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ABSTRACT

A computer program which generates randomly sequenced problems for testing the abilities of students to add, subtract, and multiply one-digit numbers is described. Appendices provide tables of random sequences with directions for using the tables. The 54-statement FORTRAN program which can be used in generating additional sequences is also appended. (SD)

A Computer Program for Generating Sequences of Primary Arithmetic Facts in Random Order

by

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[1]The author wishes to express his thanks to Robert Barcikowski for his ideas concerning random ranking.

Abstract

The assessment of knowl dge of primary arithmetic facts often necessitates the random selection of n primary facts. A computer program, written in Fortran IV, was described which would generate the 100 primary facts in random order. Tables were presented which could be used to select random sequences of primary facts.

Teachers and researchers interested in measuring arithmetic skills at the primary level often have occasion for using sequences of primary facts. In this paper primary facts are defined as those combinations involving numbers 0 through 9 where each number is combined with itself and every other number. Subtraction and division primary facts can be considered the inverse of addition and multiplication facts (e.g., 4 + 8 then 12 - 8 and 2 x 9 then 18 ÷ 9). One problem which arises when using a sequence of different primary facts is the method of selecting combinations and the order in which they are to appear. Assume that an individual wished to have the 100 addition facts arranged in random order. Arranging these facts in random order would involve considerable busy work; repeatedly arranging these facts in random order would be a monumental task. The purpose of the present paper was to describe a computer program which would arrange the primary fact combinations in random order.

Programming

The program described herein was written in Fortran IV and compiled and run using the computer facilities at the State University of New York at Binghamton. The program consists of two major parts. The initial stage of the program generates 100 random numbers each having a value between 0.0 and 1.0. Random numbers were generated using a Scientific Subroutine Package program entitled RANDU. These numbers were then ranked from smallest to largest while at the same time a vector of integers 1 through 100 were ranked in a corresponding fashion. As an example, assume that the first four real random numbers generated were as follows: .345237568, .872345289, .336474590, .782352796. These numbers would then be ordered as .336474590, .345237568, .782352796, and .872345289. The corresponding vector of integers would then be reordered from 1, 2, 3 and 4 to 3, 1, 4 and 2. This procedure was used to randomly arrange integers 1, 2, 3...100.

The second phase of the program entailed matching each random ranking to a corresponding entry in a 10 x 10 matrix. As an example, the third integer in the integer vector might be 57. This value, 57, would correspond to the 6th row and 7th column of a matrix and the combination 6 7 would then be printed. Likewise a value of 86 in the integer vector would correspond to the 9th row and 6th column of a matrix thus resulting in the combination 9 6. The 10th row and 10th column of the matrix were interpreted as 0 so that the value 100 in the integer vector corresponded to the combination 0 0. The basic computer program is presented in Appendix C.

Tables 1 through 25 in Appendix A present various random arrangements of the 100 primary combinations. Appendix B presents random arrangements of the primary combinations but in a problem type format (addition, subtraction, multiplication). The problem presentation of combinations was achieved by simply changing the write FORMAT statements to print the appropriate sign and lines. For subtraction, the sum of each element was used as the minuend, and the second element of each combination as the subtrahend. Thus for the combination 2 8 the following subtraction combination would result 10 - 8. If division facts were desired one could simply find the product of each combination and use that value as the dividend, and designate the second value of each combination as the divisor, so that 5 8 becomes 40 ÷ 8. By ignoring facts which have 0 as the divisor, one can obtain the 90 pertinent division facts.

When using Tables 1 through 40 a convenient way to select a starting point is to randomly select two numbers 1 through 10. These numbers can then be used to find the entry in the ith column and the jth row. By recording this combination and proceeding left to right and row by row and, if necessary, continuing at the top of the table, the desired number of random facts can be obtained.

References

Corle, C. Teaching Mathematics in the Elementary School. New York: Ronald Press, 1964.

Appendix A

TABLE 1

6	2	8	0	6	7	4	7	8	5
7	6	4	5	8	5	5	7	0	0
3	7	6	4	8	3	0	1	8	3
2	2	5	8	3	8	1	5	1	3
7	2	6	9	7	8	8	6	3	2
6	1	4	2	1	8	6	5	4	2
5	9	4	8	9	1	7	3	1	3
7	3	7	2	1	3	8	1	9	9
5	4	1	7	9	6	1	2	1	6
5	0	4	0	6	6	6	8	0	2
7	0	0	7	2	0	3	7	8	6
3	7	4	9	9	9	6	4	5	3
2	9	2	6	2	4	9	8	4	5
7	4	5	0	3	1	5	7	4	4
1	4	0	1	5	3	0	4	5	0
2	6	3	8	6	5	2	3	1	6
2	0	1	3	2	0	3	4	8	6
0	8	1	7	4	0	0	2	9	1
9	9	5	1	9	4	5	5	9	5
0	9	3	7	8	9	8	9	7	2

TABLE 2

9	2	6	0	7	2	3	4	4	5
8	2	5	9	9	6	0	6	0	0
4	7	6	5	4	6	8	2	3	9
9	2	7	8	4	5	1	7	4	4
9	2	9	1	1	4	7	1	5	5
9	1	2	0	8	7	0	2	9	1
9	6	1	6	2	6	1	3	8	5
6	3	1	2	5	6	5	1	5	3
9	2	8	1	1	0	6	7	0	8
7	4	5	7	9	3	0	5	9	6
0	0	0	7	4	2	5	8	7	8
8	6	4	3	1	3	6	3	1	7
8	5	8	4	4	7	1	3	5	3
2	5	0	8	2	8	4	7	4	6
4	0	0	5	1	0	5	7	0	7
3	2	0	2	3	1	7	7	7	4
2	4	3	3	5	5	2	3	3	6
0	5	5	3	1	0	8	2	8	4
7	2	1	9	9	0	6	6	8	3
6	9	6	5	3	5	8	1	4	9

TABLE 3

5	0	2	8	9	6	5	5	0	4
4	2	8	0	8	8	0	7	7	2
7	7	3	8	8	4	9	4	4	9
2	3	6	6	2	9	4	4	8	9
1	0	6	4	5	3	6	3	6	1
8	4	3	1	9	7	9	2	7	0
5	8	6	2	1	0	2	7	2	1
1	4	0	1	3	5	2	9	7	2
0	9	1	0	2	4	8	7	3	6
6	6	7	0	4	5	9	1	0	5
3	6	5	2	2	7	4	3	7	5
3	4	2	6	0	7	6	1	6	6
3	0	1	6	3	8	1	7	9	9
9	8	9	1	8	1	6	8	7	3
0	5	2	5	9	7	8	7	8	7
1	5	9	3	5	4	7	0	8	5
0	1	8	9	0	1	4	8	2	4
9	1	5	1	3	5	7	3	3	0
3	2	3	9	1	4	5	9	6	6
5	5	4	2	4	3	8	0	2	6

