

Guffith

May 23, 1957

PROJECT: STRETCH

SUBJECT: Table Searching

REFERENCE: Project STRETCH memo, "A General Technique for Searching Tables with a Non-Uniform Interval, May 20, 1957, by E. F. Codd

An examination of figure 2 of Mr. Codd's excellent memo indicates that there is a consistency in the values of the high and low addresses (last two columns of the table). Advantage may be taken of this pattern to save bits in the table entries. The bits saved may be used either to permit larger table arguments, larger tables or a combination of these desiderata.

If one first treats the high and low addresses not as locations relative to the table origin but rather as amounts for deflection of the search upwards or downwards in the table, one observes that the low column always produces negative deflections and the high column shows positive deflections. The reason for this is quite obvious.

Also, one observes that on any given line the absolute values of the deflections of the two columns are almost equal. By a simple reassignment of the successive compare points the deflections may always be made equal. Hence, only one column need be maintained in place of the proposed two. The sense of the deflection may be obtained from the result of the comparison. The non-symmetrical STOP indications may be supplied by having two stop bits, one for high results, one for low.

Furthermore, it may be noticed that the maximum deflection occurs at the middle-point of the table and deflects to the quarter-points of the table. Therefore, the maximum deflection magnitude requires two bits fewer for its binary representation than does the largest relative address of the table. This is because the deflection amount is one-fourth of the table length.

Thus, the table format has capacity for considerably larger arguments or considerably larger tables or both. For example, with a 39 bit argument, the table length is restricted to 2^{25} words (no restrictions at all). This is obtained from taking 39 bits for the argument and two

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stop bits, leaving 23 bits for the deflection. The table may then be four times larger than the maximum deflection, or 2^{25} words long.

Of course, these suggestions for saving bits depend upon having the table stored in a continuously-addressed area of memory. Should this be neither possible or desirable Mr. Codd's treatment is essential.

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RG/jv