

Sorting of data

(Reference: Chapter 8 in W. H. Preuss, *et al.*, Numerical Recipes in Fortran, 2nd ed., Cambridge University Press, 1992)

Learning objectives

1. Develop problem solution skills using computers and numerical methods
2. Review of methods for sorting of tabular data
3. Develop programming skills using FORTRAN
 - New FORTRAN elements in this module
 - subroutines

Introduction

Sorting of tabular data may seem trivial, and perhaps not worth spending time learning. After all, most of our needs may be filled by the capabilities of Excel or some other spreadsheet program. Just by marking the data to be sorted, and pressing the *Sort*-button, and the job is done.

However, frequently we have measured data from the laboratory or the field, or data-sets that have been generated numerically, that we need to input to a computer program that requires that the numbers are sorted in ascending or descending order. Although we in most cases may easily import the data into Excel and perform sorting of the data before returning it to the input file of the computer program, it will in many cases be convenient to be able to call a subroutine that checks if an input data set is properly sorted, and if not, do a sorting procedure.

Several methods for sorting exist, as you may see in the reference above. For our purpose, we will use the *Straight insertion method* to illustrate sorting of data.

Straight insertion method

Straight insertion is a simple method which uses simple picking and insertion for sorting one number at a time. In the table below, an example of such sorting is illustrated. Given an initial sequence of unsorted data, the first run finds the first number (1) that is out of sequence relative to the first number (7), and puts it into sequence. Then, the next number out of sequence (4) is located and put into its right place. In the third run, the third number out of sequence (6) is put in its right place, and so on. For this particular table, it takes 6 runs to sort the entire sequence of numbers.

<i>Initial order</i>	7	1	8	4	6	3	5	2
<i>After 1st run</i>	1	7	8	4	6	3	5	2
<i>After 2nd run</i>	1	4	7	8	6	3	5	2
<i>After 3rd run</i>	1	4	6	7	8	3	5	2
<i>After 4th run</i>	1	3	4	6	7	8	5	2
<i>After 5th run</i>	1	3	4	5	6	7	8	2
<i>After 6th run</i>	1	2	3	4	5	6	7	8

Programming exercise

1. Make a MAIN PROGRAM that reads tabular data (N pairs of values of XT and YT) from an input file IN.DAT, and a FORTRAN subroutine, SORT(N,XT,YT), that may be called with the data as input arguments, which sorts the values in ascending order before returning the results to the calling program. Print the initial data table as well as the sorted table to an output file OUT.DAT
2. Test the subroutine by sorting the following table according to increasing values of x . The corresponding value of y is to be sorted together with x .

x	y
0,2	0,008
1,0	1,0
0,4	0,064
0,6	0,216
0	0
0,8	0,512

References to Numerical Recipes:

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