TABLE 4

2	9	7	1	5	7	4	0	1	3
8	8	2	7	7	5	0	8	5	8
9	2	5	3	6	0	5	6	2	7
0	2	5	5	4	2	5	5	6	8
9	7	5	4	3	1	5	7	3	6
9	4	5	3	7	6	2	0	1	3
8	2	4	7	0	5	3	9	8	3
2	5	1	7	3	6	5	7	7	0
8	7	8	1	5	7	2	4	5	9
3	3	5	0	8	1	7	4	1	6
3	7	5	6	4	1	1	4	6	0
4	7	1	1	7	2	5	8	8	9
1	6	5	0	4	5	0	0	2	8
1	9	0	4	5	4	1	5	4	4
2	8	0	2	4	8	7	1	5	7
5	0	6	0	2	8	0	4	3	5
5	3	8	6	5	3	0	6	4	4
4	6	1	0	3	3	0	2	5	6
8	3	2	6	8	6	1	2	9	1
6	2	3	6	9	7	8	1	2	3

TABLE 5

8	5	9	3	1	5	8	3	9	4
1	5	9	5	6	0	3	0	8	9
8	5	7	3	0	1	0	7	3	6
8	1	7	2	6	5	3	2	6	1
7	0	8	4	9	0	9	3	2	9
4	2	9	0	0	0	5	4	1	7
6	0	0	8	2	7	4	6	8	7
2	4	8	6	4	9	5	8	7	0
5	2	2	6	5	8	2	3	4	4
6	9	9	5	3	2	3	7	3	8
8	2	1	1	1	8	7	1	1	5
0	5	3	9	2	5	6	0	1	9
0	2	8	6	9	4	3	6	3	3
1	0	4	6	2	4	8	3	3	1
5	9	1	7	5	6	4	4	9	4
8	4	8	8	2	0	6	7	1	2
6	0	7	5	2	7	1	9	6	2
7	9	5	7	7	1	7	6	4	8
9	2	4	5	0	7	2	6	1	0
3	6	1	4	7	3	2	9	4	5

TABLE 6

3	2	4	6	8	4	C	9	8	9
1	8	8	9	7	6	2	1	8	2
2	7	2	3	C	3	P	3	2	7
2	5	9	2	6	5	5	4	4	7
0	6	5	1	4	5	0	1	0	4
8	5	4	7	2	5	3	1	7	0
8	3	9	3	8	8	8	6	5	0
4	9	7	6	2	3	5	3	8	5
5	3	2	7	C	3	6	7	7	5
3	C	5	8	1	7	C	1	2	9
5	1	7	2	5	8	C	6	6	5
7	2	3	0	C	6	C	1	4	4
1	6	1	5	1	7	4	4	5	9
0	2	6	2	8	4	3	5	1	3
2	7	0	6	1	3	5	2	4	2
3	6	5	8	5	3	6	7	9	1
1	6	4	0	9	7	1	6	9	1
3	6	4	4	5	C	4	7	8	5
4	5	3	4	8	8	2	9	5	7
1	5	8	7	C	1	6	0	6	9

TABLE 7

4	4	9	9	6	0	8	7	3	2
1	0	4	8	7	5	4	5	7	8
0	7	4	9	2	1	9	6	2	1
1	0	3	7	7	4	9	6	3	2
5	7	5	3	6	9	6	6	2	8
2	4	9	4	C	1	3	9	C	8
2	9	9	9	4	2	3	5	8	5
9	7	6	0	2	1	C	0	6	1
6	3	5	5	4	4	4	5	7	8
5	5	8	3	5	6	7	7	8	2
4	1	3	3	9	6	3	0	2	2
8	3	2	3	3	4	8	8	5	6
8	7	4	6	3	7	5	5	8	8
3	9	9	8	1	1	4	5	5	9
0	0	1	0	C	8	2	9	C	7
9	0	1	3	7	C	4	5	4	7
3	6	2	7	1	3	C	1	7	4
9	2	2	3	5	6	6	9	6	4
8	5	9	1	6	1	C	7	1	1
1	6	2	8	1	C	2	2	7	6

TABLE 8

8	0	8	5	6	4	5	5	2	6
9	9	0	5	C	4	3	2	5	1
0	0	7	0	6	9	6	5	6	2
0	1	7	6	2	1	8	7	5	6
9	9	1	2	3	9	5	9	4	8
3	6	0	4	5	3	6	5	6	1
4	C	1	3	8	3	C	3	6	8
5	4	2	8	8	6	5	3	7	6
0	1	8	9	4	3	1	5	1	4
3	9	7	9	9	9	4	9	8	1
2	7	1	7	4	7	9	8	6	7
3	2	7	1	C	3	C	5	6	0
7	1	3	7	2	8	C	7	2	4
9	3	4	4	7	2	7	6	0	3
1	9	4	2	5	3	2	8	7	3
5	8	9	1	C	7	8	4	8	0
5	0	1	3	6	9	4	2	0	5
4	8	1	2	3	2	7	9	2	8
5	9	1	9	3	2	6	6	7	4
1	4	6	7	1	2	4	9	5	2

TABLE 9

4	3	9	5	8	C	C	3	7	5
7	1	3	7	3	8	1	4	3	3
9	2	3	1	9	1	6	7	7	5
8	C	6	0	5	2	6	1	9	1
0	4	9	4	6	9	4	6	1	5
0	8	C	9	8	9	1	9	9	9
1	8	5	7	8	1	C	1	5	4
8	9	5	2	6	4	2	1	4	0
9	0	9	2	5	6	4	5	6	6
7	7	1	8	6	C	6	8	7	2
4	2	3	8	3	2	9	1	3	3
4	3	3	1	C	1	4	6	8	9
9.	3	3	6	7	5	C	6	7	1
2	9	7	3	C	C	6	5	9	5
8	8	2	3	1	6	6	5	3	9
4	8	3	2	3	1	4	2	5	6
7	2	7	4	4	8	0	7	1	8
7	7	6	2	3	7	4	5	7	2
4	2	2	7	8	C	2	2	8	2
5	6	2	4	0	5	9	5	5	4

TABLE 10

1	1	5	4	4	9	3	2	7	3
9	3	1	5	4	5	3	4	7	2
4	3	0	3	6	8	7	5	6	1
8	0	1	1	7	1	5	9	0	8
7	7	2	6	8	2	8	6	2	2
9	4	3	9	0	9	8	4	0	7
0	0	6	7	6	3	7	6	1	2
5	6	1	3	6	9	0	3	2	8
0	4	4	5	5	5	2	5	0	3
4	2	7	2	3	2	5	6	3	7
0	3	8	4	5	8	9	8	9	6
2	4	7	6	0	9	2	3	4	5
3	0	9	2	0	9	9	5	5	4
6	8	3	2	0	6	0	8	4	1
1	7	1	2	8	1	9	9	8	2
4	2	1	1	2	7	7	9	5	6
1	1	3	0	6	4	8	9	9	5
5	6	8	9	8	3	6	1	8	5
4	7	8	5	7	1	0	4	7	3
9	8	4	7	1	0	7	0	6	5

