, KR-KN, KR-KP, KN-KP, KP-KB, KP-KN, KP-KP, KBP-K, KNP-K, KPP-K, KQ-KRB, KQ-KRN, KQ-KRP, and so on).

Pawnless positions are reflected so that the White king is within the triangle a8-a5-d5. If this puts it on the long diagonal, the position is further reflected so that the Black king lies on or above this diagonal; if the Black king also lies on this diagonal, the position is reflected so that the White queen lies on or above it; if the White queen is absent or also lies on it, the position is reflected so that the Black queen lies on or above it; and so on.

For positions with pawns, the squares are assumed to be ordered in sequence a7-b7-c7-...-h7-a6-b6-...-h2, and the position is reflected so that the White pawns are as near as possible to a7. If there are no White pawns, or if the White pawns are disposed symmetrically, the same criterion is applied to the Black pawns; if these too are disposed symmetrically, or if they are non-existent, the White king is placed in the left-hand half of the board.

Within a group of positions with the same material, the locations of the White pawns take first priority, then the locations of the Black pawns, then the White king, and so on. This means that all the positions with the same material and with the pawns in the same locations are grouped together.

Searching for particular positions or sets of positions

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IMPORTANT NOTICE. This section relates only to my own experience using the versions of ChessBase and CQL currently installed on my own machine. It is possible that there are facilities of these programs which I have overlooked, or that there are more recent versions offering additional facilities. If the proprietors or admirers of these programs consider that either of them has been inadequately represented and care to alert me to facilities which I have overlooked, I shall be very happy to issue a new version of this text appropriately revised.

Some searches for particular positions can be done using either ChessBase or CQL, but searching for positions with the men in a particular relationship to each other can be conveniently done only using CQL, and searching for positions with a particular depth to the win can be done only using ChessBase.

Positions with particular material can be picked out in ChessBase by searching on Material and in CQL by using :piececount.

Searches for pawnless positions in which one or more men are on particular squares can be performed by CQL using :flip (and :flipcolor if appropriate). This will pick up the desired position irrespective of the orientation in which it is stored in the file. ChessBase is less flexible, and to find pawnless positions with (say) the White King on e1 it is necessary to put the king on e1, h4, h5, or e8 on the 'Or' board and to use V-Mirror, or to put it on all eight squares e1/h4/h5/e8/d8/a5/a4/d1.

Searches for positions with pawns in which one or more men are on particular squares can be performed by CQL using :flipvertical and by ChessBase using V-Mirror. Searches for positions with the key men in a particular relationship to each other (for example, the "trebuchet" position with White Ka5, Pb4 against Black Kc4, Pb5) can be performed by CQL using :flipvertical and :shift, but there is no convenient ChessBase equivalent.

Full-point zugzwangs can be found using either ChessBase or CQL by looking for positions with result 0-1.

Positions with a particular depth to mate or capture can be selected using ChessBase by specifying "n" under Tournament, bracketing it by spaces so that a search for say 1 does not also pick up 10, 11, 21, etc. There is no equivalent facility in CQL. Squeeze positions with

a particular increase in depth can be selected using ChessBase by specifying "+n" similarly.

Note regarding legality and retro-analytical effects

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The positions have been analysed ignoring legality, possible retro-analytical effects, and castling. Specifically,

- each position is presented as an object in its own right, no account being taken of whether it could have been produced by a sequence of legal moves from the normal initial array;
- no account is taken of the possibility that the side to move may have the option of an "en passant" capture;
- it is assumed that neither side can still castle, even if its king and one or both of its rooks are in their normal game array positions.

Additionally, no account is taken of the "fifty-move rule"; any eventual mate is treated as a win, even if more than fifty moves between successive captures or pawn moves necessarily occur on the way to it.

Sourcing and validation

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My immediate source for the reciprocal zugzwangs was a set of spreadsheets prepared by Guy Haworth and made available on the ICGA web site. These in turn, with the exception of that relating to five-against-one positions, were prepared from data extracted from the Nalimov depth-to-mate tablebases on Eiko Bleicher's web site <www.k4it.de> by programs written by Marc Bourzutschky and Eiko himself. The five-against-one spreadsheet was prepared from a depth-to-capture tablebase calculated by Marc. The spreadsheets include some "en passant" zugzwangs, where the player to move is assumed to have the option of a capture en passant, but these are not included in the present file.

The statistics for zugzwangs with up to five men were checked against the well-established figures presented in a note by Guy and others in the December 2001 issue of the ICGA Journal (pages 225-230), and appear to agree exactly. The statistics for zugzwangs with six men were checked against a further spreadsheet made available by Guy on the ICGA web site, and they appear to agree exactly except in some cases where both sides have pawns. Here, Guy's statistics include the "en passant" zugzwangs which I have excluded, and direct comparison is impossible. However, a paper "6-man Chess and Zugzwangs" by Eiko Bleicher and Guy, presented to a recent ICGA conference, includes a table which enables his statistics to be adjusted to exclude these (or mine to be adjusted to include them), and if these adjustments are made our results again appear to agree exactly.

Additionally, spot checks were made to verify that some expected zugzwangs did indeed appear in the file, and it was confirmed that the zugzwangs in a small random sample from the file did indeed have the properties claimed for them.

Nearly all this work, including the verification of sample positions, depends on the validity of the Nalimov tablebases on Eiko Bleicher's web site. Some of these (for positions with up to five men, and for most pawnless positions with six men) repeated ground already covered by others, and various key parameters were verified against what was already known from other sources before they were posted. No previous data were available for six-man positions with pawns and the Nalimov tablebases stood and may still stand alone, but I am not aware of any respect in which they have been challenged and I think their validity is generally accepted.

The squeeze positions were extracted for me from the Nalimov tablebases by Eiko Bleicher using tools provided by Marc Bourzutschky. For positions with up to five men, Marc provided statistics giving the numbers of positions expected, and these numbers were duly observed. For most of the six-man positions, no previous statistics were available, and no validation has been performed beyond some spot checks. The files of squeeze positions should therefore be regarded as provisional pending independent verification.

Availability =====

I am not claiming any rights in these files, and am happy that they be freely disseminated. However, I ask anyone taking and using them, at least during the next year or two: please register yourself with me by sending an e-mail to

johnbeasley@mail.com

so that I can contact you if there proves to be a need to send out a new version of any file.

Acknowledgements =====

My contribution to this exercise has been entirely cosmetic, and my immediate acknowledgements are to Guy Haworth in respect of the reciprocal zugzwangs and to Eiko Bleicher and Marc Bourzutschky in respect of the squeeze positions. Guy in turn makes extensive acknowledgements in his spreadsheets, citing initials which I read as referring to Eiko Bleicher, Marc Bourzutschky, Peter Karrer, Eugene Nalimov, John Tamplin, Ken Thompson, and Christoph Wirth, and I am sure that tracing back down the literature would identify further workers whose contributions, though now duplicated or overtaken, were significant advances at the time.