Programming Practice

2018-12-06

Week 14

Notice

Notice

- Project 3rd Week submission due date has been extended.
  →12/18(Tue) 14:00

- No further delay allowed after 12/18(Tue) 14:00.

Notice – Final Exam

- The Final exam is on 12/16(SUN) 13:00.

Practice Lecture

Big Integer

- **Big integer** is used for mathematical operation which involves very **big integer** calculations that are outside the limit of all available primitive data types(int, long long etc.).

- Ex) 19573293052938594982738592839102938573293829502,

295739482908593028928573920185763958482910536930293739204
76939285039139582 7,

684029503920583920395848483920192576739203982938493029375
948398271615285986709356281928358392830932934275930135720
579306096750000126582737772835192835638273592837592837592

Homework Problems

1. Big Integer(Multiplication)

Problem. **1**

Big Integer(Multiplication)

Description

Calculate multiplication of two big integers X and Y.

X and Y are 0 or positive integers up to 100 digits.

Input

First line contains a single big integer X.

Second line contains a single big integer Y.

Output

Print the result of X * Y.

Sample

[input]

```
103958275843
9275391759692
```

[output]

```
964253735134767338784035 6
```

[input]

```
9876543212345678 9
123456789
```

[output]

```
1219326311415942675019052 1
```

Problem. **1**

Big Integer(Multiplication)

Sample

[input]

```
39572934540193529304384759302019282938492830 59
```

```
95928374610192837409876543211234568923852810
```

[output]

```
37961672889963241232069788195682476578968907926104592006600368240403072276874
9382542545790
```

[input]

```
10000000000000000000000000000000000000000000000000000000000000000000000000000
```

```
99999999998888888887777777776666666666555555555554444444444433333333332222
222221111111111
```

[output]

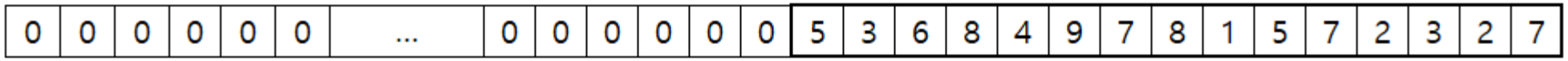
```
99999999998888888887777777776666666666555555555554444444444433333333332222
22222211111111100000000000000000000000000000000000000000000000000000000000000
```

Big Integer

- You can manage these 'big' numbers with integer array. Separate the 'big' number into single digits, and save each digit in each element.

- Since problem description specifies maximum 100 digits,
  use an int array of length 100, and save to the right-end of the array for convenience.

- Ex) When value is: `536,849,781,572,327`

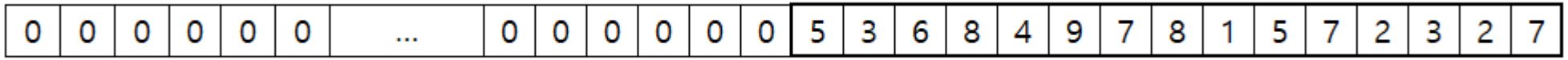


Tip) Saving to the right-end of int array

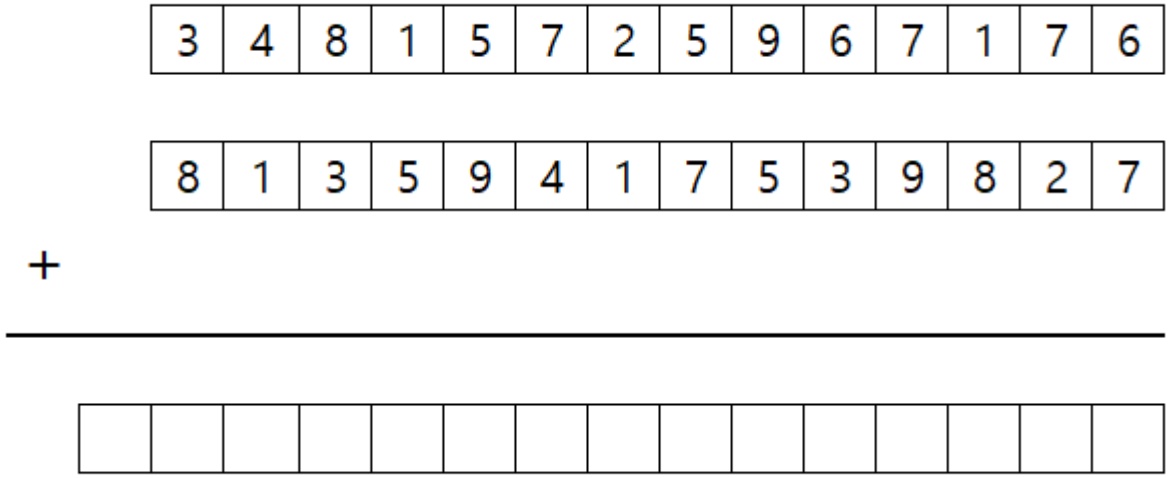
- First, get whole input as a string with %s. (Since problem description specifies maximum 100 digits, use a char array of length 100+).

- Use `strlen` to find out how many digits are in the big integer.

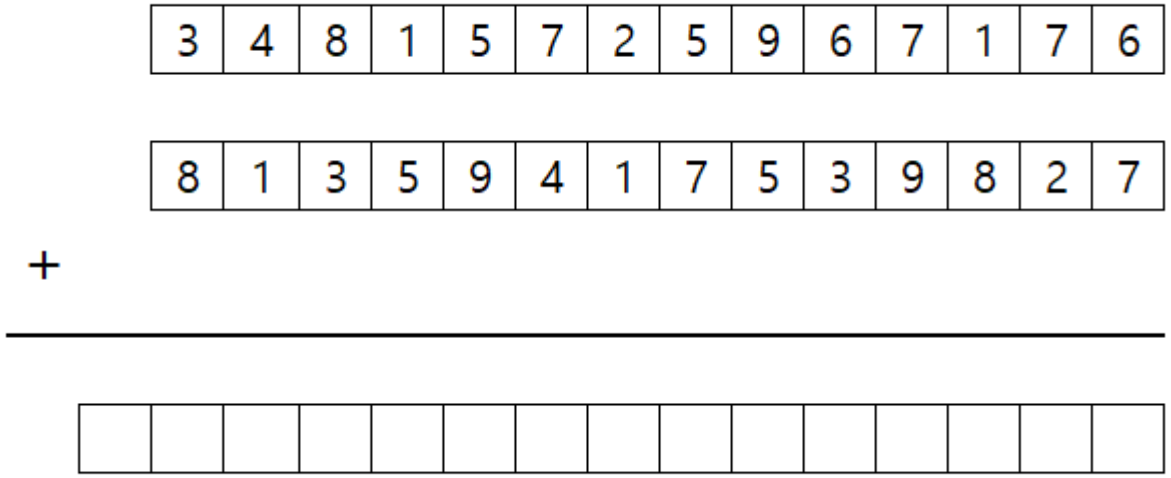
- Start from the right-end of the string (*i.e.* total index - 1).
  Parse each character to integer, and save each digit as a single element of an int array (of length 100).



