LZ77 – Exercise 2

Multimedia Technology

Tutorial 2, section 2b

LZ77

Assume we are applying LZ77 encoding with a 4+4 character window, starting with the left part of the window empty.

Show how the sequence "accccacaccaa" is encoded and how the output from the encoder is decoded.

acccacacaccaa

In each step, we need to:

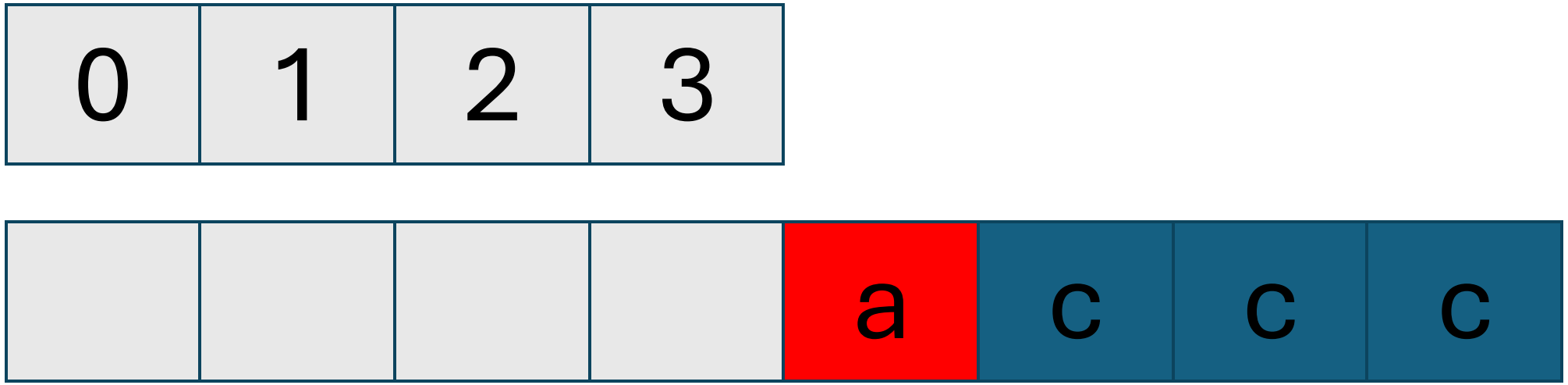
- Select as **input** from the right window the maximum number of symbols that we can match in the left window.
- Extract the code (o,l,c)

where **o** is the index of the left position,
where **l** (L lowercase) is the length of the matched string,
and **c** is the next symbol we did not match.

- In the next step we slide to the right by the number of symbols matched (n+1)

Step 1

accccacaccaa



The initial window is empty (4 empty cells).

Step 1

accccacaccaa

0	1	2	3

				a	c	c	c

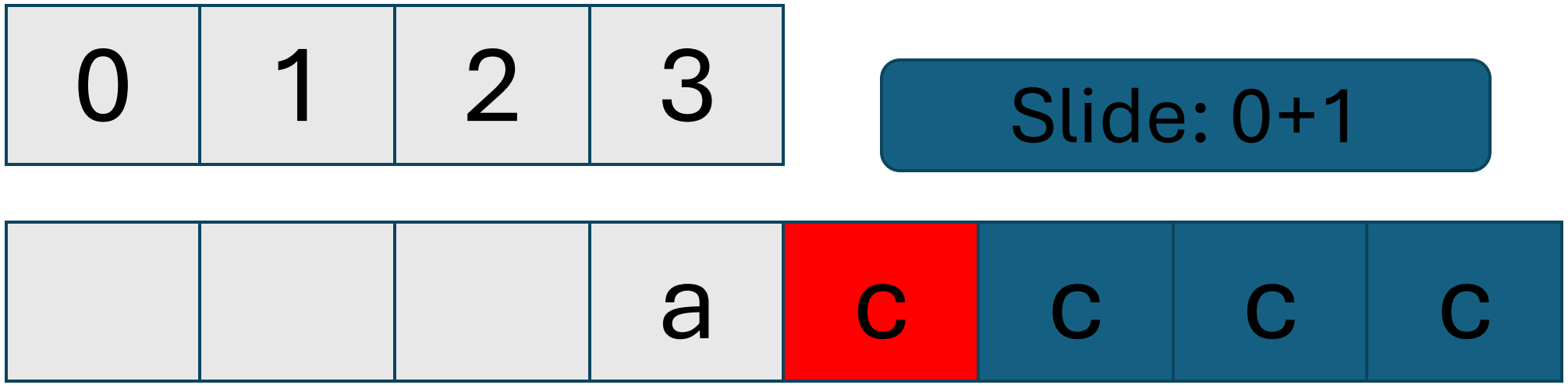
The initial window is empty (4 empty cells).

