Computer Science 3731/6906 **Fall 2018**

Assignment 6

Date due: October 31 (in class) See Assignment 2 for instructions on electronic submission.

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1. Write an array–returning function *FindOrder(A,n)* which returns an integer array ordering the elements of the integer array $A[1:n]$, i.e., which returns such an array $R[1:n]$, that:

$$A[R[i]] \leq A[R[j]] \text{ for } 1 \leq i < j \leq n.$$

   For example, if $A = [1, 3, 6, 3, 2, 6, 5]$, the returned array is $[1, 5, 2, 4, 7, 3, 6]$, i.e., the sequence $A[R[1]], A[R[2]], ...$ is ordered.

   Write also a Fortran program which reads the data, invokes *FindOrder* and prints the results.

2. Permutations of n elements can be systematically generated using an integer n–element array, initialized to $[1, 2, ..., n]$, and systematically rearranging elements of this array. For example, if $n = 5$, the consecutive permutations are:

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[1,2,3,4,5]
[1,2,3,5,4]
[1,2,4,3,5]
[1,2,4,5,3]
[1,2,5,3,4]
[1,2,5,4,3]
[1,3,2,4,5]
..........
[5,4,3,2,1]
```

   Write a logical Fortran function *NextPerm(A,n)* which generates the next permutation of elements of an integer array $A[1:n]$ and returns TRUE if the next permutation exists; otherwise FALSE is returned.

   Write also a Fortran program which reads the data, invokes *NextPerm* several times and prints the results.

   Hint: The next permutation can be generated by searching from the right end of A for the first pair of increasing consecutive elements. Let the first element of this pair be denoted x. x is swapped with the smallest element greater than x among the elements following x, and then the part following (the original) x is ordered. For example. if $A = [1, 2, 5, 4, 3]$, the first pair of increasing elements from the right end is $(2, 5)$, so $x = 2$. It is swapped with 3 and then the last 3 elements of A are ordered, so the generated permutation is $A = [1, 3, 2, 4, 5]$. If $A = [3, 5, 4, 2, 1]$, the next permutation is $A = [4, 1, 2, 3, 5]$. There are $n!$ permutations of n elements.