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|---|---|
| TITLE | Matrix Modifying Input |
| TYPE | Closed subroutine with one program parameter which utilizes routine N - 2.  The link is |

$$\begin{array}{|l} 50 \ kF \\ 50 \ pF \\ \hline \end{array}$$
$$26 \ xF$$

where k is the location beginning at which the non-zero elements of matrix A are stored and x is the first word of this routine.

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| NUMBER OF WORDS | 43 words plus the 26 words of N - 2. |
| TEMPORARY STORAGE | 0, 1, 2, S4, ..., (q - 1) S4 where q is the number of columns in A. |
| PRESET PARAMETERS | S3, S4, S6.  During the input of this routine, locations 3, 4, and 6 must contain the following quantities: |

3)  00 F  00  nF          n is the number of rows in the matrix A

4)  00 F  00  aF          The locations ( a + i )
$(i = 0, 1, ..., q - 1)$ are used as temporary storage for each successive row of A before its nonzero elements are stored in their modified form.

6)  00 F  00  cF          c is the location of the first word of routine N - 2.

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| ACCURACY | A maximum of 9 decimal places. |
| DURATION | Approximately the reading time. |
| DESCRIPTION | The role of this routine is to take in a matrix, modify |

its nonzero elements so that the last ten bits of the element indicate the row and column in which the element appears and then store

consecutively only the modified non-zero elements. It will handle matrices punched out in row form where a zero element is represented by a plus sign and each row except the last is terminated by the symbol N. The last row of the matrix is terminated by the symbol J. For example, the matrix

$$
\begin{array}{ccc}
+\ .1 & 0 & 0 \\
0 & 0 & -.1 \\
+\ .2 & 0 & 0
\end{array}
$$

is punched as

$$
\begin{array}{cccc}
+1 & + & + & N \\
+ & + & -1 & N \\
+2 & + & + & J
\end{array}
$$

The elements of the matrix are read in a row at a time by means of Routine N - 2. The number of locations needed to store the matrix A is equal to the number of non-zero elements in the matrix plus one. While the size of the matrix which can be stored depends upon the number of non-zero elements, the maximum matrix which this routine will handle correctly is a matrix with 511 columns. There is no restriction on the number of rows.

METHOD

The last 10 bits of the non-zero elements of the matrix are discarded, for these bits are used to indicate the row and column in which these non-zero elements appear. The first non-zero element of each row has one in the $2^{-30}$th position of the word while the remaining non-zero elements of the row have zero in this $2^{-30}$th position. The remaining 9 bits $2^{-31}$ through $2^{-39}$ indicate the particular column of this row in which this non-zero element appears. These non-zero elements are stored rounded off to 30 binary bits. A one is placed in the $2^{-29}$th position if the unmodified number is greater in absolute value than ǀ the modified

number + 1/2 $\cdot$ $2^{-29}$| otherwise a zero is placed in this $2^{-29}$ position.

| DATE October 5, 1955 |
| --- |
| PROGRAMMED BY R. P. Polivka |
| APPROVED BY J.P.Nash |

RPP/mge

October 5, 1955

| LOCATION | ORDER | | NOTES | PAGE 1 |
|---|---|---|---|---|
| 0 | K5 F | | | |
| | 42 30L | | Set link | |
| 1 | 10 20F | | | |
| | 42 17L | | | |
| 2 | L5 3F | | | |
| | L4 4F | | Form a + n | |
| 3 | 42 36L | | | |
| | 26 38L | | | |
| 4 | 10 1F | | | |
| | 40 37L | | $2^{-30}$ | |
| 5 | 50 S4 | | | |
| | 50 5L | | | |
| 6 | 26 S6 | | to N2 | |
| | 40 33L | | | |
| 7 | 26 40L | | | |
| | F5 32L | | Column counter | |
| 8 | 40 32L | | | |
| | L3 (S4) | | | |
| 9 | 36 19L | | → element = zero | |
| | 50 (S4) | | | |
| 10 | J0 34L | | | |
| | L5 32L | | Modify the non-zero | |
| 11 | L4 37L | | elements | |
| | S4 S4 | | | |
| 12 | 40 F | | | |
| | L4 35L | | | |
| 13 | 40 1F | | | |
| | L4 F | | | |
| 14 | 10 1F | | | |
| | 40 37L | | Round-off test | |
| 15 | L7 37L | | | |
| | L2 S4 | | | |

| LOCATION | ORDER | NOTES |
|---|---|---|
| 16 | 32 22L | |
| | 41 37L | |
| 17 | L5 1F | |
| | 40 ( )F | |
| 18 | F5 17L | |
| | 40 17L | Increase |
| 19 | F5 8L | |
| | 40 8L | Addresses |
| 20 | 42 9L | |
| | 42 15L | |
| 21 | L0 36L | |
| | 36 24L | At end of row? |
| 22 | 22 7L | |
| | 41 37L | |
| 23 | L5 F | |
| | 22 17L | |
| 24 | L5 11L | |
| | 42 8L | Reset addresses for |
| 25 | 42 9L | new row |
| | 42 15L | |
| 26 | L3 33L | |
| | 36 39L | |
| 27 | L5 17L | |
| | 42 29L | Insert word indicating |
| 28 | L5 35L | end of matrix. |
| | 10 1F | |
| 29 | 32 29L | |
| | 40 ( )F | |
| 30 | 50 S4 | waste |
| | 22 ( )F | link |
| 31 | 40 ( )F | |
| | L5 8S6 | |

| LOCATION | ORDER | | NOTES          PAGE 3 |
|----------|----------|---|---|
| 32 | 00 F | | |
|    | 00 F | | |
| 33 | 00 F | | |
|    | 00 F | | Constants |
| 34 | LL 4095F | | |
|    | L1 3072F | | |
| 35 | 00 F | | |
|    | 00 1024F | | |
| 36 | 40 32L | | |
|    | L3 F | | |
| 37 | 00 F | | |
|    | 00 F | | |
| 38 | 00 20F | | |
|    | 46 31L | | |
| 39 | L5 35L | | |
|    | 26 4L | | |
| 40 | L5 31L | | |
|    | L0 8S6 | | Does each row have the |
| 41 | 40 32L | | number of elements in |
|    | L3 32L | | input? |
| 42 | 32 7L | | |
|    | FF F | | |

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