

ALGORITHM 96

ANCESTOR

ROBERT W. FLOYD

Armour Research Foundation, Chicago, Ill

The correctness of these results was confirmed by inspection of the network diagrams.

procedure ancestor (m, n); **value** n; **integer** n; **Boolean** array m;

comment Initially $m[i, j]$ is **true** if individual i is a parent of individual j . At completion, $m[i, j]$ is **true** if individual i is an ancestor of individual j . That is, at completion $m[i, j]$ is **true** if there are k, l , etc. such that initially $m[i, k], m[k, l], \dots, m[p, j]$ are all **true**. Reference: WARSHALL, S. A theorem on Boolean matrices, *J.ACM* 9(1962), 11-12;

begin**integer** i, j, k;**for** i := 1 **step** 1 **until** n **do****for** j := 1 **step** 1 **until** n **do****if** m [j, i] **then****for** k := 1 **step** 1 **until** n **do****if** m [i, k] **then**m [j, k] := **true****end** ancestor

CERTIFICATION OF ALGORITHM 96

ANCESTOR [Robert W. Floyd, *Comm. ACM*, June, 1962]

HENRY C. THACHER, JR.*

Argonne National Laboratory, Argonne, Ill.

* Work supported by the U.S. Atomic Energy Commission

The body of this procedure was tested on the LGP-30 using the Dartmouth translator. After inclosing conditional statements in **begin end** brackets (apparently necessary for this translator), the procedure operated satisfactorily for the following matrices:

 $n = 5$, Time: 8'15"

F T T F F	F T T T T
F F F F T	F F F F T
F F F T F	→ F F F T T
F F F F T	F F F F T
F F F F F	F F F F F

 $n = 6$, Time: 13'15"

F T T F F F	F T T T T T
F F F T F F	F F F T F T
F F F F T F	→ F F F T F T
F F F F F T	F F F F F T
F F F F F F	F F F F F F

 $n = 9$, Time 31'2"

F T T F F F F F F	F T T T T T T T T
F F F F T F F F F	F F F F T T T T F
F F F T T F F F F	F F F T T T T T T
F F F F F F F F T	F F F F F T T T T
F F F F F T T F F	→ F F F F F T T T F
F F F F F F T F F	F F F F F F T F F
F F F F F F T F F	F F F F F F T F F
F F F F F F F F F	F F F F F F F F F
F F F F F T T F F	F F F F F T T T F