Big Integer (addition)

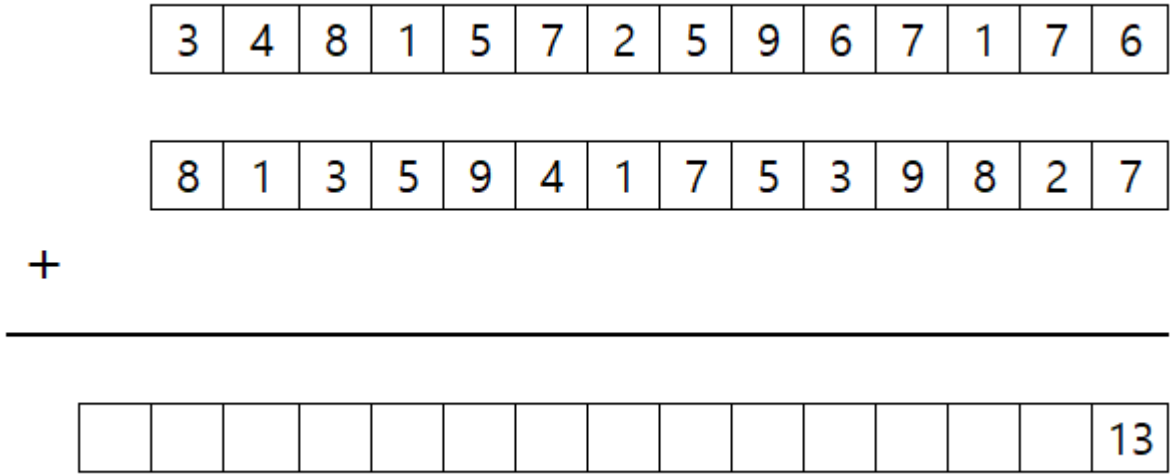


Big Integer (addition)



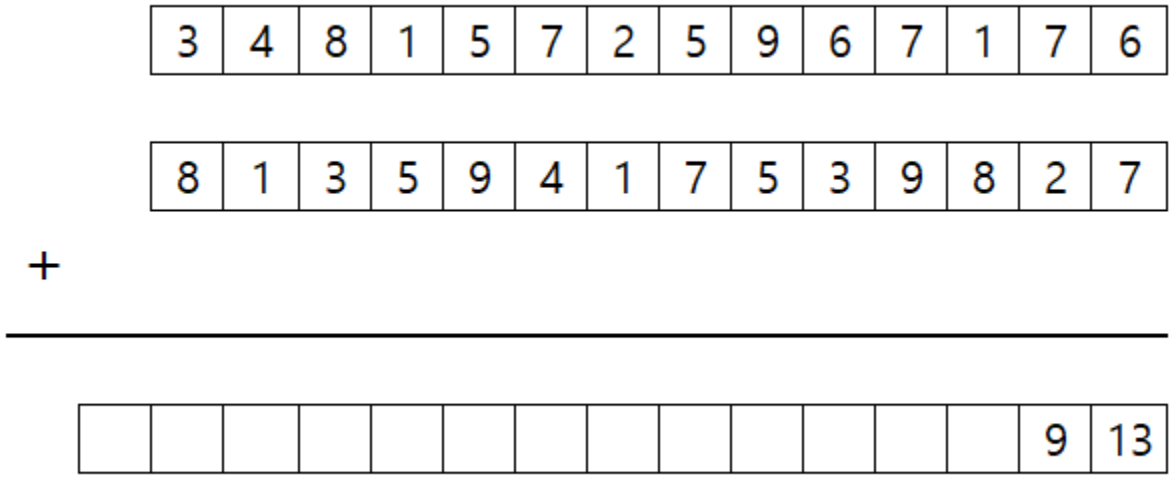
Prepare a sum array (with big enough size)

Big Integer (addition)



Add each decimal place, one by one.

Big Integer (addition)



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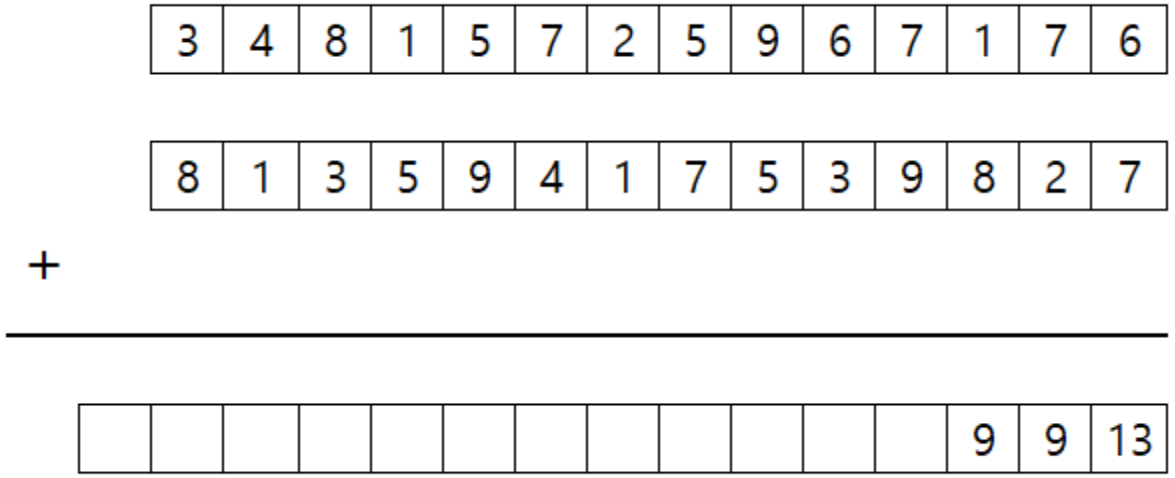

Add each decimal place, one by one.