Code: (0,0,a)

We didn't have a match

Step 2

acccccacaccaa



Step 2

acccccacaccaa

0	1	2	3

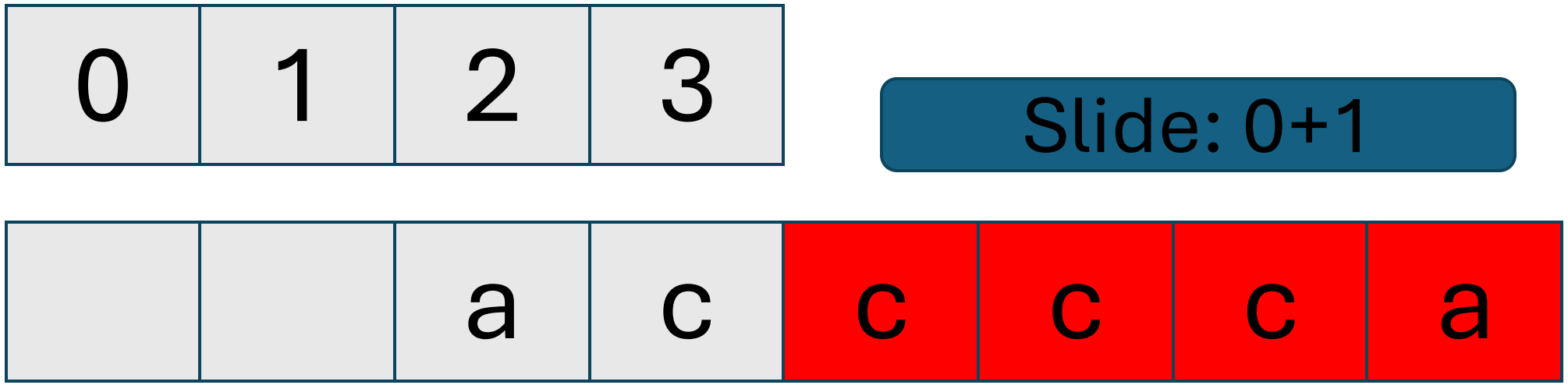
			a	c	c	c	c

Code: (0,0,c)

