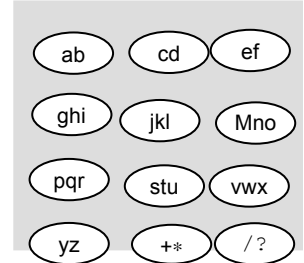


## Problem D

### Optimal Keypad

Optimus Mobiles produces mobile phones that support SMS messages. The Mobiles have a keypad of 12 keys, numbered 1 to 12. There is a character string assigned to each key. To type in the  $n^{\text{th}}$  character in the character string of a particular key, one should press the key  $n$  times. Optimus Mobiles wishes to solve the problem of assigning character strings to the keys such that for typing a random text out of a dictionary of common words, the average typing effort (i.e. the average number of keystrokes) is minimal.



To be more precise, consider a set of characters  $\{a, b, c, \dots, z, +, *, /, ?\}$  printed on a label tape as in Fig. 2. We want to cut the tape into 12 pieces each containing one or more characters. The 12 labels are numbered 1 to 12 from left to right and will be assigned to the keypad keys in that order.

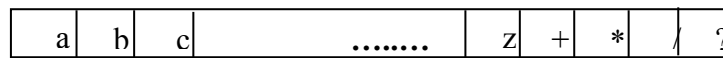


Figure 2

You are to write a program to find the 11 cutting positions for a given dictionary of common words. The cutting positions should minimize the average number of keystrokes over all common words in the dictionary. Your output should be a string of 11 characters, where character  $i$  in this string is the first character of the  $(i+1)^{\text{th}}$  label.

#### Input (filename: D.IN)

The first line contains a single integer  $t$  ( $1 \leq t \leq 10$ ), the number of test cases. Each test case starts with a line, containing an integer  $M$  ( $1 \leq M \leq 10000$ ), the number of common words in the test case. In each  $M$  subsequent line, there is a common word. Each common word contains at most 30 characters from the alphabet  $\{a, b, c, \dots, z, +, *, /, ?\}$ .

#### Output (Standard Output)

The output contains one line per test case containing an optimal cut string. Obviously, there may be more than a single optimal cut string, so print the optimal cut string which is the smallest one in lexicographic order

D.in	Standard Output
2	bcdefghijko
2	bcdefhlnowy
hi	
ok	
5	
hello	
bye	
how	
when	
who	