TABLE 11

8	6	1	7	5	6	6	4	2	3
8	8	4	1	8	3	9	7	8	3
6	9	6	2	2	2	C	9	2	7
2	2	5	5	2	6	9	6	4	5
0	2	5	9	9	3	6	5	5	1
5	0	2	9	3	2	C	7	0	5
0	8	3	5	3	1	3	7	2	0
3	1	5	1	7	8	4	7	1	2
3	6	8	9	8	3	9	3	1	9
1	4	9	7	C	9	C	4	2	4
1	C	1	7	5	1	8	0	8	2
1	4	9	8	6	3	2	1	3	3
1	4	4	4	8	5	5	3	7	0
6	9	3	0	7	5	3	6	0	0
4	2	9	5	3	4	4	1	9	8
4	7	5	9	C	2	1	0	1	5
4	7	7	8	3	7	4	4	C	7
6	6	2	6	8	9	5	8	8	4
7	0	5	6	1	C	9	2	6	6
3	7	4	1	7	6	8	9	6	7

TABLE 12

4	5	0	6	9	7	0	2	6	1
9	6	6	6	1	2	0	1	2	9
5	6	3	6	9	9	5	0	4	6
7	0	8	5	4	8	5	4	4	1
7	9	5	2	1	3	2	7	6	0
1	2	2	0	2	2	9	4	4	1
1	7	4	8	0	4	8	3	1	9
4	3	7	0	9	8	1	0	7	6
8	3	7	1	5	4	7	1	6	9
7	4	8	8	4	2	0	0	3	5
7	5	9	2	6	3	0	4	4	2
6	0	9	7	9	9	7	0	6	5
9	5	1	4	3	8	8	2	0	8
6	8	6	1	6	9	3	3	8	2
3	6	9	2	7	8	7	1	7	3
7	7	3	9	5	8	9	1	7	1
9	1	8	2	8	0	0	5	9	6
0	3	5	4	4	5	3	1	7	8
3	2	5	3	4	4	1	2	5	0
3	2	9	5	3	5	5	8	3	2

TABLE 13

9	0	2	4	3	5	8	6	7	5
9	5	7	1	4	3	3	5	3	6
4	8	0	6	5	7	6	1	5	6
9	6	2	1	5	1	0	6	9	9
9	3	4	1	8	2	8	9	5	1
4	9	5	1	5	0	5	8	6	4
3	0	3	2	7	7	4	7	2	3
3	3	0	9	4	5	2	6	2	6
5	7	1	9	1	8	4	1	5	9
7	5	2	7	0	0	6	9	0	1
6	1	8	0	1	0	1	2	0	2
8	3	7	9	8	0	7	4	6	1
2	5	5	7	5	7	8	3	2	2
5	4	1	2	6	8	2	5	6	3
1	3	3	4	4	4	8	5	2	5
5	1	2	8	4	0	1	8	8	2
4	3	7	3	5	6	6	5	8	9
7	8	7	7	0	7	2	3	8	5
0	0	0	6	8	6	0	4	7	9
7	8	1	4	4	3	4	3	0	2

TABLE 14

6	4	8	1	2	8	7	2	2	1
8	6	9	0	4	0	5	0	9	7
3	0	8	5	3	3	2	6	4	4
3	1	8	1	9	0	1	1	9	8
2	6	7	8	0	6	9	1	9	5
2	7	2	1	9	9	9	2	2	8
0	6	4	9	0	8	7	3	7	5
8	0	2	1	6	6	8	6	7	3
6	2	0	5	9	4	7	9	1	1
6	3	7	0	5	5	0	8	6	9
4	5	5	4	5	3	8	5	1	6
0	7	9	3	4	7	4	6	5	2
0	6	9	4	9	8	4	5	6	3
5	3	0	7	6	2	1	5	4	5
7	1	8	3	9	1	2	1	5	7
4	4	3	1	3	3	6	8	2	3
3	9	1	8	2	0	0	2	7	2
8	4	1	8	2	2	3	5	1	8
7	2	0	7	4	9	3	1	8	6
6	7	0	9	4	7	4	4	7	5

TABLE 15

6	5	5	8	4	9	4	7	3	1
1	9	7	2	5	1	2	7	5	6
9	5	3	6	C	3	6	8	1	5
5	2	1	9	4	3	3	7	3	5
3	7	2	0	4	3	5	5	7	2
9	8	7	7	5	4	7	4	2	3
4	1	1	9	4	4	5	1	7	8
0	6	5	0	4	3	6	9	6	3
3	2	6	4	6	C	0	7	C	2
6	9	0	7	5	3	C	5	9	6
9	7	7	1	C	7	1	2	6	4
3	4	1	1	2	9	C	0	4	6
4	9	8	9	3	6	8	2	8	6
8	8	4	2	7	7	9	1	8	8
6	5	1	3	0	5	C	5	3	2
2	C	8	8	8	8	5	1	C	2
8	1	4	5	8	C	7	2	8	2
1	2	1	3	5	1	C	4	C	5
2	9	1	9	8	6	7	5	1	3
8	9	7	4	6	6	3	6	4	2

TABLE 16

3	7	3	4	9	0	9	9	9	8
3	8	1	5	8	6	9	0	3	4
6	4	4	9	3	2	9	5	4	7
2	8	4	4	6	8	5	1	0	6
5	7	5	6	2	8	8	6	3	1
5	1	6	0	2	7	2	8	5	6
7	3	8	6	5	5	1	0	7	8
2	7	6	7	8	4	7	7	3	9
0	7	5	1	2	3	1	1	4	9
2	5	9	9	1	4	8	1	6	2
1	0	4	1	3	1	2	9	5	1
5	3	7	4	0	8	7	1	0	2
2.	7	6	0	5	8	2	1	5	2
0	4	3	9	7	1	3	0	2	2
7	2	4	8	2	7	4	4	0	8
7	5	2	8	4	0	3	1	8	0
2	0	9	6	8	6	5	6	0	6
6	0	7	4	3	6	3	5	4	9
3	2	3	8	0	4	7	9	0	6
8	9	9	5	1	9	9	6	5	1

TABLE 17

4	4	1	0	7	C	6	6	7	2
3	1	5	9	4	C	8	1	1	1
2	3	8	6	2	8	1	9	8	5
3	1	2	2	4	3	2	2	1	6
1	4	6	7	5	9	5	5	9	2
3	0	3	5	9	4	3	7	0	9
5	0	8	9	3	8	7	6	9	1
5	4	9	9	2	5	6	4	5	7
2	0	2	4	1	7	8	3	1	2
C	5	7	7	C	3	C	7	6	0
0	8	1	3	C	1	1	3	8	8
6	7	9	9	3	8	1	6	6	4
1	4	8	6	1	5	7	9	3	6
7	6	8	7	4	4	7	6	5	5
4	9	6	6	C	9	7	5	9	7
2	1	9	0	1	8	8	2	7	9
4	3	4	9	2	5	2	7	2	2
4	9	5	3	8	1	2	2	6	5
0	7	0	5	3	4	4	6	5	3
2	0	8	0	4	8	9	6	8	3