Big Integer (addition)

	3	4	8	1	5	7	2	5	9	6	7	1	7	6
	8	1	3	5	9	4	1	7	5	3	9	8	2	7
+														
		11	5	11	6	14	11	3	12	14	9	16	9	9	13

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Big Integer (addition)

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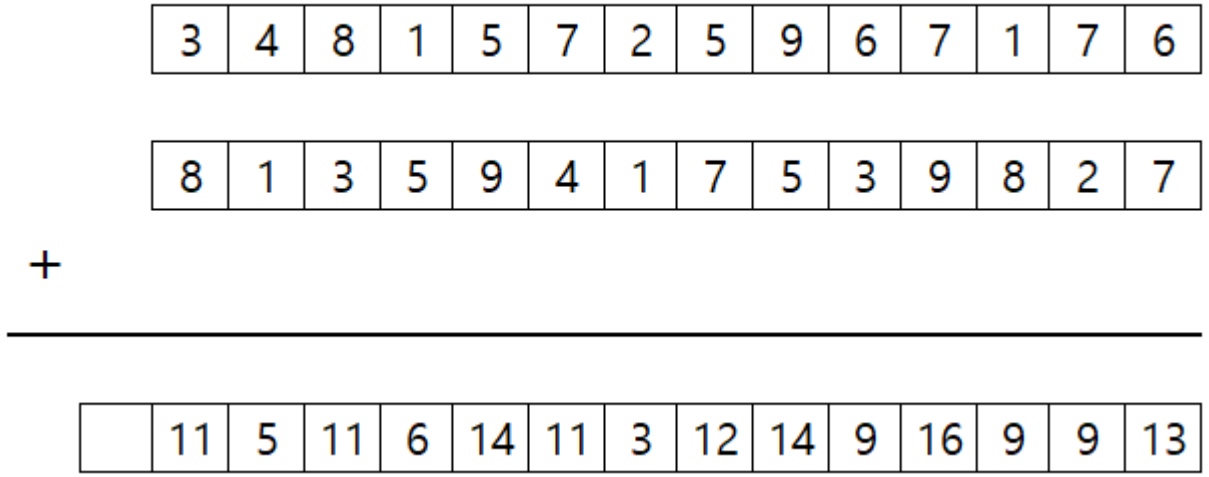
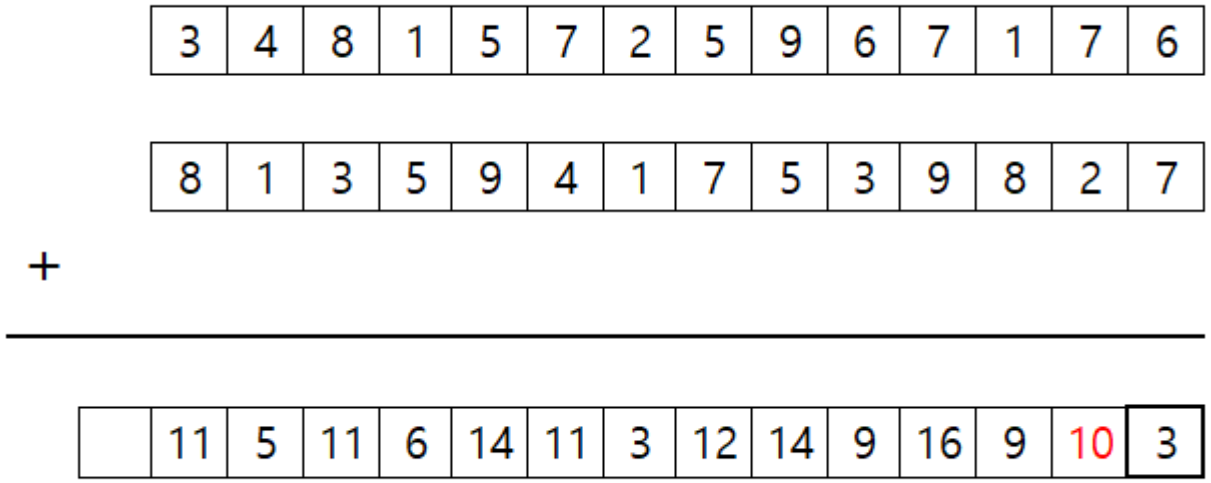
Big Integer (addition)



For each `s[i]` *(right-to-left order)*:

```
s[i]    = s[i] % 10;
s[i-1] += s[i] / 10;
```

Big Integer (addition)



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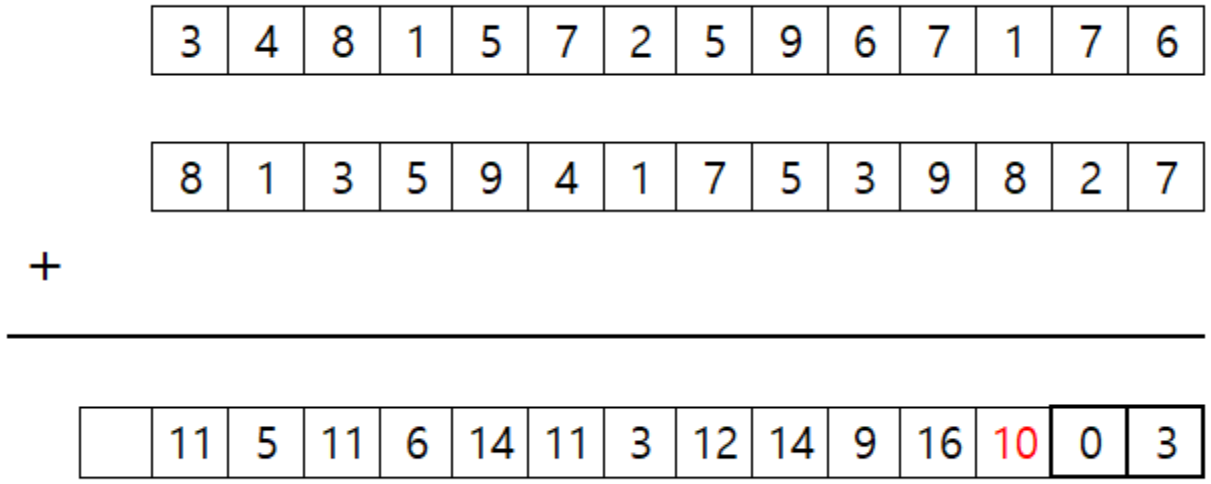

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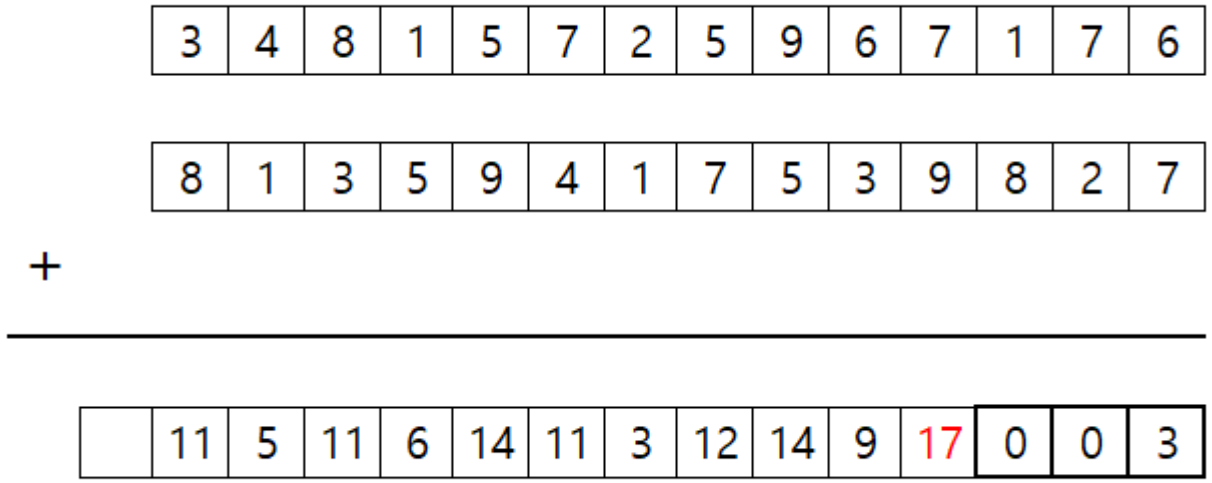

