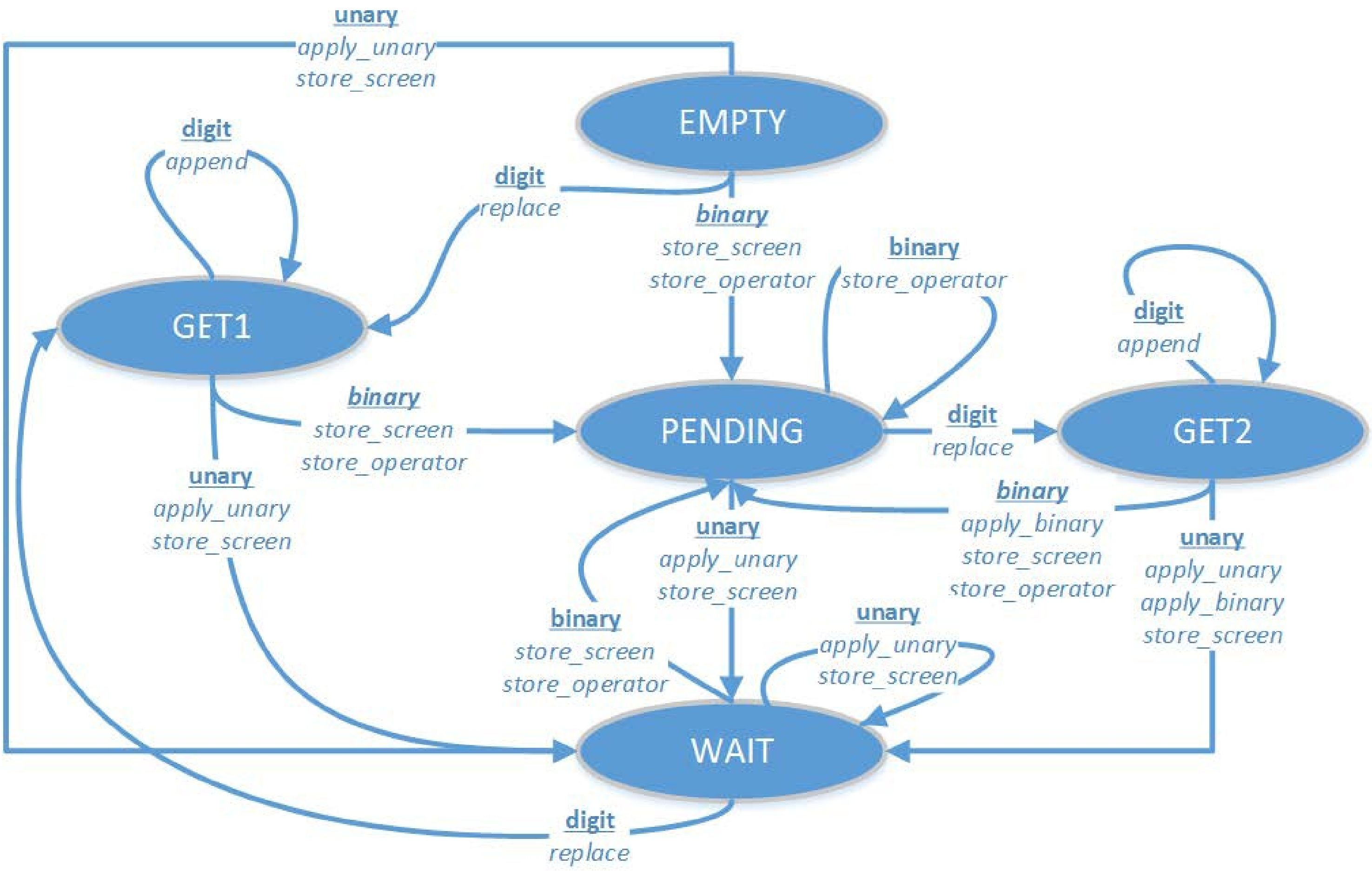
ECOO '16 R3 P4 - Cuthbert's Calculator

Your friend Cuthbert has a broken calculator. When it was working properly, it had buttons for all 10 decimal digits (0 through 9), plus three binary operators $(+, -, \times)$, two unary operators $(\pm, x^2)$, two memory functions (`store` and `recall`) and a `clear` button. Binary operators require two operands to produce an answer (e.g. $12 + 4 = 16$). Unary operators require only one operand: the $\pm$ button changes the sign of the number on the screen and displays the result; the x^2 button squares the number on the screen and displays the result. The calculator **cannot** display more than 8 digits.