TABLE 18

5	9	8	8	1	1	1	6	1	3
8	4	5	0	9	2	1	7	6	8
2	0	4	7	6	2	1	7	7	9
1	6	7	6	6	9	4	7	8	3
5	9	6	7	9	4	7	7	0	3
4	0	C	9	6	3	3	2	4	6
2	3	4	5	8	C	2	5	5	3
7	4	1	9	2	C	5	2	C	9
8	1	0	9	8	8	1	2	9	0
9	8	8	8	1	6	5	6	4	5
3	0	4	3	2	5	1	6	4	9
7	7	C	5	2	1	3	3	4	9
4	3	C	5	8	3	7	5	7	9
9	2	5	5	4	3	C	6	5	1
6	2	8	6	1	4	7	4	4	7
2	3	8	9	0	5	4	8	2	1
1	5	4	2	9	8	7	3	6	0
7	3	6	4	5	7	8	1	8	2
8	9	3	5	C	C	6	2	6	6
3	7	C	7	3	1	4	0	1	5

TABLE 19

1	8	2	0	4	7	4	2	5	0
7	4	C	5	0	3	7	9	9	6
3	9	1	6	3	8	8	7	2	1
4	6	6	1	3	3	1	0	7	2
2	7	3	9	0	3	3	0	6	3
6	2	2	0	9	8	1	4	9	5
4	2	7	3	2	2	9	1	5	1
3	8	5	9	5	1	9	0	2	3
0	4	8	8	6	9	7	5	7	4
7	6	2	8	6	1	4	4	1	9
2	6	4	9	8	1	C	8	4	0
2	7	5	7	6	1	8	9	8	2
3	6	5	9	C	8	7	6	8	5
6	5	7	5	C	5	8	4	7	0
6	0	2	0	1	1	7	1	9	6
2	3	3	1	5	9	6	8	2	3
9	5	5	4	9	5	5	3	9	9
8	5	6	4	C	3	8	7	3	4
1	6	6	4	5	3	2	7	4	7
4	8	C	1	1	0	4	7	2	9

TABLE 20

6	5	1	3	9	4	3	2	9	5
5	5	9	9	0	4	2	3	6	2
2	3	6	4	1	0	8	5	5	9
2	7	6	7	7	1	2	6	7	1
1	2	0	9	4	0	5	2	0	8
5	5	8	4	9	4	3	4	3	7
6	0	2	9	8	2	4	0	9	3
2	6	9	3	0	8	8	7	8	6
8	5	2	0	7	4	3	9	1	9
6	8	6	9	0	3	3	7	8	2
2	3	4	3	3	1	0	7	6	9
0	9	6	4	8	4	2	6	4	9
1	1	4	6	6	5	1	5	8	7
2	1	1	8	9	1	6	0	3	8
8	0	4	2	6	3	7	6	8	4
4	0	2	7	1	0	1	7	9	5
5	3	2	8	0	3	7	7	9	4
9	5	1	8	5	1	2	5	5	0
7	8	1	7	5	7	6	6	1	7
7	1	3	4	4	3	3	0	0	9

TABLE 21

2	1	0	1	2	1	0	3	5	7
5	1	8	3	6	0	4	2	4	5
9	4	4	5	8	8	0	9	0	0
2	0	6	6	3	9	6	6	1	0
3	9	6	9	3	0	1	2	7	1
3	0	6	3	7	7	5	2	6	6
4	7	9	4	7	2	2	0	3	5
9	4	4	8	2	8	0	5	4	9
6	4	1	6	0	5	5	5	1	9
5	7	9	1	9	0	8	3	7	9
6	1	7	3	5	0	8	6	1	8
8	4	7	5	1	2	2	0	2	1
4	5	3	3	7	7	8	2	6	4
3	7	1	8	9	3	7	3	7	4
9	8	8	2	6	1	9	6	4	2
7	0	6	6	4	8	8	2	2	9
8	5	0	4	9	6	3	2	4	9
8	5	3	5	1	3	9	7	1	5
6	8	5	2	3	7	2	7	8	7
9	5	2	4	0	8	1	0	4	1

TABLE 22

1	9	0	7	5	2	7	7	4	2
0	2	6	0	3	8	4	5	1	5
1	3	1	0	1	9	1	7	0	7
6	3	9	1	4	3	7	1	2	7
4	6	5	8	5	0	3	8	3	8
2	5	4	1	2	0	4	5	0	8
7	3	6	4	2	6	5	3	3	2
3	2	4	3	7	0	7	4	5	4
1	7	5	6	4	9	4	5	6	5
1	9	8	1	0	4	5	6	8	1
3	7	0	9	3	3	5	3	4	6
1	2	8	9	6	8	0	9	8	9
5	0	0	9	8	4	3	4	5	0
5	4	5	8	7	6	7	4	9	7
8	7	6	2	9	4	1	6	6	8
2	6	3	6	0	7	3	7	6	0
1	8	2	0	2	8	6	7	0	9
2	6	1	9	0	9	2	8	3	1
9	8	2	1	2	1	9	2	4	9
7	3	2	5	9	8	6	3	9	5

TABLE 23

2	7	1	1	0	8	7	3	1	3
2	8	4	3	2	2	0	9	9	7
5	8	0	3	3	5	9	6	6	9
1	5	7	1	0	9	2	8	4	3
4	2	9	6	5	9	2	7	4	5
3	1	6	7	7	0	4	1	1	4
6	0	5	3	1	3	3	8	0	1
0	4	6	0	6	3	7	6	1	8
2	4	4	7	4	9	8	7	6	6
7	4	2	6	5	9	4	3	6	5
9	7	7	2	2	1	5	2	8	0
1	9	4	6	0	2	8	8	1	3
6	5	8	0	6	5	0	2	5	3
1	2	9	9	9	5	5	5	0	4
3	9	6	9	0	4	5	2	3	8
2	8	2	4	8	9	3	9	8	8
7	4	1	1	9	7	0	3	7	2
2	6	1	0	5	7	0	5	5	3
4	1	1	6	4	3	8	0	9	4
7	5	7	3	8	6	3	6	7	0

TABLE 24

4	5	9	0	4	3	5	0	9	4
3	2	3	7	5	7	1	3	5	6
6	4	5	5	1	5	6	9	5	8
9	7	5	6	5	6	7	8	9	0
8	0	6	9	2	0	0	0	6	7
6	8	4	5	5	9	1	5	3	6
4	1	8	1	4	8	1	7	9	3
1	3	1	4	4	8	9	4	7	5
1	2	2	2	0	3	5	0	0	5
8	4	1	8	6	5	5	0	4	8
6	7	5	7	6	2	5	5	2	8
2	1	3	9	8	5	0	0	6	7
2	6	1	7	1	5	3	1	8	3
7	6	1	3	0	1	8	6	4	3
3	7	6	3	3	5	0	7	4	7
2	2	0	4	6	7	2	5	8	8
6	4	5	7	6	5	8	3	2	1
5	0	4	0	2	3	5	0	0	7
9	7	5	3	2	1	4	6	4	2
2	7	4	1	2	2	2	1	0	3