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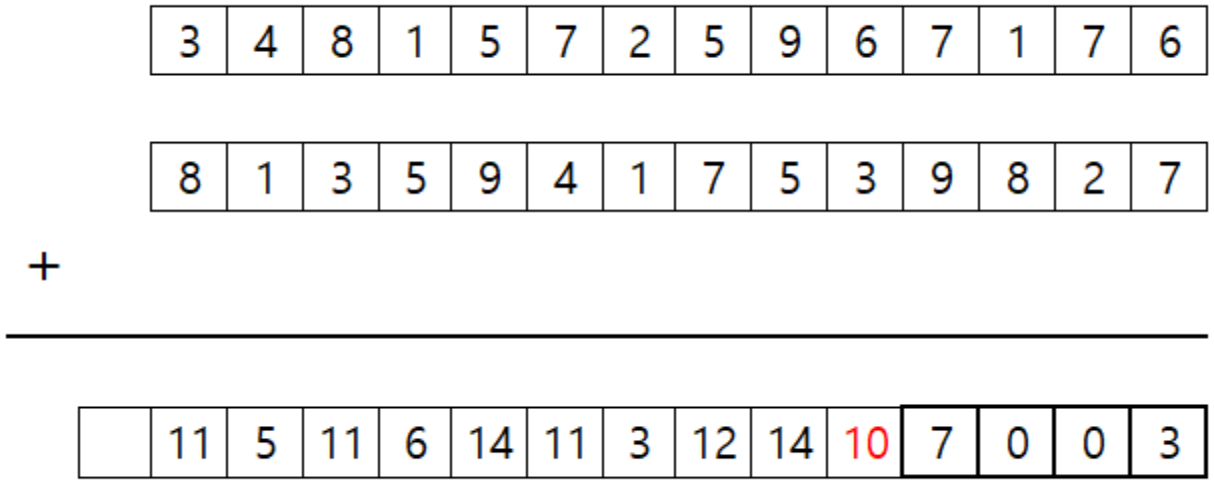

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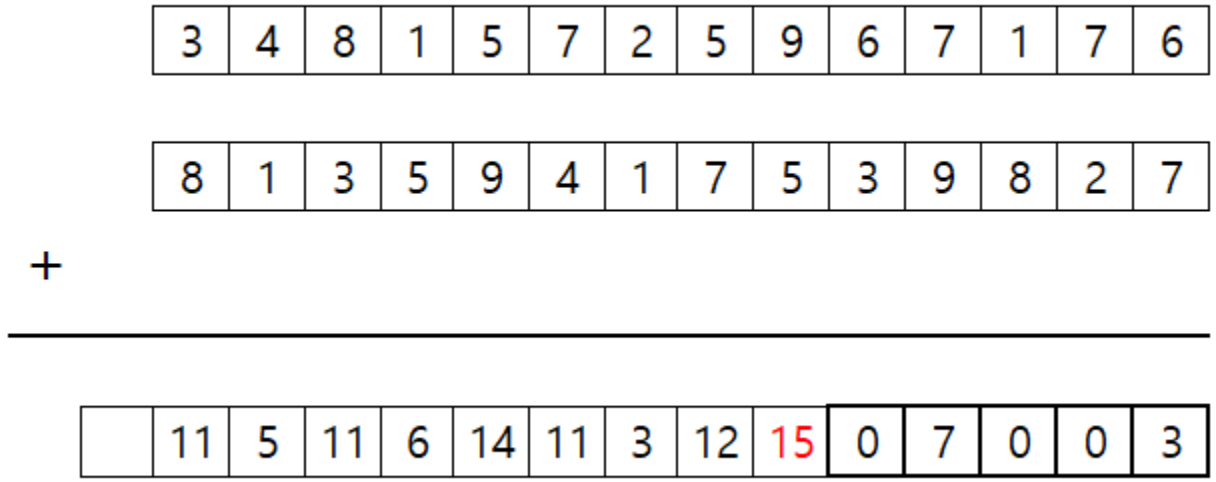

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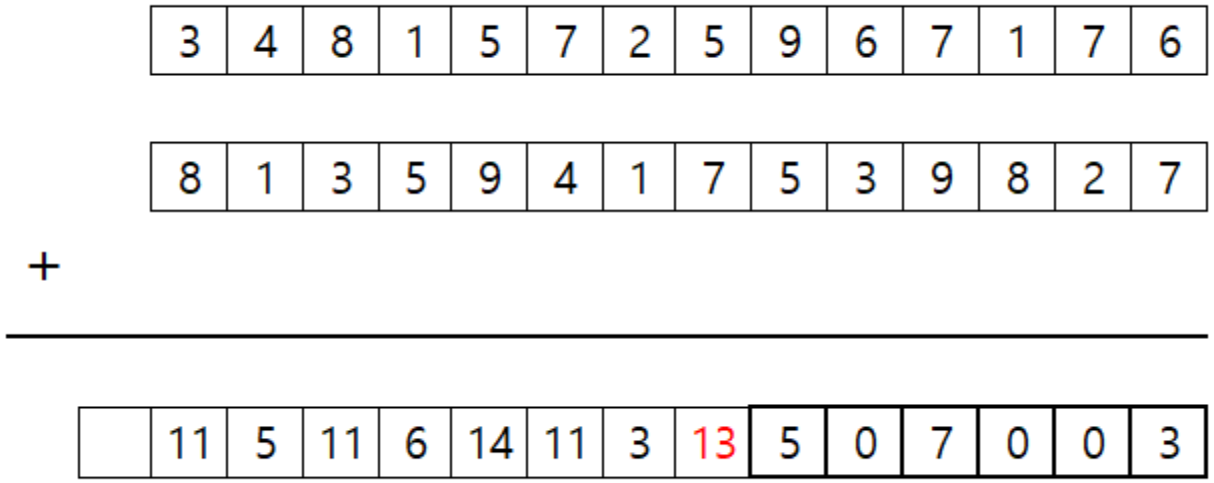

