Project Euler #24: Lexicographic permutations

This problem is a programming version of Problem 24 from projecteuler.net

A permutation is an ordered arrangement of objects. For example, $dabc$ is one possible permutation of the word $abcd$. If all of the permutations are listed alphabetically, we call it lexicographic order. The lexicographic permutations of abc are:

$$\mathbf{abc} \quad \mathbf{acb} \quad \mathbf{bac} \quad \mathbf{bca} \quad \mathbf{cab} \quad \mathbf{cba}$$

What is the N^{th} lexicographic permutation of the word $abcdefghijklm$?

Input Format

The first line contains an integer T , i.e., number of test cases.
Next T lines will contain an integer N.

Constraints

$1 \leq T \leq 1000$
$1 \leq N \leq 13!$

Output Format

Print the values corresponding to each test case.

Sample Input

```
2
1
2
```

Sample Output

```
abcdefghijklm
abcdefghijkml
```

Solution:

position → length ℓ : word

$0 \cdot (\ell-1)! + 1 \rightarrow 1 \cdot (\ell-1)! : a$

$1 \cdot (\ell-1)! + 1 \rightarrow 2 \cdot (\ell-1)! : b$

...

$3 \cdot (\ell-1)! + 1 \rightarrow 4 \cdot (\ell-1)! : d$

pos = 0 ⇒ pick "a"

queue = [a, b, c, d]

$n \leftarrow n - pos \cdot (\ell-1)!$

$0 \cdot (\ell-2)! + 1 \rightarrow 1 \cdot (\ell-2)! : ab$

$1 \cdot (\ell-2)! + 1 \rightarrow 2 \cdot (\ell-2)! : ac$

...

pos = 1 ⇒ pick "c"

queue = [b, c, d]

$n \leftarrow n - pos \cdot (\ell-2)!$

$0 \cdot (\ell-3)! \rightarrow 1 \cdot (\ell-3)! : acb$

...

pos = 0 ⇒ pick "b"

queue = [b, d]

$n \leftarrow n - pos \cdot (\ell-3)!$

$0 \cdot (\ell-4)! \rightarrow 1 \cdot (\ell-4)! : acbd$

queue = [d]

$n \leftarrow n - pos \cdot (\ell-4)!$

→ acbd