TABLE 25

3	0	8	8	9	3	1	0	4	3
2	4	0	1	7	9	8	2	3	1
9	6	4	0	7	7	7	2	1	0
9	6	0	3	4	8	5	4	2	5
1	4	1	5	4	2	7	8	7	2
9	5	1	6	8	3	7	7	1	0
3	7	5	6	5	3	7	6	4	5
7	3	5	7	0	3	0	2	2	1
8	9	9	2	4	0	6	5	4	8
2	8	3	6	4	1	4	9	7	8
4	5	1	0	0	1	1	6	5	1
1	3	7	7	9	0	6	9	2	4
2	8	5	7	5	7	8	5	3	2
7	4	4	2	8	9	5	7	4	5
2	8	8	0	2	0	9	2	9	4
2	3	5	0	8	6	2	1	1	9
3	6	4	9	9	1	6	5	7	9
6	8	6	0	5	5	3	1	6	4
6	3	8	2	0	6	9	3	3	1
5	8	9	9	8	0	6	5	0	3

Table 26

Appendix B

7 + 5	2 + 5	C + C	2 + 2	5 + 2	3 + 5	1 + 7	4 + 9	8 + 6	3 + 2
2 + 3	9 + 6	7 + 4	1 + 5	5 + 8	3 + 1	5 + 6	2 + 9	2 + 1	7 + 8
8 + 7	7 + C	6 + 8	4 + C	6 + 3	8 + 9	4 + 8	9 + 8	1 + 4	2 + 4
C + 5	1 + 1	4 + 7	4 + 1	1 + 6	4 + 2	3 + 4	5 + 7	6 + 6	4 + 3
3 + 7	1 + 3	6 + 9	5 + 4	C + 8	3 + 9	9 + 0	7 + 6	8 + 3	4 + 4
3 + C	7 + 7	6 + C	2 + C	C + 7	5 + 9	2 + 8	7 + 1	6 + 4	6 + 5
8 + 1	2 + 7	4 + 6	3 + 6	8 + C	7 + 9	C + 4	3 + 3	8 + 8	5 + C
9 + 4	9 + 5	1 + 9	9 + 1	6 + 2	1 + C	9 + 9	C + 1	C + 9	8 + 2
3 + 8	2 + 6	1 + 2	C + 2	8 + 4	9 + 3	5 + 1	4 + 5	1 + 9	9 + 5
7 + 3	6 + 7	9 + 2	6 + 1	5 + 5	5 + 3	C + 3	9 + 7	C + 6	7 + 2

7	8	8	6	4	4	5	1	9	6
+ 5	+ 7	+ 0	+ 1	+ 8	+ 5	+ 1	+ 0	+ 0	+ 3
4	4	6	8	1	3	0	1	7	9
+ 4	+ 3	+ 9	+ 4	+ 6	+ 2	+ 7	+ 1	+ 5	+ 9
5	6	5	2	6	3	7	2	9	4
+ 2	+ 7	+ 0	+ 9	+ 4	+ 1	+ 8	+ 3	+ 3	+ 5
8	9	7	3	6	5	7	9	1	3
+ 2	+ 7	+ 7	+ 6	+ 5	+ 5	+ 1	+ 2	+ 5	+ 3
2	2	4	1	5	0	2	3	6	8
+ 1	+ 5	+ 7	+ 2	+ 8	+ 1	+ 0	+ 5	+ 9	+ 1
6	2	0	9	8	0	1	5	5	3
+ 0	+ 6	+ 2	+ 1	+ 3	+ 5	+ 4	+ 4	+ 9	+ 4
0	4	0	9	7	0	9	3	4	1
+ 8	+ 6	+ 5	+ 5	+ 2	+ 4	+ 4	+ 3	+ 0	+ 3
2	1	5	6	7	8	4	3	2	3
+ 8	+ 8	+ 7	+ 0	+ 4	+ 5	+ 2	+ 7	+ 2	+ 0
0	8	7	7	5	0	4	8	0	9
+ 0	+ 6	+ 3	+ 6	+ 3	+ 3	+ 1	+ 9	+ 6	+ 6
1	1	7	8	2	5	8	5	2	3
+ 5	+ 7	+ 0	+ 2	+ 4	+ 5	+ 9	+ 6	+ 7	+ 9

8	1	4	5	1	C	D	8	6	7
+ 5	+ 4	+ 9	+ 3	+ C	+ 8	+ 4	+ 2	+ 7	+ 8
8	1	3	7	5	4	2	3	4	C
+ 8	+ 5	+ 6	+ C	+ 5	+ E	+ 7	+ 1	+ 7	+ 3
2	9	5	4	3	8	7	9	7	6
+ C	+ E	+ 6	+ 4	+ 7	+ C	+ 5	+ 5	+ 1	+ 4
6	E	7	3	1	3	C	8	D	9
+ 5	+ C	+ 9	+ 4	+ 1	+ 2	+ D	+ 5	+ 1	+ 8
2	E	8	5	C	5	7	6	5	1
+ 2	+ 4	+ 7	+ C	+ E	+ 4	+ 3	+ 5	+ 7	+ 6
1	4	9	E	2	5	2	3	D	3
+ 3	+ 1	+ 1	+ 3	+ 5	+ 2	+ 3	+ C	+ 2	+ 3
1	8	2	5	7	5	3	7	9	7
+ 8	+ E	+ 1	+ 1	+ 4	+ 2	+ 8	+ E	+ 7	+ 7
5	2	E	4	5	5	1	5	1	3
+ C	+ 4	+ 1	+ 3	+ 5	+ 4	+ 7	+ 8	+ 2	+ 9
2	4	C	4	3	E	8	C	4	1
+ E	+ 2	+ 5	+ C	+ 5	+ 8	+ 1	+ 5	+ 5	+ 5
2	5	4	C	E	E	5	7	2	8
+ 8	+ 3	+ 8	+ 7	+ 2	+ E	+ 5	+ 2	+ 5	+ 3