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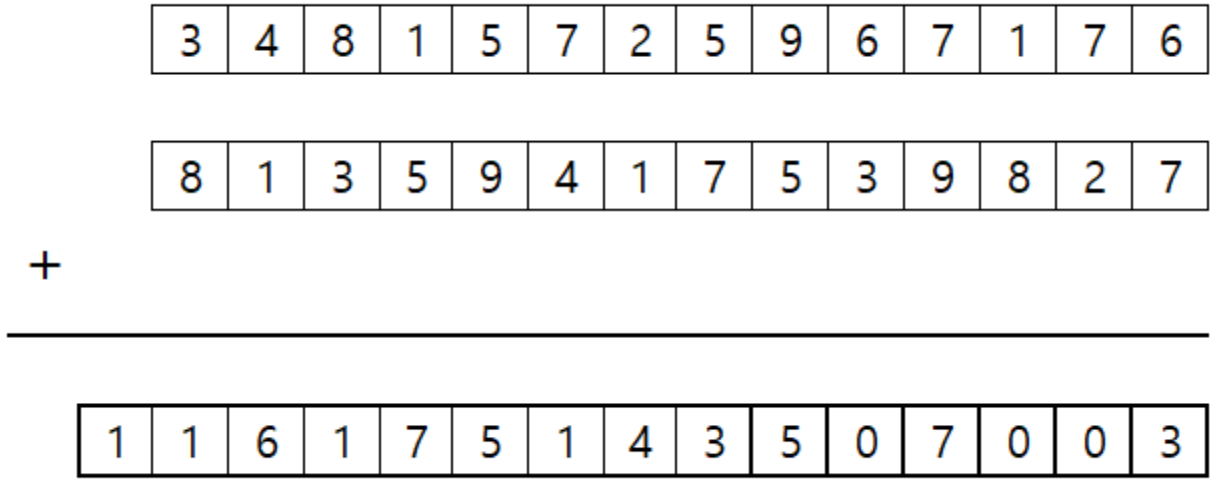
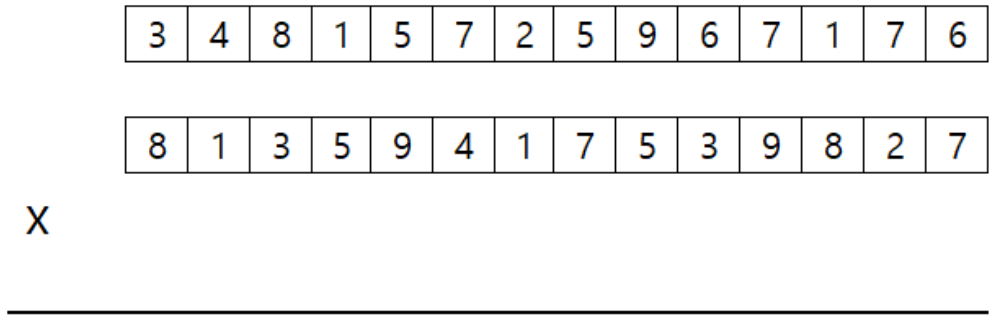
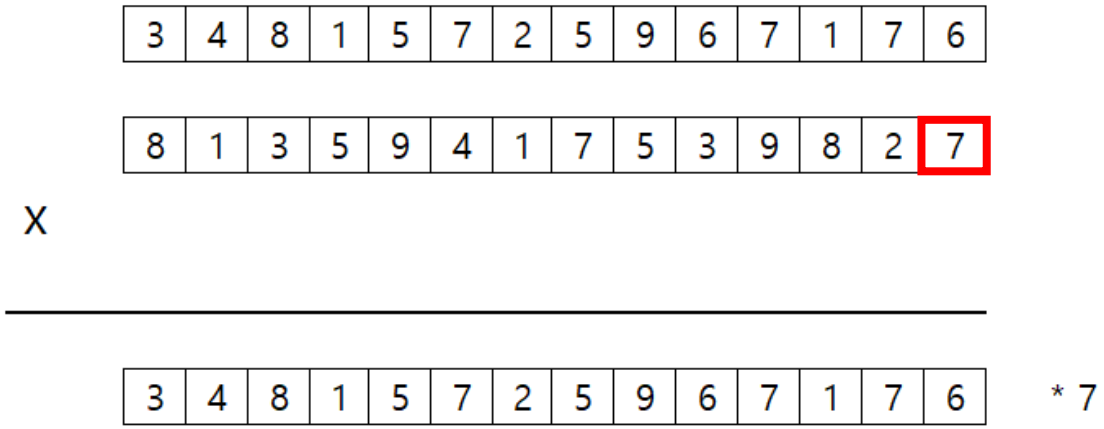


Completed.

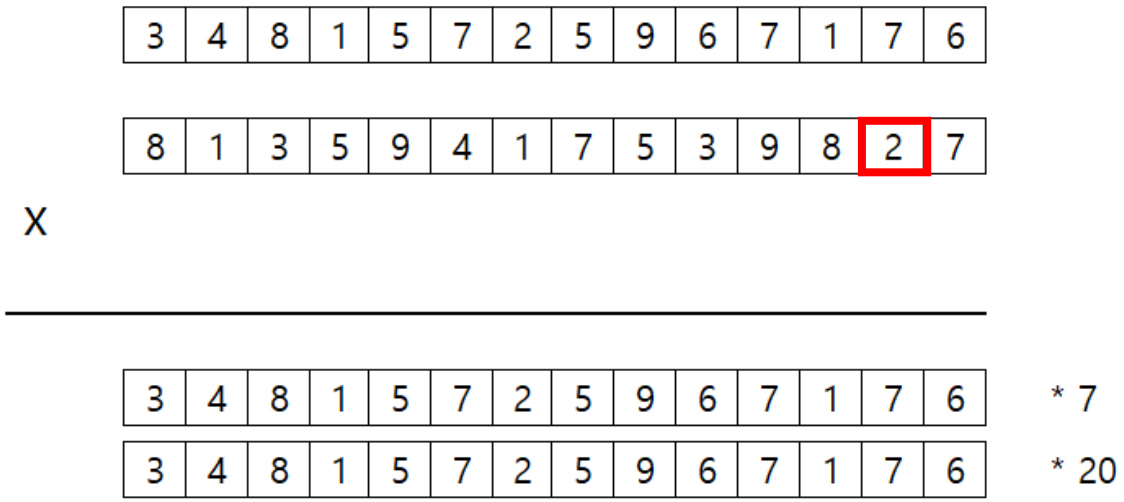
Big Integer (multiplication)



