NOTES

COMPRESSING A CHESS-ENDGAME DATABASE

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ABSTRACT

A method of compressing a chess-endgame database taking advantage of the arrangement of the number of moves-to-mate between adjacent positions within the database is described. A subset of KQK with White to move (WTM) is used to illustrate the technique.

1. INTRODUCTION

One of the problems with computer-chess endgame databases (especially when microcomputer-implemented) is their large size. To show how such databases may profitably be compressed considerably, we take as an example a subset of the KQK endgame. The subset considered has fixed positions for the two Kings (WK on e8; BK on a8). Diagram 1 shows the number of moves to mate for each of the 45 legal positions.

♚	x	x	x	♔	4	4	4
x	x	4	4	4	4	4	4
x	4	x	4	4	4	4	4
x	3	4	x	4	4	4	4
x	3	4	4	x	4	4	4
x	3	4	4	4	x	4	4
x	3	4	4	4	4	x	4
x	3	4	4	4	4	4	x

DIAGRAM 1
× = forbidden position of the white Queen.

We number the rows and files from 0 to 7, and use the following abbreviations: WKR = row(WK); WKF = file(WK); BKR = row(BK); BKF = file(BK); WQR = row(WQ); WQF = file(WQ). A possible indexing function F1 for each KQK position may now be:

$$F1 = 32768*BKR + 4096*BKF + 512*WKR + 64*WKF + 8*WQR + WQF.$$

This indexing method guarantees that each position in the KQK database has a different entry point in the database, given by F1.

2. DIFFERENT INDEXING FUNCTIONS

The subset of moves-to-mate (M) of the KQK database, corresponding with the white King and black King confined to positions e8 and a8, respectively, using F1 as indexing function, is given in Figure 1 (values of 0 indicate illegitimate KQK positions, otherwise moves to mate).

entry[233216]...entry[233279]
↓ ↓

0 3 4 4 4 4 4 0 0 3 4 4 4 4 0 4 0 3 4 4 4 0 4 4 0 3 4 4 0 4 4 4 0 3 4 0 4 4 4 4 0 4 0 4 4 4 4 4 0 0 4 4 4 4 4 4 0 0 0 0 0 4 4 4

Figure 1: Moves-to-mate (M) using F1 as the indexing function.

If we define an M-interval as a contiguous set of database entries with the same M-values (disregarding illegitimate positions), the information in Figure 1 may equally well be expressed by Table 1.

M-interval			M-value
#	lower bound	upper bound	
1	233216	233217	3
2	233218	233222	4
3	233223	233225	3
4	233226	233231	4
5	233232	233233	3
6	233234	233239	4
7	233240	233241	3
8	233242	233247	4
9	233248	233249	3
10	233250	233279	4

Table 1: M-intervals corresponding to Figure 1.

Note that by convention we include illegitimate positions as part of the next-higher indexed legitimate position.

That the indexing function may have a profound influence on the number of intervals generated is shown by exhibiting the alternative indexing function F2:

$$F2 = 32768*BKR + 4096*BKF + 512*WKR + 64*WKF + 8*WQF + WQR.$$

The above procedure is repeated to obtain Figure 2 and Table 2.

entry[233216]...entry[233279]
↓ ↓

0 0 0 0 0 0 0 0 3 3 3 3 3 4 0 0 4 4 4 4 4 0 4 0 4 4 4 4 0 4 4 0 4 4 4 0 4 4 4 0 4 4 0 4 4 4 4 4 4 0 4 4 4 4 4 4 0 4 4 4 4 4 4 4

Figure 2: Moves-to-mate (M) using F2 as the indexing function.

M-interval			M-value
#	lower bound	upper bound	
1	233216	233228	3
2	233229	233279	4

Table 2: M-intervals corresponding to Figure 2.

So, whereas indexing function F1 leads to 10 M-intervals, F2 reduces this figure (by effectively rearranging the KQK subset database) to an optimal value of 2. (Optimal because the number of M-intervals equals the number of different M-values.)

Other indexing functions may be used. The number of different indexing functions of the kind of F1 and F2 equals 720 (being 6!, i.e., all permutations of the 6 parameters (BKR, BKF, etc.) involved), but of course also other types of indexing functions may be tried.

For the complete KQK database with WTM the maximum number of moves-to-mate is known to be 10. It is tempting to devise an indexing function yielding, for the *complete* KQK database, a number of M-intervals which exceeds the required minimum of 10 by the lowest amount possible.

3. REFERENCES

Held, G. (1983). *Data Compression.* Wiley/Heyden. ISBN 0471 26248X.

Hewlett Jr., C.W. (1977). *Chess Catalog for the Endgame White Queen and White King* vs. *Black King*. Publ. by C.W. Hewlett, Waynesboro, Virginia, USA.

Roycroft, A.J. (1985). Chess-Endgame Data-Base 'Oracles': Necessary and Desirable Features. *ICCA Journal*, Vol. 8, No. 2, pp. 100-104.

Photo by M. Newborn

Ossi Weiner, suitably coloured, playing Mephistophelian gambits.
Tony Marsland has the role of Dr. Faustus. ACM Tournament Orlando, Florida, 1988.