9	5	4	C	1	7	2	1	2	7
+ 9	+ 5	+ 5	+ 5	+ 8	+ 1	+ 1	+ 9	+ 4	+ 7
4	7	9	C	9	1	C	5	8	5
+ 4	+ 9	+ 5	+ 8	+ 2	+ 3	+ 9	+ 3	+ 2	+ 1
C	6	2	4	9	8	8	C	6	2
+ 2	+ 6	+ 6	+ 8	+ 3	+ 1	+ 7	+ 1	+ 1	+ 3
1	C	3	5	8	1	6	9	5	6
+ C	+ 7	+ 1	+ 9	+ 6	+ 5	+ 4	+ 8	+ 2	+ 5
8	4	7	7	C	1	8	3	7	1
+ 9	+ C	+ 2	+ 3	+ 4	+ 4	+ 4	+ 6	+ 8	+ 7
1	4	C	8	3	2	6	3	7	5
+ 6	+ 9	+ C	+ 8	+ 9	+ 2	+ C	+ 8	+ 4	+ 7
3	8	9	C	6	9	6	C	5	5
+ 5	+ ^	+ C	+ 6	+ 9	+ 1	+ 8	+ 3	+ 6	+ 4
7	1	2	2	2	4	3	5	4	8
+ 5	+ 1	+ 7	+ 5	+ 9	+ 6	+ 4	+ C	+ 1	+ 3
5	9	9	2	9	7	3	3	7	3
+ 8	+ 4	+ 6	+ 8	+ 7	+ 6	+ C	+ 7	+ C	+ 3
6	1	6	8	4	3	4	6	4	2
+ 2	+ 2	+ 3	+ 5	+ 2	+ 2	+ 3	+ 7	+ 7	+ 0

5	6	3	2	7	8	8	9	6	0
+ C	+ 7	+ 2	+ 3	+ 4	+ 3	+ 7	+ 9	+ 9	+ 4
3	4	5	7	1	9	1	2	5	9
+ 8	+ 3	+ 9	+ C	+ 3	+ 2	+ C	+ 6	+ 6	+ 6
8	8	7	8	4	5	1	2	3	3
+ 1	+ 4	+ 3	+ 8	+ 6	+ 4	+ 4	+ 2	+ 5	+ 9
C	9	4	5	3	1	6	3	7	3
+ 9	+ 3	+ 7	+ C	+ 3	+ 8	+ 8	+ 0	+ 8	+ C
5	3	1	6	6	8	C	2	7	7
+ 1	+ 6	+ 6	+ 1	+ C	+ 6	+ 7	+ 4	+ 1	+ 6
2	C	C	C	1	2	9	6	3	8
+ C	+ 3	+ C	+ 6	+ 9	+ 9	+ 5	+ 3	+ 1	+ 9
9	7	6	4	6	4	2	1	9	4
+ 1	+ 9	+ 2	+ 8	+ 5	+ 2	+ 8	+ 7	+ 8	+ C
4	4	5	7	9	C	2	7	5	3
+ 1	+ 9	+ 2	+ 5	+ 7	+ 8	+ 5	+ 2	+ 3	+ 7
6	5	2	7	1	1	C	8	6	4
+ 6	+ 8	+ 1	+ 7	+ 2	+ 1	+ 2	+ 2	+ 4	+ 4
4	5	3	5	2	8	C	1	5	0
+ 5	+ 4	+ 4	+ 5	+ 7	+ 5	+ 1	+ 5	+ 7	+ 5

Table 31

6	13	11	7	9	1	4	10	9	10
- 3	- 7	- 8	- 7	- 9	- 0	- 2	- 5	- 4	- 4
7	11	7	13	18	17	0	8	13	13
- 6	- 7	- 3	- 6	- 9	- 8	- 0	- 5	- 9	- 5
6	7	10	12	6	3	8	10	9	11
- 4	- 4	- 8	- 3	- 2	- 2	- 8	- 2	- 6	- 9
8	15	10	4	6	9	14	12	9	14
- 0	- 7	- 3	- 1	- 5	- 1	- 9	- 4	- 3	- 6
12	9	15	12	11	1	14	3	16	9
- 7	- 7	- 9	- 9	- 2	- 1	- 8	- 1	- 9	- 0
5	7	9	10	6	5	12	7	5	11
- 2	- 1	- 2	- 6	- 0	- 1	- 8	- 0	- 0	- 5
4	2	5	6	2	4	8	8	7	5
- 0	- 2	- 5	- 1	- 0	- 4	- 3	- 1	- 2	- 3
7	2	9	12	15	6	13	16	4	11
- 5	- 1	- 5	- 6	- 8	- 6	- 8	- 8	- 4	- 3
5	11	16	14	10	3	8	10	4	11
- 4	- 4	- 7	- 5	- 9	- 3	- 7	- 1	- 3	- 6
10	8	15	9	14	3	13	12	17	8
- 7	- 2	- 6	- 8	- 7	- 0	- 4	- 5	- 9	- 6

8	13	4	8	0	10	7	9	9	9
- 6	- 4	- 1	- 4	- 0	- 2	- 0	- 7	- 5	- 0
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7	3	15	3	15	11	12	10	4	12
- 2	- 2	- 8	- 0	- 6	- 5	- 5	- 9	- 3	- 4
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13	5	6	7	8	7	4	3	8	5
- 9	- 4	- 0	- 1	- 2	- 3	- 0	- 3	- 1	- 5
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10	7	2	10	13	17	12	8	12	14
- 5	- 6	- 0	- 6	- 7	- 9	- 8	- 0	- 9	- 5
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12	5	6	10	18	2	10	9	6	9
- 7	- 1	- 3	- 8	- 9	- 2	- 1	- 9	- 6	- 3
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7	6	16	16	10	12	8	6	4	11
- 7	- 2	- 9	- 7	- 7	- 3	- 7	- 4	- 4	- 2
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14	2	11	7	9	15	5	6	11	3
- 7	- 1	- 6	- 4	- 2	- 9	- 0	- 5	- 8	- 1
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1	10	5	1	8	12	5	8	11	10
- 0	- 4	- 3	- 1	- 8	- 6	- 2	- 3	- 3	- 3
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9	14	13	16	17	11	15	6	14	9
- 8	- 6	- 6	- 8	- 8	- 9	- 7	- 1	- 8	- 4
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13	11	8	13	9	9	4	11	14	7
- 5	- 4	- 5	- 8	- 6	- 1	- 2	- 7	- 9	- 5
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14	7	9	13	11	9	0	10	10	14
- 9	- 3	- 1	- 7	- 3	- 7	- 0	- 2	- 5	- 7
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9	4	4	7	8	11	10	3	6	7
- 4	- 4	- 1	- 7	- 5	- 7	- 9	- 3	- 1	- 1
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9	18	6	13	1	16	9	16	7	9
- 6	- 9	- 2	- 4	- 0	- 7	- 0	- 8	- 4	- 8
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2	9	5	8	2	8	2	12	17	14
- 2	- 3	- 0	- 6	- 1	- 3	- 0	- 9	- 8	- 5
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15	9	10	12	14	5	15	11	17	10
- 7	- 5	- 4	- 6	- 6	- 4	- 9	- 4	- 9	- 6
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6	15	6	13	11	6	8	5	1	8
- 6	- 6	- 5	- 5	- 6	- 3	- 0	- 3	- 1	- 8
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9	11	12	16	4	7	12	7	10	7
- 9	- 5	- 3	- 9	- 2	- 0	- 4	- 2	- 3	- 5
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11	5	4	9	8	6	6	3	13	14
- 9	- 1	- 0	- 2	- 1	- 0	- 4	- 0	- 9	- 8
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3	13	8	8	11	7	10	11	12	12
- 1	- 8	- 2	- 7	- 2	- 6	- 8	- 8	- 8	- 7
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3	8	5	15	5	10	4	13	12	10
- 2	- 4	- 5	- 8	- 2	- 1	- 3	- 6	- 5	- 7
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6	9	10	13	7	10	8	13	9	6
- 6	- 9	- 5	- 5	- 5	- 3	- 3	- 7	- 0	- 0
11	9	6	8	8	9	9	5	6	10
- 3	- 2	- 1	- 4	- 2	- 5	- 6	- 4	- 2	- 7
12	6	5	10	11	4	1	4	15	12
- 3	- 5	- 1	- 4	- 9	- 3	- 1	- 1	- 6	- 8
11	8	5	7	14	3	11	16	10	6
- 4	- 0	- 2	- 3	- 5	- 1	- 7	- 9	- 1	- 4
3	9	6	2	8	3	5	7	17	8
- 0	- 1	- 3	- 0	- 7	- 3	- 0	- 2	- 8	- 6
7	0	3	13	18	2	13	11	11	12
- 1	- 0	- 2	- 6	- 9	- 1	- 4	- 6	- 2	- 6
7	15	9	14	12	2	4	10	12	7
- 6	- 9	- 8	- 9	- 7	- 2	- 0	- 6	- 9	- 4
1	7	15	7	17	11	10	14	10	4
- 0	- 7	- 8	- 0	- 9	- 8	- 9	- 6	- 8	- 2
16	5	13	12	8	8	8	10	5	16
- 7	- 5	- 9	- 4	- 1	- 8	- 5	- 2	- 3	- 8
4	11	14	9	9	15	9	14	12	13
- 4	- 5	- 8	- 3	- 7	- 7	- 4	- 7	- 5	- 8