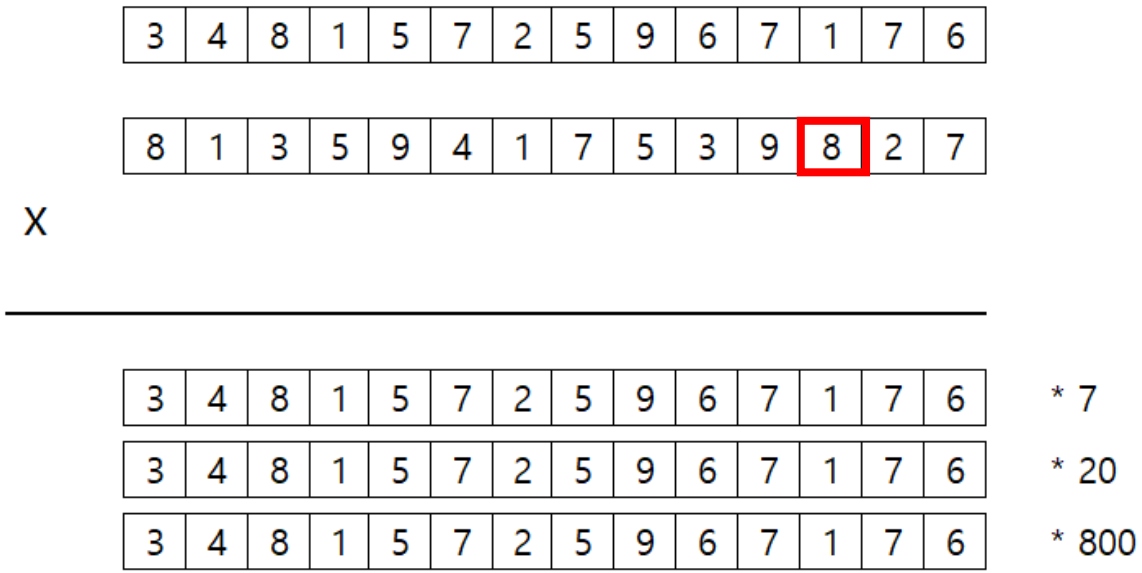
Big Integer (multiplication)



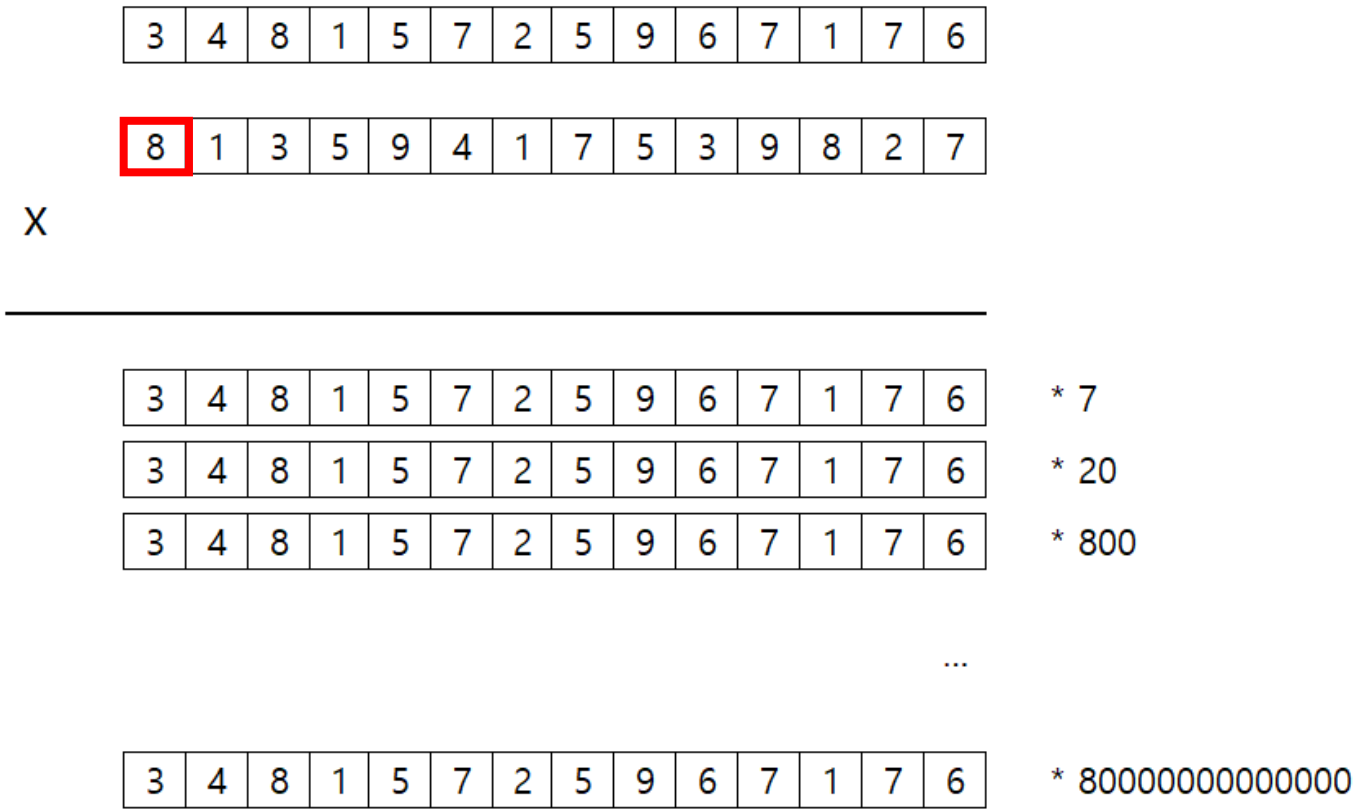
Big Integer (multiplication)



