An APL permutation routine for computer search operations

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As Pecter (1975) has pointed out, one problem associated with computer searches for maximization, goodness of fit, etc. is the limited availability of permutation routines, particularly in convenient languages. If a single ordering of N integers produces an optimal combination (according to whatever criteria), the problem may be stated as that of creating a list of all $N!$ strings to be searched. This is an enormous task for any N greater than, say, 4 or 5, and may be a particularly noxious one for researchers limited to APL dial-up facilities rather than local computer support. Function PERMUTATIONS (see Table 1) is executed with the argument SIZE (for N) and calls EXTEND, which contains the algorithm for adding an additional integer to a string of any length. EXTEND may also be used independently for that purpose. The final solution, an $N!$ by N matrix named PERMS, whose rows represent all permutations of the integers 1 to N , is left global to the workspace and available for any searching functions that are performable in APL.

Support and Availability. These functions were developed on an IBM 370/128 system, under APL/SV. They are extensively condensed (and, hence, cryptic) for efficiency in light of the large number of line execu-

Table 1	
▽ PERMUTATIONS SIZE	
[1]	$C \leftarrow \rho P \leftarrow PERMS \leftarrow 1 \ 1 \ \rho 1$
[2]	$A \leftarrow P \leftarrow PERMS$
[3]	$PERMS \leftarrow ((!C), C) \rho D \leftarrow 0$
[4]	$B \leftarrow EXTEND \ P[D \leftarrow D+1;]$
[5]	$PERMS[(((D-1) \times C) + (!C));] \leftarrow NEW$
[6]	$\leftarrow (D < (!C-1)) / B$
[7]	$\leftarrow (SIZE \geq C+C+1) / A$
[8]	'THE PROGRAM HAS TERMINATED NORMALLY'
▽	
▽ EXTEND SET	
[1]	$V \leftarrow (((L + ((\rho SET) + 1)) * 2) - L) \rho SET$
[2]	$NEW \leftarrow (L, L) \rho L, (((L * 2) - 1) \rho ((L \rho 0), L))$
[3]	$R \leftarrow N + 0$
[4]	$ROWS \leftarrow (N = (\rho V)) / 0$
[5]	$R \leftarrow R + 1 + C + 0$
[6]	$COLS \leftarrow (C = L) / ROWS$
[7]	$\leftarrow (NEW[R; C+C+1] = L) / COLS$
[8]	$NEW[R; C] \leftarrow V[N+N+1]$
[9]	$\leftarrow (R \leq L) / COLS$
▽	

tions involved. Line-by-line comments, copies, and example uses may be obtained at no cost from the author at the Department of Psychology, State University of New York, Binghamton, New York 13901.

REFERENCE

- PECTER, R. Subroutine for generating all permutations of N integers. *Behavior Research Methods & Instrumentation*, 1975, 7, 57.