

Combinatorics HW 2.2

Student ID: 2020280261

Name: Samuel Pegg

Score:

1. Find the 2020th permutation with nine numbers of 1-9 in lexicographic order? The first permutation is 123456789.

The 2020th permutation is 2019 permutations forward. Using integer division, we get the following table:

2019 mod 1	0	2019/1	1
2019 mod 2	1	2019/2	1010
1009 mod 3	1	1009/3	336
336 mod 4	0	336/4	84
84 mod 5	4	84/5	16
16 mod 6	4	16/6	2
2 mod 7	2	2/7	0
0 mod 8	0	0/1	0
0 mod 9	0	0/1	0

Hence we can write 2019 as follows:

$$2019 = 0 \times 8! + 0 \times 7! + 2 \times 6! + 4 \times 5! + 4 \times 4! + 0 \times 3! + 1 \times 2! + 1 \times 1! + 0 \times 0!$$

Starting with a blank output, we add the 0th element of the permutation 123456790, which is 1. This gives us a new output.

Output = 1

Then remove 1 since we cannot have it repeated: this leaves us with 23456789. Next we add the 0th element of 2345678, 2, hence our output is now

Output = 12

Continuing this process, we get the following:

3456789 – want 2nd element

Output = 125

346789 – want 4th element

Output = 1258

34679 – want 4th element

Output = 12589

3467 – want 0th element

Output = 125893

467 – want 1st element

Output = 1258936

47 – want 1th element

Output = 12589367

4 – want 0th element

Output = **125893674**

Hence the 2020th permutation is **125893674**. This can be verified with my OJ3, Generating Permutation Lexicographically code.