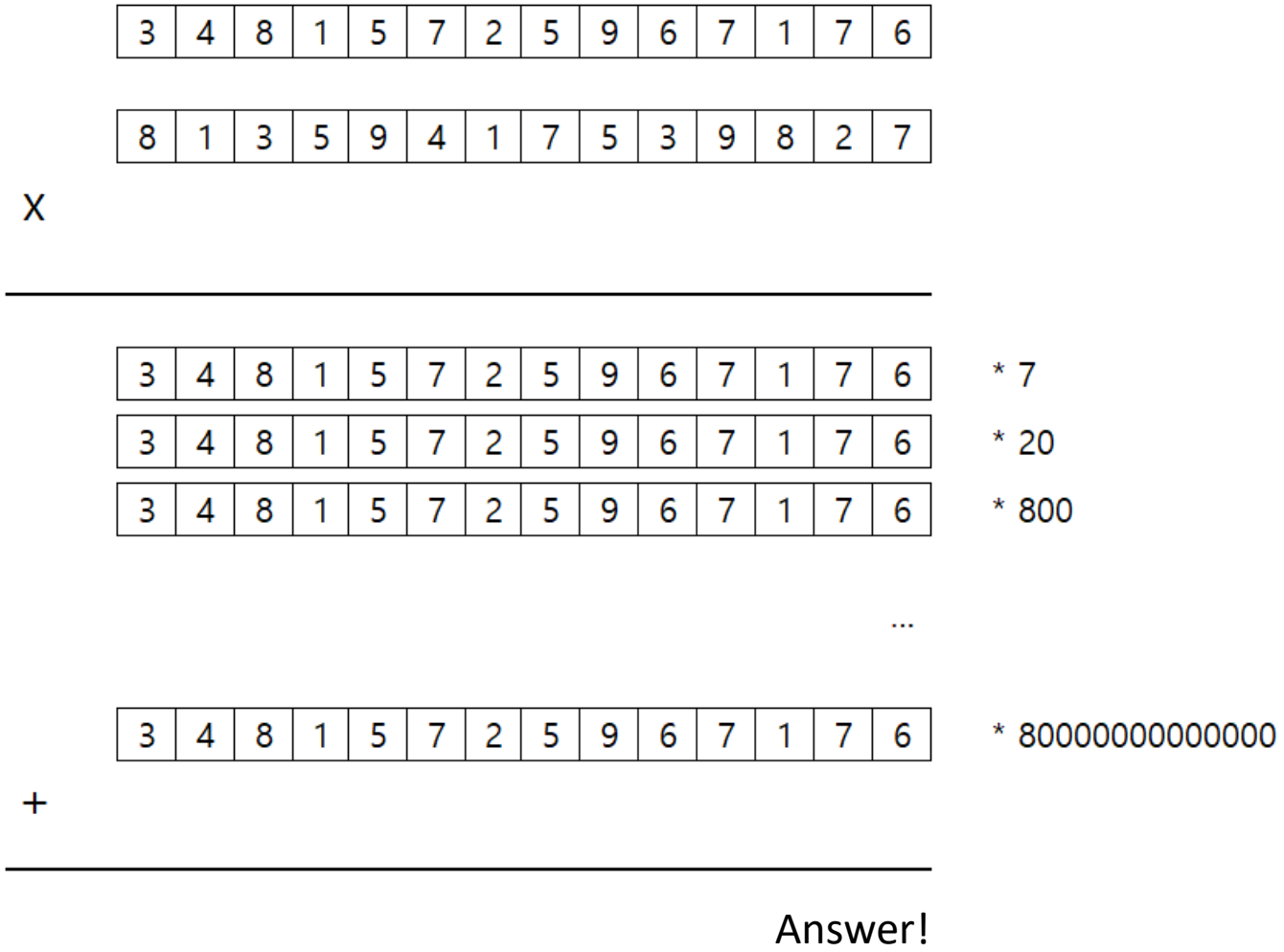
Big Integer (multiplication)



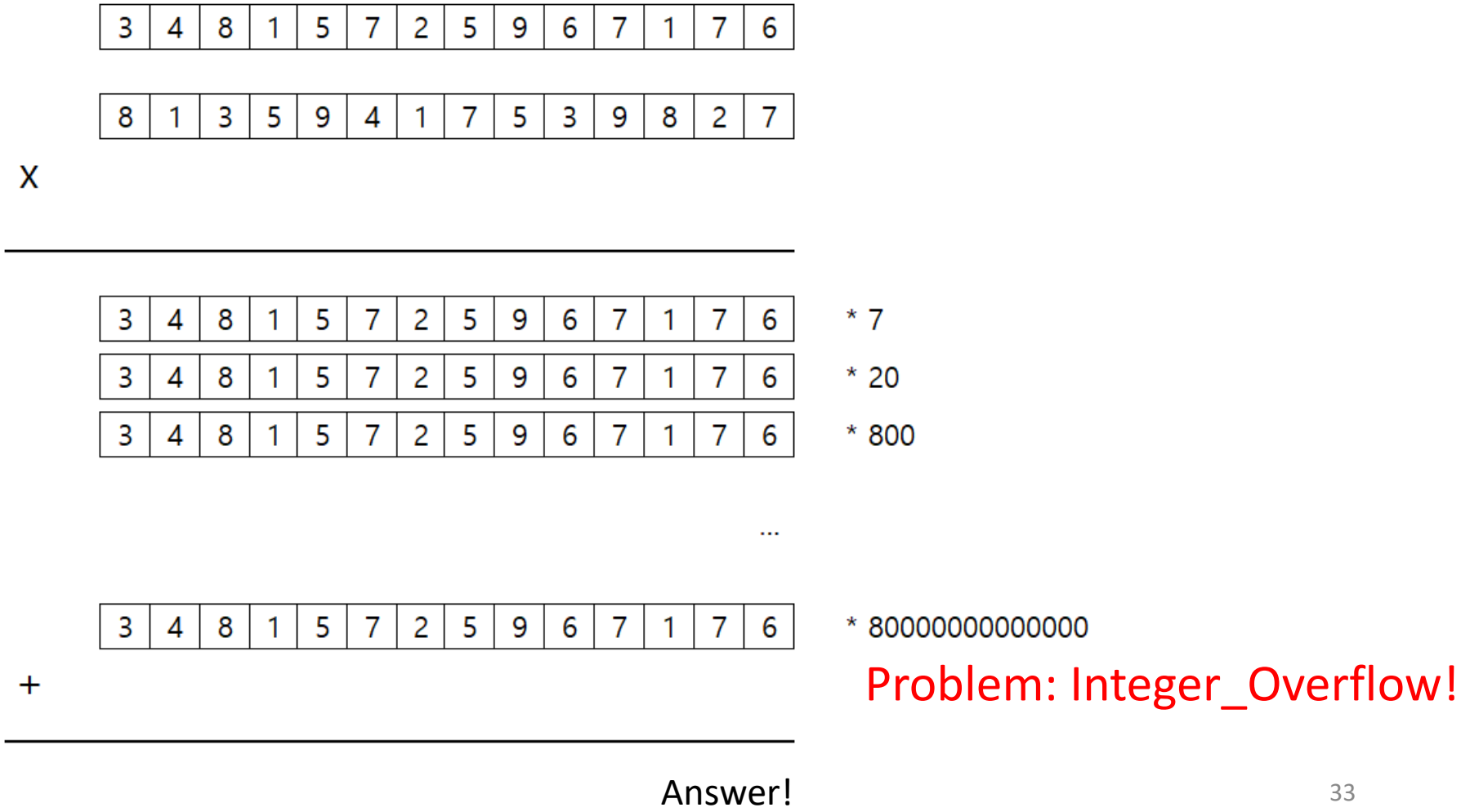
Big Integer (multiplication)



Big Integer (multiplication)