8 - 1 =	11 - 4 =	11 - 2 =	3 - 1 =	8 - 0 =	8 - 5 =	9 - 4 =	14 - 6 =	5 - 0 =	13 - 7 =
12 - 6 =	7 - 6 =	6 - 1 =	6 - 0 =	14 - 5 =	0 - 0 =	3 - 3 =	11 - 5 =	9 - 6 =	12 - 4 =
5 - 4 =	8 - 2 =	12 - 8 =	16 - 7 =	5 - 2 =	4 - 4 =	13 - 6 =	10 - 7 =	9 - 3 =	15 - 6 =
10 - 9 =	10 - 8 =	10 - 6 =	3 - 2 =	11 - 6 =	9 - 5 =	4 - 2 =	9 - 8 =	6 - 5 =	2 - 1 =
12 - 3 =	8 - 8 =	13 - 8 =	12 - 7 =	9 - 2 =	14 - 8 =	9 - 9 =	10 - 3 =	13 - 9 =	8 - 4 =
3 - 0 =	5 - 3 =	4 - 3 =	9 - 1 =	15 - 9 =	15 - 8 =	17 - 9 =	8 - 7 =	2 - 0 =	14 - 9 =
7 - 7 =	8 - 3 =	10 - 4 =	1 - 0 =	13 - 5 =	15 - 7 =	9 - 7 =	17 - 8 =	6 - 2 =	7 - 0 =
6 - 6 =	11 - 3 =	10 - 5 =	9 - 0 =	12 - 5 =	2 - 2 =	11 - 9 =	4 - 0 =	10 - 2 =	12 - 9 =
7 - 4 =	18 - 9 =	5 - 5 =	4 - 1 =	14 - 7 =	16 - 9 =	8 - 6 =	6 - 3 =	7 - 2 =	11 - 7 =
7 - 1 =	5 - 1 =	11 - 8 =	1 - 1 =	7 - 5 =	16 - 8 =	13 - 4 =	6 - 4 =	7 - 3 =	10 - 1 =

6	2	1	C	9	C	1	1	1	4
X 3	X 4	X 7	X 4	X 5	X 5	X 2	X C	X 9	X 9
C	9	3	6	7	7	8	3	5	6
X 2	X 8	X 4	X 7	X 6	X 2	X 2	X 1	X 5	X 1
7	8	3	8	C	6	3	8	4	4
X 9	X ?	X 2	X 1	X 1	X 4	X 6	X 7	X 6	X 2
1	4	9	8	6	2	0	2	7	3
X 1	X C	X 1	X 6	X 2	X 2	X 3	X C	X 5	X 0
8	4	7	1	6	C	6	8	6	0
X 8	X 7	X 1	X 4	X 8	X [illegible]	X 9	X [illegible]	X [illegible]	X 7
4	2	5	4	C	5	5	8	0	4
X 4	X 7	X 4	X 8	X 8	X 6	X 3	X 5	X 9	X 1
8	2	9	[illegible]	3	3	1	1	1	2
X 9	X 1	X 7	X 6	X 3	X 9	X 5	X 8	X [illegible]	X 6
5	5	7	9	9	2	5	2	3	1
X 9	X 1	X 8	X 2	X 9	X 3	X C	X 8	X 5	X 3
4	3	6	7	3	4	5	9	8	7
X 3	X 7	X 6	X 4	X 8	X 5	X 2	X 0	X 4	X 7
9	2	5	7	C	9	2	7	6	5
X 4	X 9	X 8	X 3	X 6	X 3	X 5	X 0	X 5	X 7

4	5	6	0	6	7	C	2	9	3
X 4	X 2	X 7	X 6	X C	X 6	X 5	X 3	X 3	X C
2	1	3	7	4	1	1	4	9	3
X 8	X 9	X 4	X 4	X 7	X 6	X 5	X 3	X 6	X 3
2	4	C	5	2	5	C	5	3	3
X 4	X 1	X 2	X 7	X 9	X 4	X C	X 1	X 7	X 5
5	2	2	5	3	1	7	C	5	5
X 1	X 2	X 7	X 9	X 1	X 4	X 5	X 3	X 6	X C
5	1	8	2	6	6	4	8	4	3
X C	X 9	X 7	X 6	X 5	X 2	X 8	X 3	X 2	X 2
8	8	2	2	7	C	2	4	C	1
X 5	X 1	X 5	X C	X 3	X 4	X 1	X C	X 8	X 3
8	8	4	7	8	7	4	8	6	5
X 8	X 4	X 9	X 7	X 2	X C	X 6	X C	X 9	X 5
1	1	5	8	7	3	6	1	5	0
X C	X 7	X 9	X 5	X 1	X 6	X 1	X 1	X 2	X 7
5	5	3	5	5	C	8	9	1	7
X 5	X 3	X 9	X 7	X 4	X 1	X 6	X 8	X 2	X 9
6	5	6	6	4	C	6	7	7	3
X 6	X 8	X 3	X 4	X 5	X 9	X 8	X 2	X 8	X 8