We didn't have a match

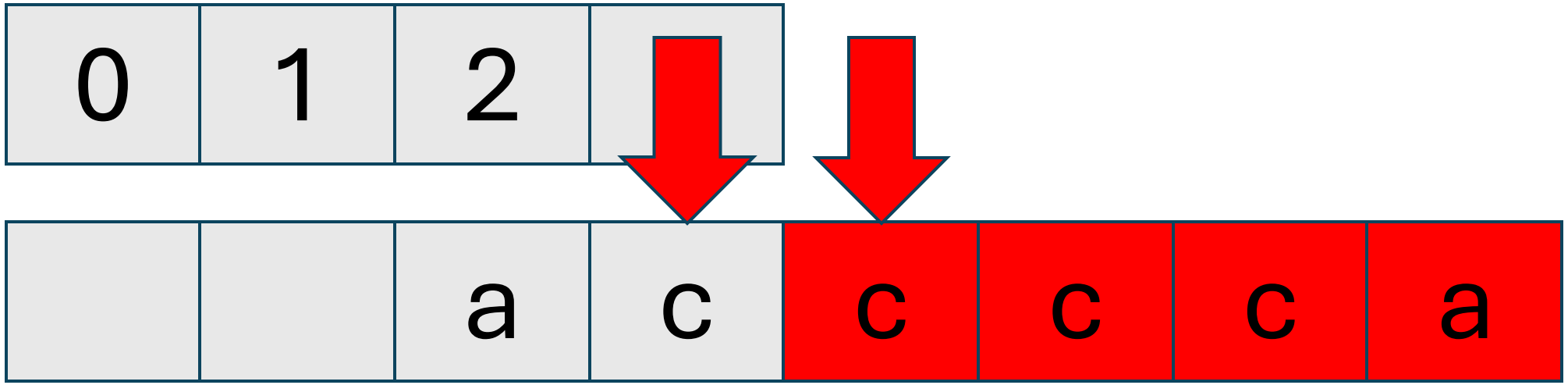
Step 3

acccccacaccaa



Step 3

acccccacaccaa

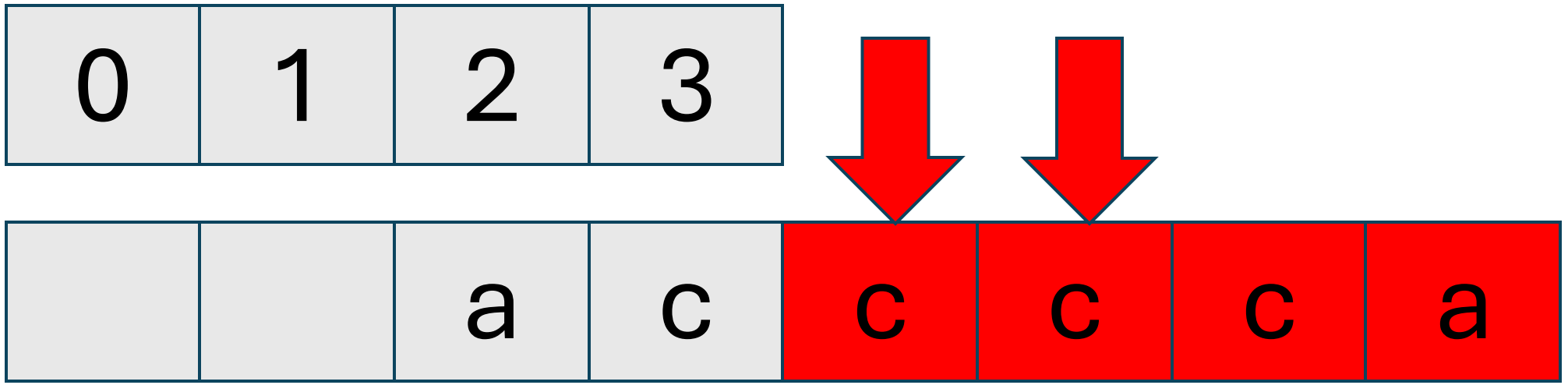


Code: (3,3,a)

1.We matched the first 'c' with the 'c' in position with index 3 (left).

Step 3

acccccacaccaa

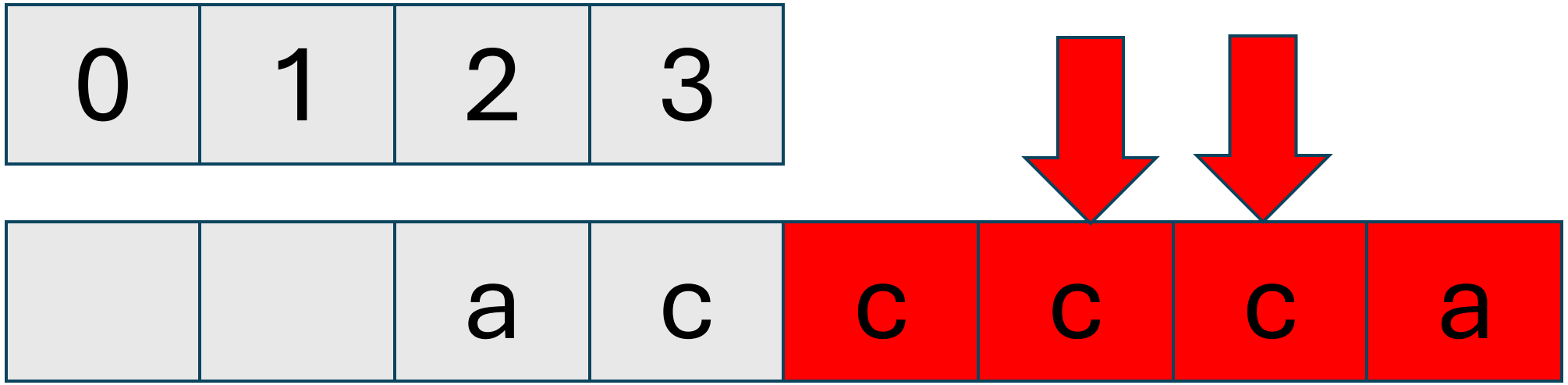


Code: (3,3,a)

1. We matched the first 'c' with the 'c' in position with index 3 (left).
2. We matched the second 'c' from the right with the first 'c' from the left.

Step 3

acccccacaccaa



Code: (3,3,a)

1.We matched the first 'c' with the 'c' in position with index 3 (left).
2.We matched the first 'c' with the 'c' in position with index 3 (left).
3. We matched the third 'c' from the right to the second c from the right.

Step 3

acccccacaccaa

0	1	2	3

		a	c	c	c	c	a

Code: (3,3,a)

1.We matched the first 'c' with the 'c' in position with index 3 (left).
2.We matched the first 'c' with the 'c' in position with index 3 (left).
3. We matched the third 'c' from the right to the second c from the right.
4.We did not find a match for 'a'.

Step 4

acccccacaccaa

0	1	2	3

Slide: 3+1

c	c	c	a	c	a	c	c

Step 4

acccccacaccaa

0	1	2	3

c	c	c	a	c	a	c	c

Code: (2,3,c)

1. We matched 'ca' with 'ca' (index 2 from the left).
2. We matched c (third position from the right) with c (first position from the right).
3. We did not match the (fourth position from the right).