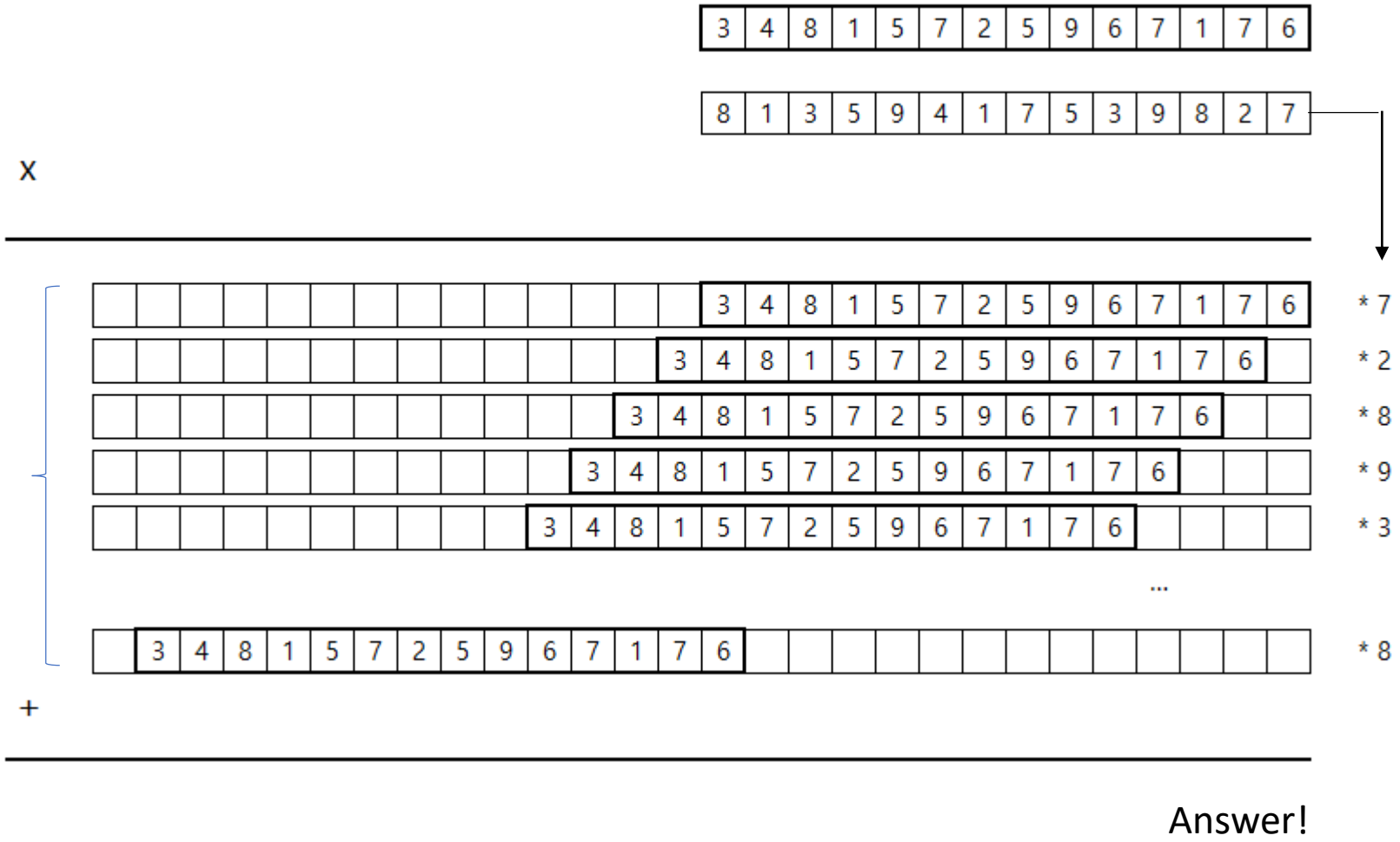


Big Integer (multiplication)



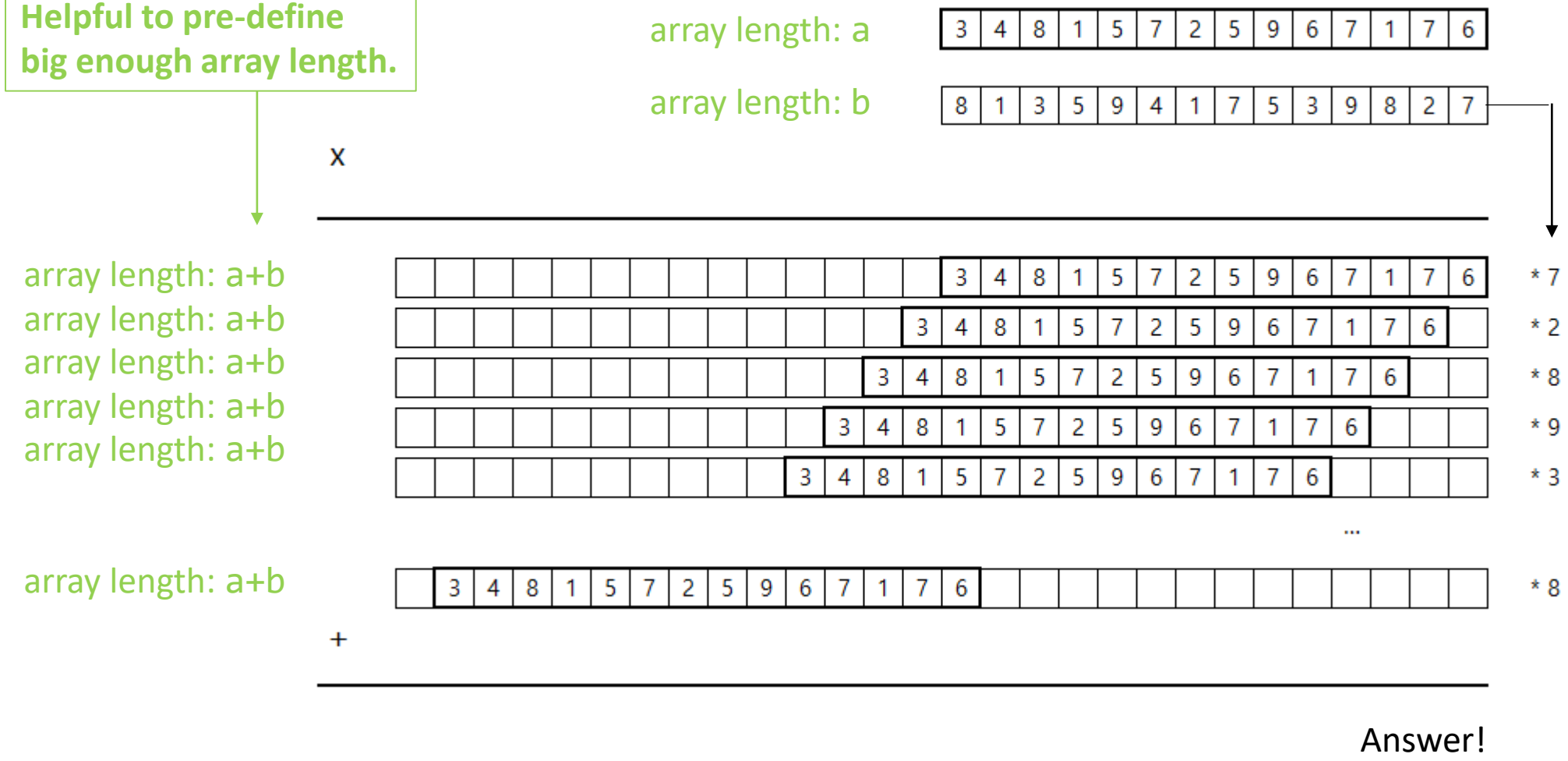
Big Integer (multiplication)

- Solution:



Big Integer (multiplication)

Helpful to pre-define big enough array length.



Answer!