ALGORITHM 51
ADJUST INVERSE OF A MATRIX WHEN AN ELEMENT IS PERTURBED

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procedure ADJUST (n, d, i, j, A, B); value i, j, n, d;
    integer i, j, n; real d; real array A, B;
comment If the n x n matrix $A = M^{-1}$ and a change, $d$, is made in the i, j-th element of $M$ this procedure will calculate the corrected matrix for $M^{-1}$ by adjusting matrix $A$. The adjusted matrix is stored in $B$;
begin integer r, s;
real t;
    t := d/(A[i, j] x d+1);
    for r := 1 step 1 until n do
        for s := 1 step 1 until n do
end ADJUST

CERTIFICATION OF ALGORITHM 51
ADJUST INVERSE OF A MATRIX WHEN AN ELEMENT IS PERTURBED [John R. Herndon, Comm. ACM 4 (Apr. 1961)]
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This procedure was programmed in FORTRAN and reduced to machine code mechanically. It was run on the Argonne-built computing machine, GEORGE. A floating-point routine was used which allows maximum accuracy to 31 bits.

The procedure was tested for matrices with $n$ ranging from 2 to 10. For each value of $n$, there were 20 successive trials; each trial consisted of a random perturbation of a randomly selected element of the matrix $M$, followed by a use of ADJUST, followed by the matrix multiplication $N := B \cdot M$. For each trial, the adjustment was evaluated by computing

$$\text{sum} := \left( \sum_{i=1}^{n} \sum_{j=1}^{n} N[i, j] \right) - n.$$ 

For random perturbations between $-1.0$ and $+1.0$, the value of sum never exceeded $2.0 \times 10^{-8}$.

There are two typographical errors present:

$B[r, s] := A[r, s] - t \times A[r, i] \times A[j, s]$ end

should be

$B[r, s] := A[r, s] - t \times A[r, i] \times A[j, s]$ end

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