Step 5

acccccacaccaa

0	1	2	3

Slide: 3+1

c	a	c	c	a	a		

Step 5

acccccacaccaa

0	1	2	3

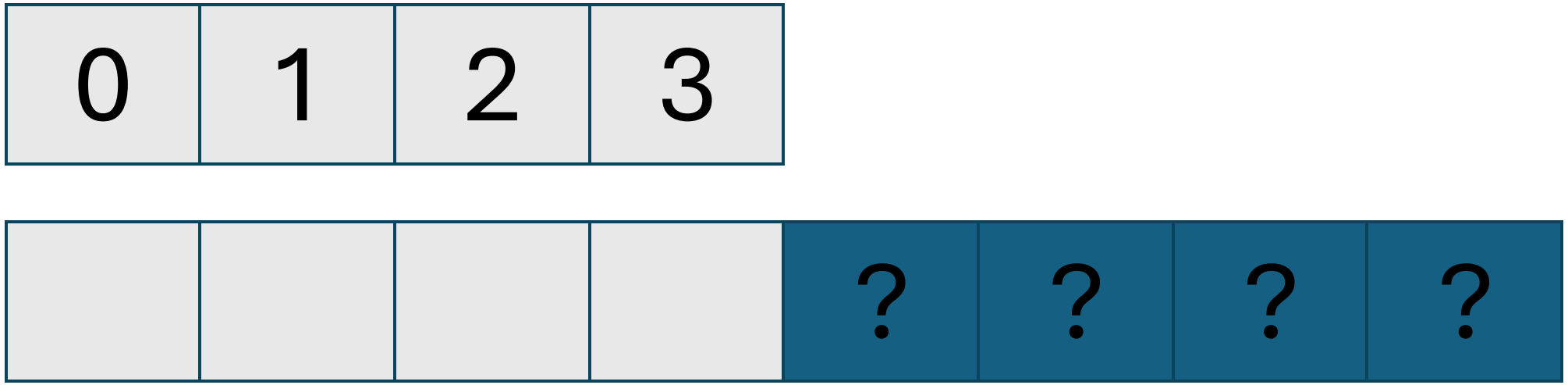
c	a	c	c	a	a		

Code: (1,1,a)

1. We matched 'a' with the 'a' in position 1 from the left.
2. We do not have a match for the final 'a' ('a' in position 2 from the right)

Decoding the output from the encoder.

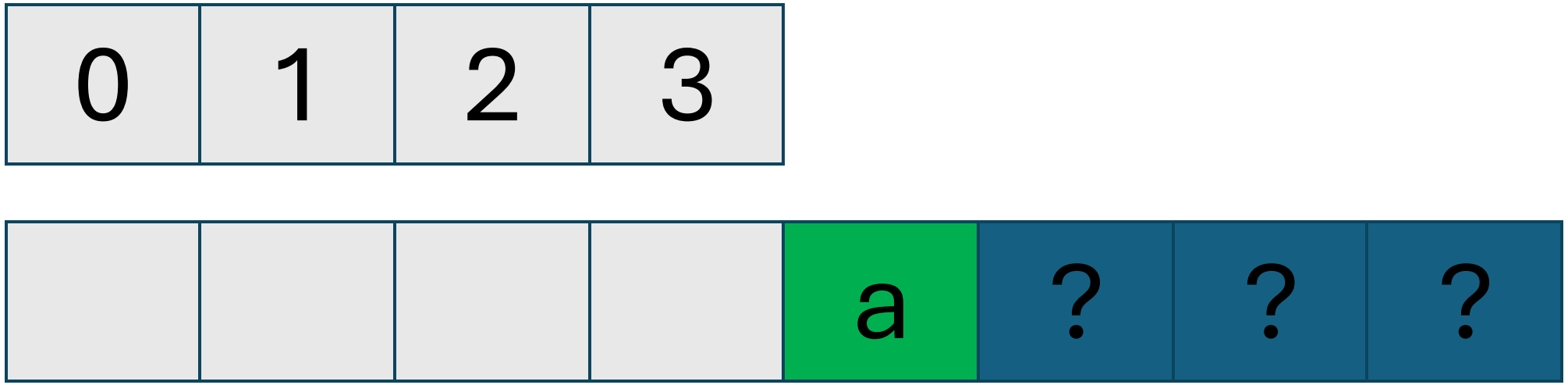
Step 1



Code: (0,0,a)