A diagram that describes the basic operation of Cuthbert's calculator is shown below. The calculator starts in the `EMPTY` state with 0 showing on the screen. When the user presses a key, if it is a digit key, the calculator moves to the `GET1` state. If it's a binary operator $(+, -, \times)$, it goes to the `PENDING` state. If it's a unary operator $(\pm, x^2)$ it goes into the `WAIT` state.

In addition, there are actions the calculator takes on each state transition. For example, if the user presses a unary operator key while the calculator is in the `GET2` state, the calculator performs the `apply_unary`, `apply_binary` and `store_screen` operations, in that order, and then moves into the `WAIT` state. A table that explains these operations is shown below as well.



OPERATION	DESCRIPTION

`replace`	Replace the contents of the screen with the digit just pressed.
`append`	Add the digit just pressed to the right of the screen.
`store_screen`	Store the contents of the screen in an internal register (`X`) for later use. If there is already something in `X` , it will be replaced.
`store_operator`	Store the operator just pressed in an internal register (`OP`) for later use. If there is already something in `OP` , it will be replaced.
`apply_unary`	Apply the unary operator to the value currently showing on the screen, and update the screen to show the result.
`apply_binary`	Perform the operation in the `OP` register using the value in the `X` register as the left operand and the value currently on the screen as the right operand, then put the result on the screen. For example if $X = 45$, $OP =$ `-` and 23 is showing on the screen, perform $45 - 23$ and put the result (22) on the screen.

The calculator also has two memory buttons `MS` and `MR` . The `MS` button will store the value currently on the screen in the memory register (`M`). The `MR` button will copy the value from `M` to the screen. The `MS` button does not change the state of the calculator. The `MR` button moves the calculator to `GET1` from `EMPTY` or `WAIT` , and to `GET2` from `PENDING` . Otherwise, it also does not change the state.

Finally there is an `AC` button which clears the screen to 0 and changes the calculator state to `EMPTY` .

Unfortunately, the calculator is broken. Only some of the buttons are working at the moment.

Input Specification

The input will contain 10 test cases. Each test case will consist of two lines.

The first line contains the available buttons (some combination of `1234567890+-*ns` , where `n` means negation and `s` means square). The `ac` , `ms` and `mr` buttons will always be available so they will not be listed.

The second line contains an integer N that can be produced on the screen using only the available buttons

$(1 \leq N \leq 1000)$.

Output Specification

Your job is to output a sequence of the available keys (in lowercase) such that when all the keys have been pressed in the order you specify, the integer N will be shown on the screen.

Special Notes

1. Your output needs to go to the file-like object `stdout` and will be scored by an automated judging program.
2. The solutions shown below are not the only possible solutions.
3. The sample input below contains only 3 cases but the input files will contain 10.

Sample Input

```
012345+-*sn
53
456*-s
78
94s-n
101
```

Sample Output

```
5 3
5 4 4 - 4 6 6 *
9 - 4 s ms 9 4 - mr -
```

Further Information

Here is a table to help explain the solution to the final sample input above:

INPUT	STATE	STORED SCREEN	STORED OPERATOR	MEMORY	SCREEN
	`EMPTY`				0
9	`GET1`				9
$-$	`PENDING`	9	`-`		9

4	`GET2`	9	`-`		4
S	`WAIT`	-7	`-`		-7
MS	`WAIT`	-7	`-`	-7	-7
9	`GET1`	-7	`-`	-7	9
4	`GET1`	-7	`-`	-7	94
$-$	`PENDING`	94	`-`	-7	94
MR	`GET2`	94	`-`	-7	-7
$-$	`PENDING`	101	`-`	-7	101

Educational Computing Organization of Ontario - statements, test data and other materials can be found at ecoocs.org