2 x 3	7 x 9	6 x 4	5 x 5	7 x 8	6 x 6	5 x 3	5 x 4	6 x 9	9 x 3
6 x 0	2 x 0	1 x 5	7 x 5	6 x 3	5 x 1	8 x 1	1 x 9	7 x 2	4 x 9
1 x 2	4 x 7	2 x 9	9 x 9	9 x 9	3 x 4	3 x 3	3 x 2	5 x 2	4 x 3
5 x 7	6 x 8	9 x 0	1 x 3	3 x 5	4 x 6	4 x 1	0 x 6	9 x 7	1 x 6
2 x 2	8 x 6	5 x 6	0 x 7	9 x 4	7 x 4	0 x 8	2 x 1	9 x 1	7 x 3
0 x 0	0 x 3	2 x 5	2 x 8	8 x 2	7 x 7	3 x 6	2 x 4	3 x 8	0 x 2
4 x 5	8 x 4	1 x 1	6 x 2	8 x 8	0 x 1	4 x 9	3 x 1	6 x 5	3 x 9
7 x 0	5 x 0	8 x 0	3 x 0	9 x 7	8 x 9	1 x 8	9 x 5	4 x 4	0 x 4
7 x 6	1 x 0	9 x 6	7 x 1	1 x 7	4 x 2	6 x 1	5 x 8	9 x 2	2 x 7
5 x 9	6 x 7	1 x 4	0 x 5	4 x 0	0 x 9	8 x 3	2 x 6	3 x 7	8 x 5

4	6	4	8	5	7	4	C	7	1
X 8	X 5	X 2	X 1	X 3	X 2	X 5	X 9	X C	X 3
3	C	6	4	8	7	2	C	7	8
X 4	X C	X 1	X 1	X 5	X 8	X 6	X 6	X 3	X 7
4	5	3	2	5	2	8	4	8	9
X 4	X 7	X 2	X C	X 5	X 4	X 9	X 5	X 3	X 6
4	7	8	8	5	9	6	9	2	6
X 9	X 5	X C	X 4	X 1	X 5	X 7	X 9	X 1	X 3
1	2	9	9	2	1	C	C	9	1
X C	X 2	X 1	X 2	X 5	X 7	X 8	X 2	X 4	X 2
1	7	6	6	4	7	4	5	6	3
X 1	X 1	X 9	X 6	X 3	X 4	X 7	X 4	X 2	X 1
9	9	5	7	1	2	5	1	5	1
X 3	X 7	X 9	X 6	X 6	X 5	X C	X 9	X 8	X 4
7	9	5	3	2	3	3	0	0	3
X 7	X 8	X 2	X 6	X 8	X 7	X 8	X 7	X 3	X 3
3	0	6	6	1	8	C	1	3	6
X 9	X 1	X C	X 4	X 5	X 6	X 5	X 8	X 5	X 8
7	3	2	9	8	4	8	2	C	5
X 9	X C	X 3	X C	X 8	X C	X 2	X 7	X 4	X 6

2	7	1	1	8	6	5	8	1	6
X 1	X 6	X 6	X 9	X 6	X 3	X 9	X 8	X 4	X 6
2	2	1	2	C	5	4	C	8	0
X 8	X C	X 5	X 6	X 5	X 6	X 9	X C	X 1	X 6
6	2	8	C	3	7	4	3	6	0
X 1	X 5	X 2	X 2	X 7	X 4	X 1	X 6	X 7	X 4
7	5	6	6	4	9	3	3	8	9
X 1	X C	X 9	X 2	X 8	X 5	X 3	X 9	X C	X 8
1	7	4	9	C	6	3	5	8	1
X 2	X 5	X 6	X 7	X 3	X 4	X C	X 8	X 3	X 8
C	5	C	2	5	7	9	1	8	3
X 9	X 7	X 8	X 9	X 3	X 3	X 1	X 3	X 5	X 2
2	1	9	5	2	C	6	4	9	4
X 3	X 1	X C	X 1	X 2	X 1	X 8	X 2	X 9	X 3
7	3	9	4	7	5	C	3	9	9
X 7	X 4	X 4	X 5	X 9	X 2	X 7	X 8	X 3	X 6
7	2	3	6	7	5	8	8	6	4
X C	X 4	X 1	X 5	X 8	X 4	X 4	X 9	X C	X 0
7	2	3	1	5	8	4	9	1	4
X 2	X 7	X 5	X 0	X 5	X 7	X 4	X 2	X 7	X 7

Appendix C

```
01          DIMENSION RAND(100), IORDER(100), NRANK(2,100)
      C    READ SEED VALUE (COLUMNS 1-9) AND NUMBER OF RUNS (COLUMNS 10-14)
02          5 READ (5, 10, END=75) ISEED, NRUNS
03         10 FORMAT(19, 15)
      C    GENERATE RANDOM SEQUENCE OF INTEGERS 1 THROUGH 100
04            CALL RANDU(ISEED, IY, RN)
05            DO 70 IR=1,NRUNS
06            DO 15 I=1,100
07            CALL RANDU(IY, IY, RN)
08            RAND(I)=RN
09         15 IORDER(I)=I
10            MHIGH=99
11         20 LARG=1
12            DO 25 J=1,MHIGH
13            IF(RAND(J) .LE. RAND(J + 1)) GO TO 25
14            HOLD=RAND(J)
15            RAND(J)=RAND(J + 1)
16            RAND(J + 1)=HOLD
17            RHOLD=IORDER(J)
18            IORDER(J)=IORDER(J + 1)
19            IORDER(J + 1)=RHOLD
20            LARG=J
21         25 CONTINUE
22            IF(LARG .EQ. 1) GO TO 30
23            MHIGH=LARG - 1
24            GO TO 20
25         30 CONTINUE
      C    RELATE EACH RANDOM RANK TO AN ENTRY IN A 10 BY 10 MATRIX
26            DO 40 I=1,100
27            NAXIS=IORDER(I) + 10
```

```
28          XTEN=NAXIS / 10
29          NTEN=XTEN
30          NHUN=NTEN * 10
31          MAXIS=NAXIS - NHUN
32          NAXIS=(NAXIS - 1) / 10
33           IF(NAXIS .EQ. 10) NAXIS=0
34          NRANK(1,I)=NAXIS
35       40 NRANK(2,I)=MAXIS
      C    PRINT 100 PRIMARY FACTS
36          WRITE(6,45) IR
37       45 FORMAT('1'//39X, 'TABLE ', I2//)
38          KK=1
39          NN=10
40          DO 55 IW=1,10
41          IF(IW .EQ. 1) GO TO 50
42          KK=KK + 10
43          NN=NN + 10
44       50 CONTINUE
45          DO 55 IL=1,2
46          IF(IL .EQ. 1) WRITE(6,60) (NRANK(IL, J), J=KK,NN)
47          IF(IL .EQ. 2) WRITE(6,65) (NRANK(IL, J), J=KK,NN)
48       55 CONTINUE
49       60 FORMAT(10X, 1016)
50       65 FORMAT(10X, 1016//)
51       70 CONTINUE
52          GO TO 5
53       75 STOP
54          END
```