Step 1

Output: a

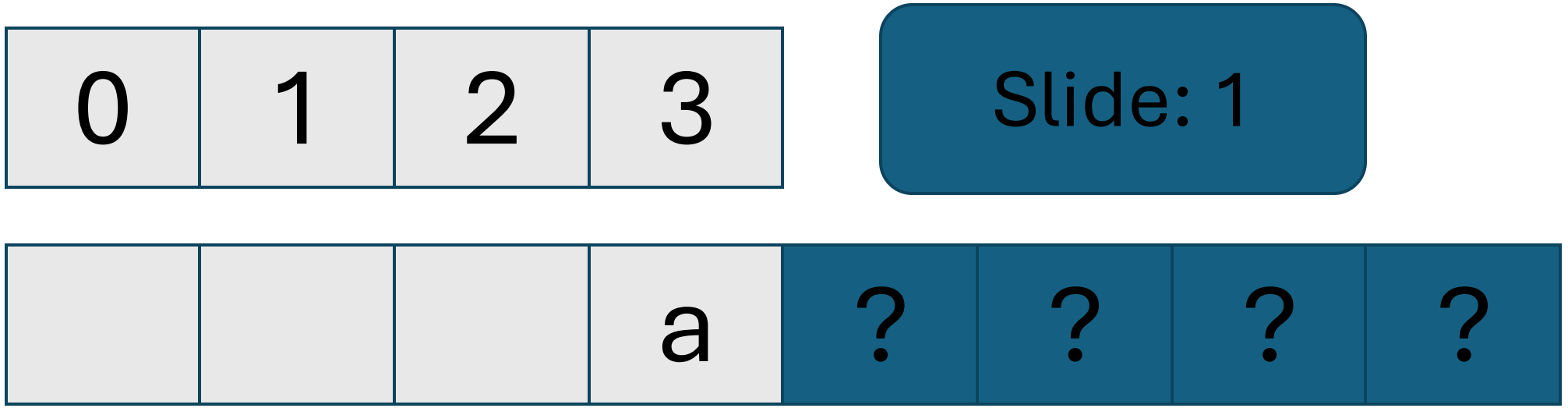


Code: (0,0,a)

