

# IE531: Algorithms for Data Analytics

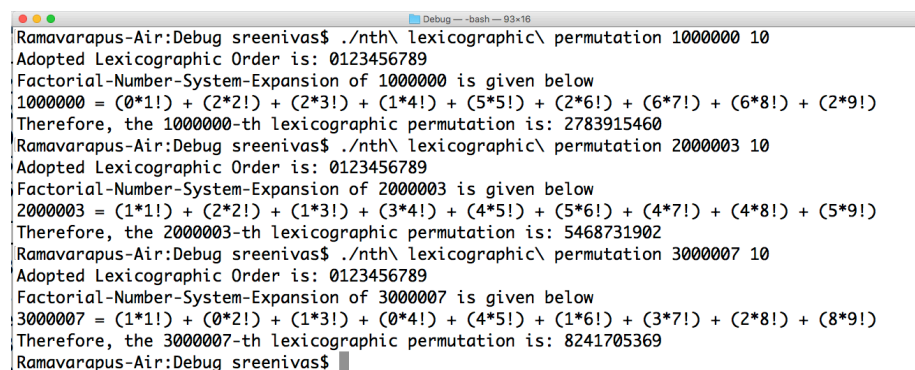
## Spring, 2016

### Programming Assignment 1: Listing the $n$ -th Lexicographic Permutation of a Symbol-Set with $m$ Symbols

**Due Date: February 29, 2016**  
©Prof. R.S. Sreenivas

This assignment is a generalization of [Problem 24 of Project Euler](#). The objective is to retrieve (or, reconstruct) a cataloged-object from a (large) collection of such objects that are ordered **lexicographically** (i.e. in “dictionary-order”). We will restrict attention to the case where the “alphabet” (over which the lexicographic/dictionary-order is maintained) is the numbers  $\{0, 1, \dots, m\}$  ( $m \leq 9$ ), where 0 is the first-member, 1 is second-member, 2 is the third-member etc. of the “alphabet.” The objective is to generate the  $n$ -th member of the lexicographic list.

You are going to write a C++ program that will take the numbers  $n$  and  $m$  are command-line variables. A sample output is shown in figure 1. I have uploaded a `hint.cpp` file on Compass, in case you need help. Before you attempt this problem make sure you view the flipped-classroom video on this assignment, and the video that covers the Academic Integrity issues that are important to this course.



```

Ramavarapus-Air:Debug sreenivas$ ./nth\ lexicographic\ permutation 1000000 10
Adopted Lexicographic Order is: 0123456789
Factorial-Number-System-Expansion of 1000000 is given below
1000000 = (0*1!) + (2*2!) + (2*3!) + (1*4!) + (5*5!) + (2*6!) + (6*7!) + (6*8!) + (2*9!)
Therefore, the 1000000-th lexicographic permutation is: 2783915460
Ramavarapus-Air:Debug sreenivas$ ./nth\ lexicographic\ permutation 2000003 10
Adopted Lexicographic Order is: 0123456789
Factorial-Number-System-Expansion of 2000003 is given below
2000003 = (1*1!) + (2*2!) + (1*3!) + (3*4!) + (4*5!) + (5*6!) + (4*7!) + (4*8!) + (5*9!)
Therefore, the 2000003-th lexicographic permutation is: 5468731902
Ramavarapus-Air:Debug sreenivas$ ./nth\ lexicographic\ permutation 3000007 10
Adopted Lexicographic Order is: 0123456789
Factorial-Number-System-Expansion of 3000007 is given below
3000007 = (1*1!) + (0*2!) + (1*3!) + (0*4!) + (4*5!) + (1*6!) + (3*7!) + (2*8!) + (8*9!)
Therefore, the 3000007-th lexicographic permutation is: 8241705369
Ramavarapus-Air:Debug sreenivas$

```

Figure 1: Sample output for this assignment. In all of these illustrative examples  $m = 10$  (i.e. the “alphabet” is  $\{0, 2, \dots, 8\}$ ). I have presented the results for three cases here (viz.  $n = 1000000$ ,  $n = 2000003$  and  $n = 3000007$ )