Output: a

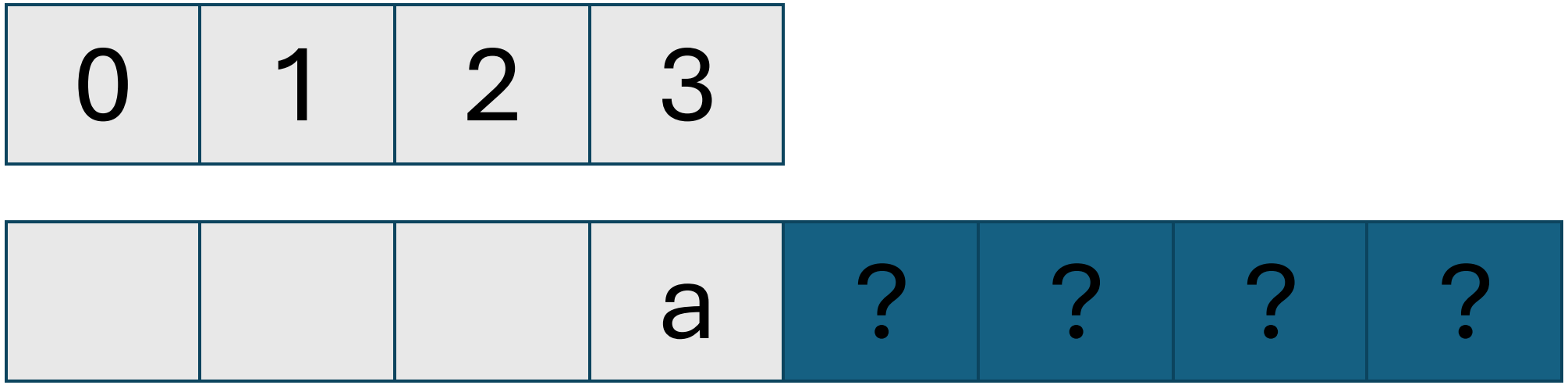
Step 2

Output: a



Step 2

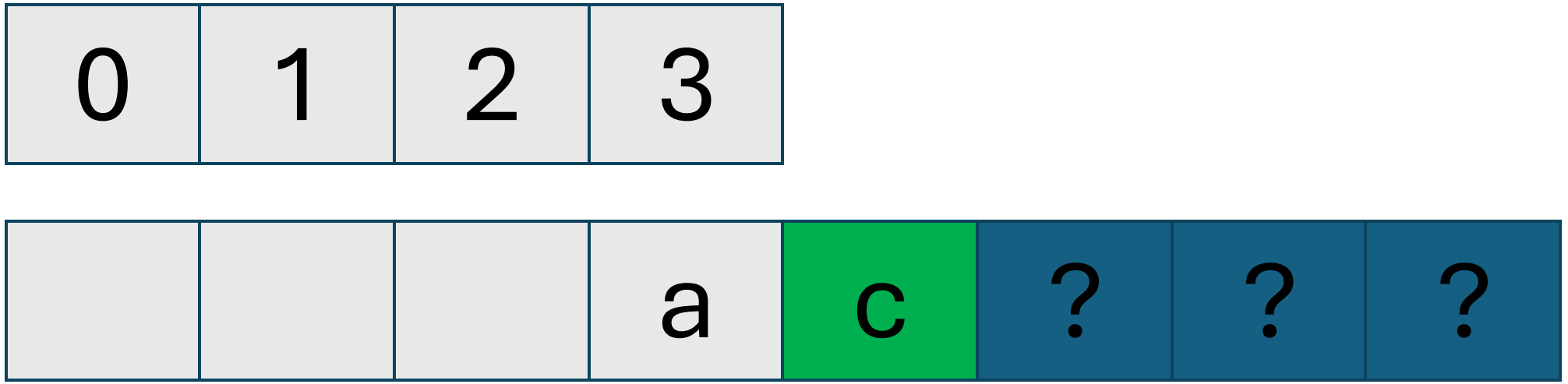
Output: a



Code: (0,0,c)

Step 2

Έξοδος: ac

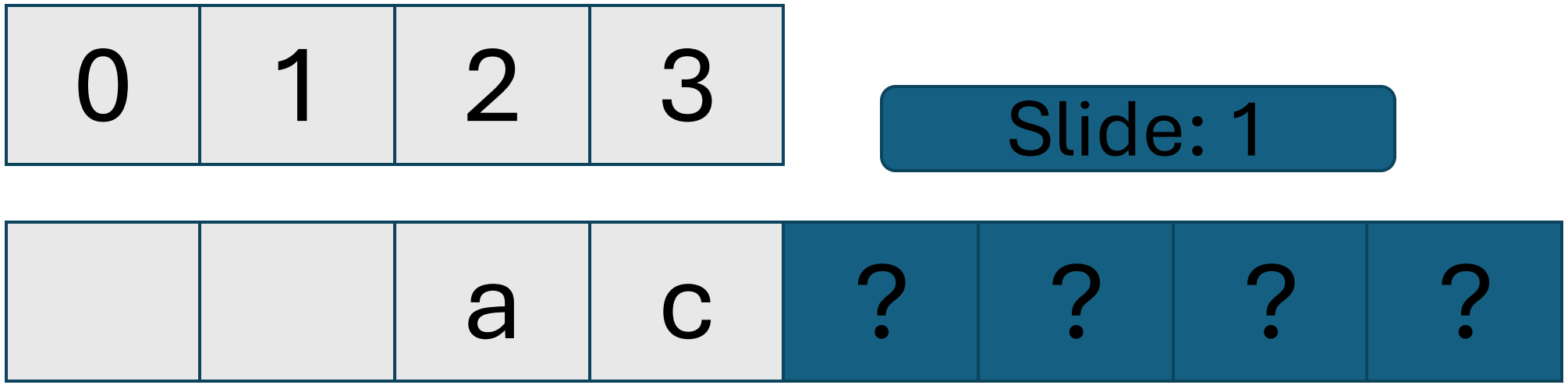


Code: (0,0,c)

Output: c

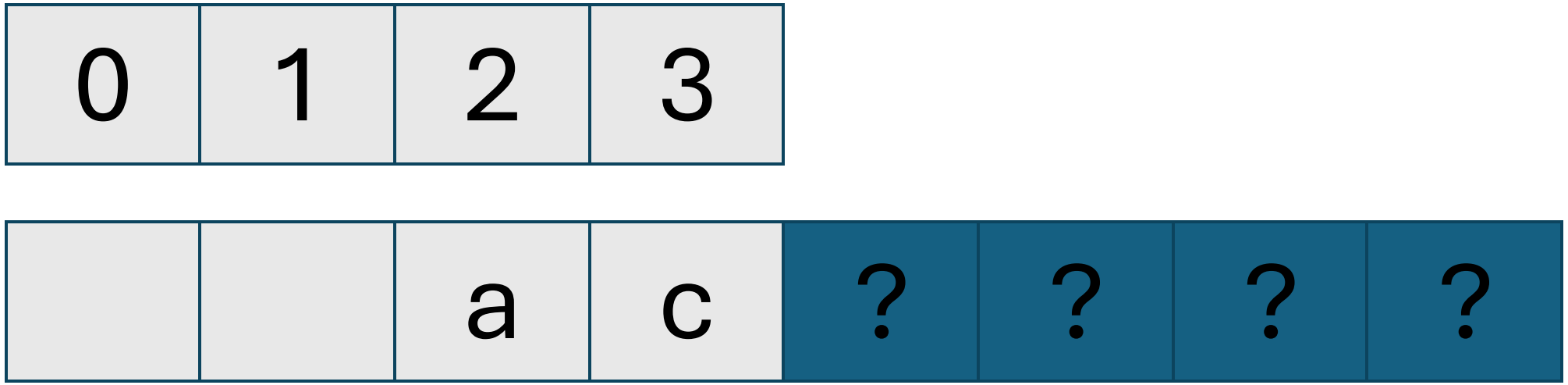
Step 3

Output: ac



Step 3

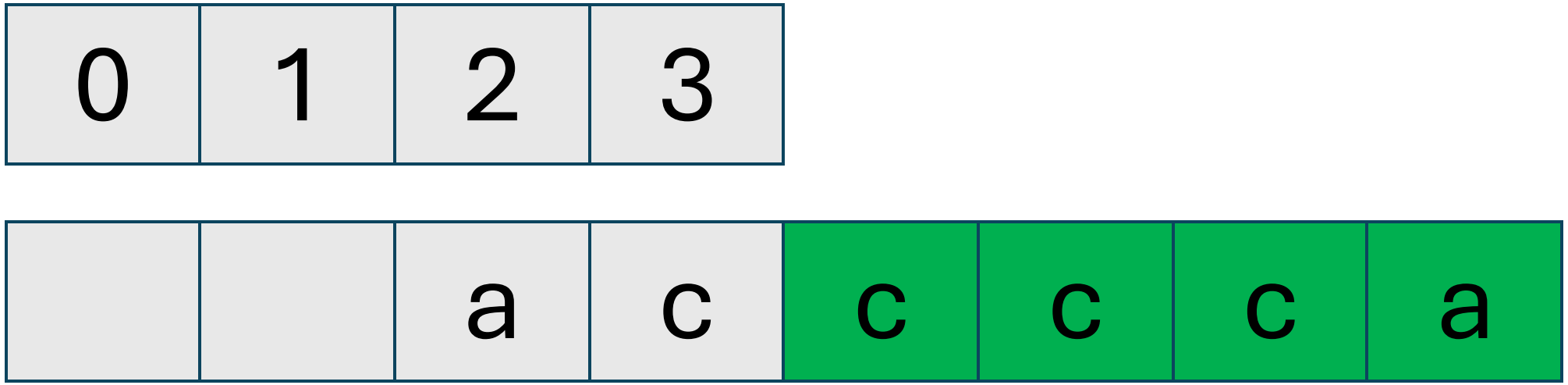
Output: ac



Code: (3,3,a)

Step 3

Output: acccca



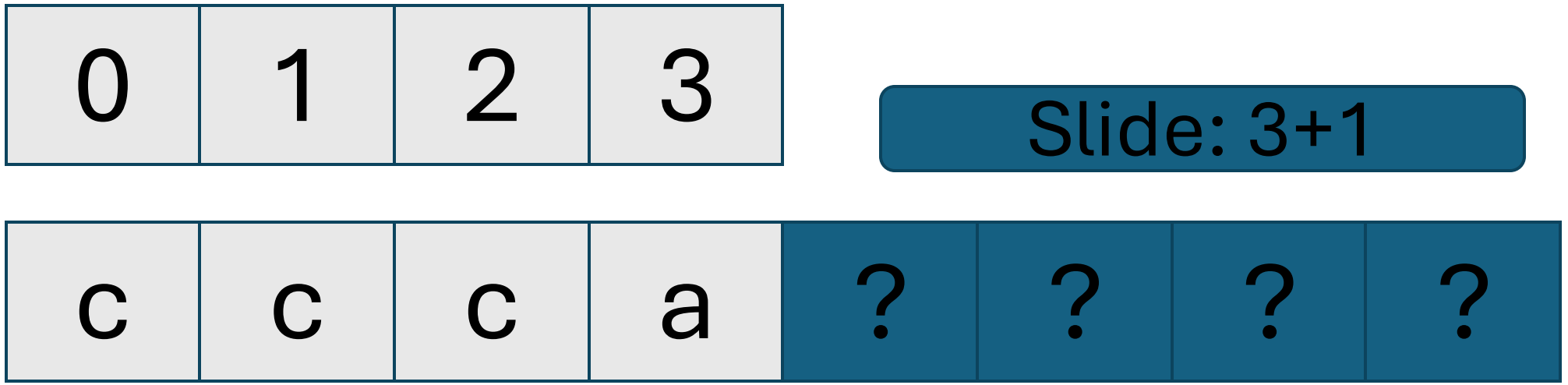
Code: (3,3,a)

1. In position with index 3 I have a 'c'
2. 'c' was matched 3 times
3. 'a' did not have a match

Output: ccca

Step 4

Output: acccca



Step 4

Output: acccccacacc

0	1	2	3

c	c	c	a	c	a	c	c

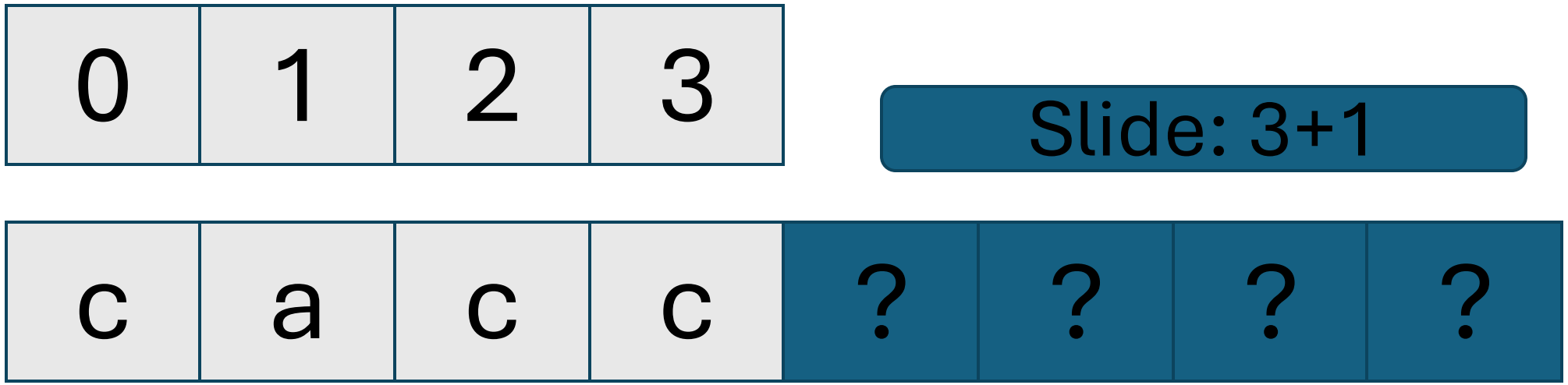
Code: (2,3,c)

1. In position 2 I have 'c'
2. We matched 3 symbols during the encoding, thus we matched 'a' so we have 'ca'.
3. We matched 1 more, the first symbol I see from the right, so 'c'.
4. We did not match 'c' during the encoding.

Output: cacc

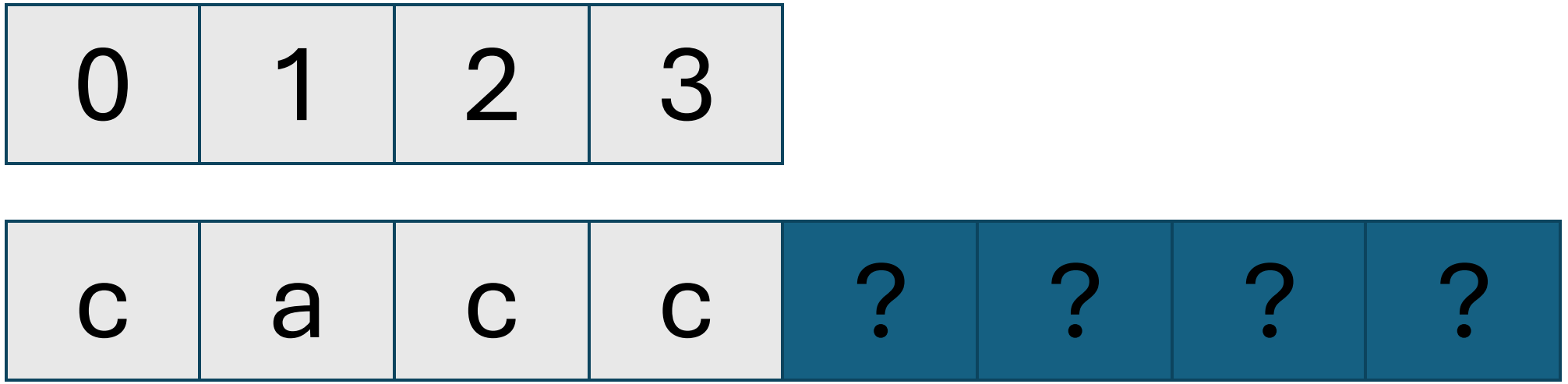
Step 5

Output: accccacacc



Step 5

Output: accccacacc



Code: (1,1,a)

Step 5

Output: accccacaccaa

0	1	2	3

c	a	c	c	a	a	?	?

Code: (1,1,a)

1. In position 1 (right) I have an 'a'
2. Only one symbol was a match, so a.
3. One more 'a' was not matched and i was added to the code.

Output: aa