Finally … Functions!

ESC101: Fundamentals of Computing

Purushottam Kar

Announcements

- Mid-sem lab exam marks available on Prutor
  - Maximum: 150, Average: 80, Standard deviation: 47
  - See rubric on website carefully before applying for regrading
  - Frivolous regrading requests will simply get penalty negative marks
- Last date for dropping Advanced Track October 12
  - Application must be an email to instructor, mentors, teammates
- Last date for dropping ESC101 course October 12
  - Application must be on standard DoAA course drop form – no email!
- Joint tutorial for B1 and B14 on October 12
  - 12 – 1 PM (same time), L19 - just an arrangement for this week ☺

The Golden Rules of Pointers

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RULE 5: Name of array points to first element of array

Does not matter whether malloc-ed array or static array

The Curious Case of Static Arrays

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Three types of arrays studied so far

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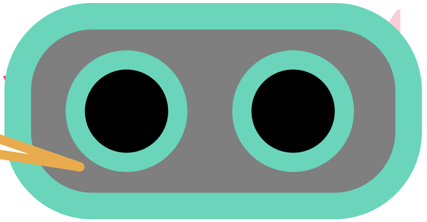

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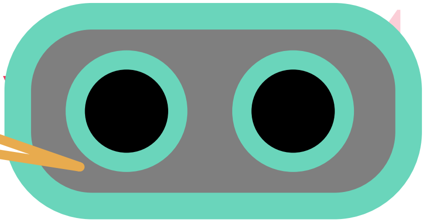

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I will hide the location of the pointer a and b from you since I store these pointers secretly in a location called the **symbol table** – no access!!

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You can modify the pointer c by saying c++ but I will not allow you to say things like a++, b++. I also dont allow you to free/realloc a and b ☺

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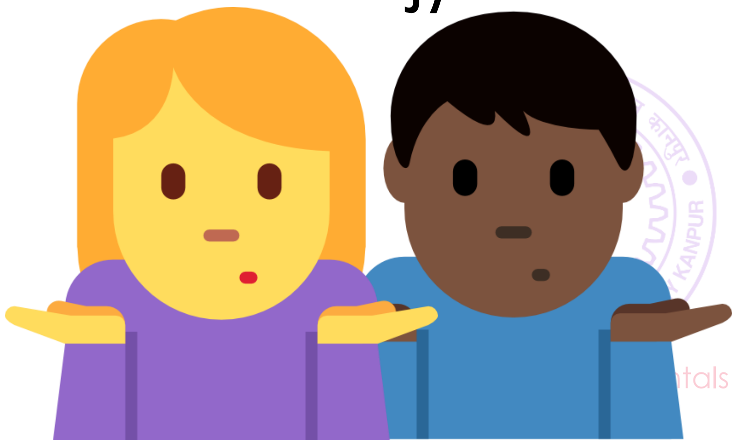

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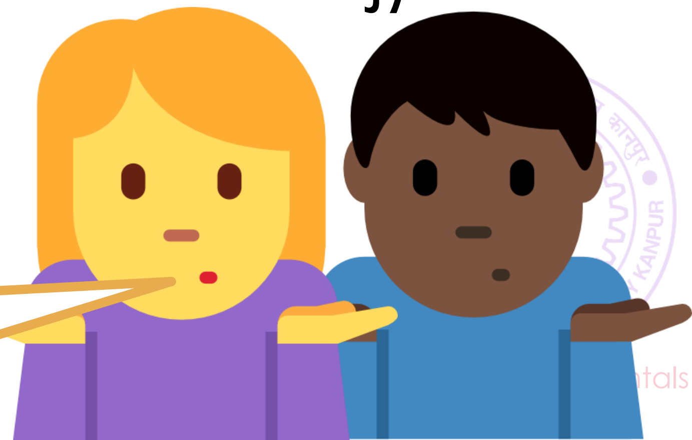

This looks exactly like the way we access an array of arrays – what is the difference?

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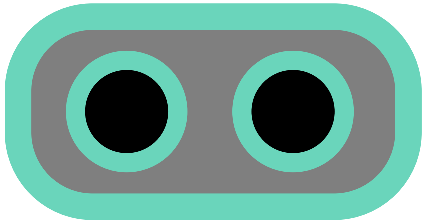

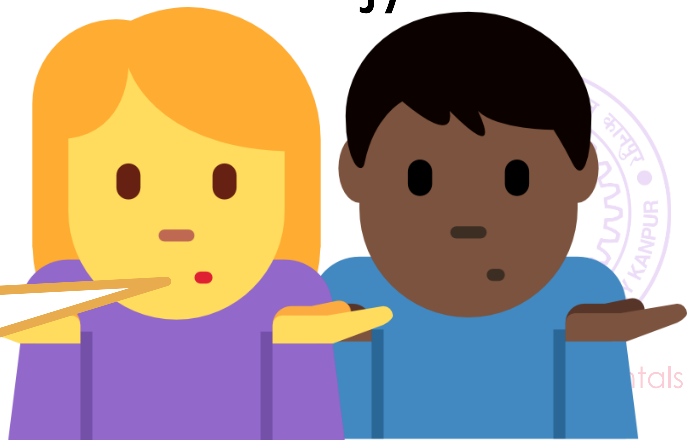

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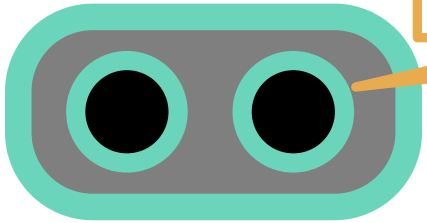
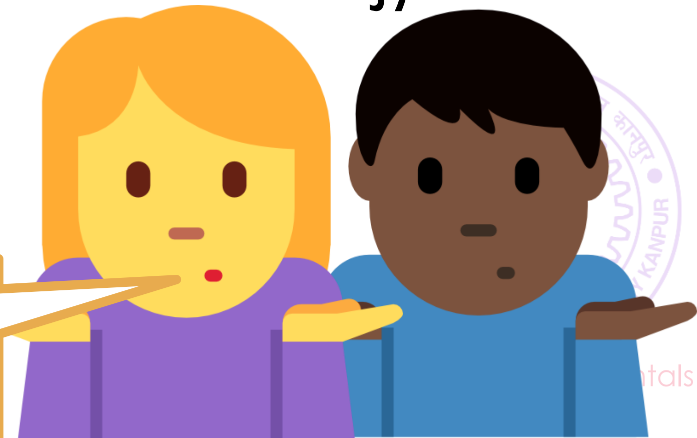


Not that much actually – let me show you the differences



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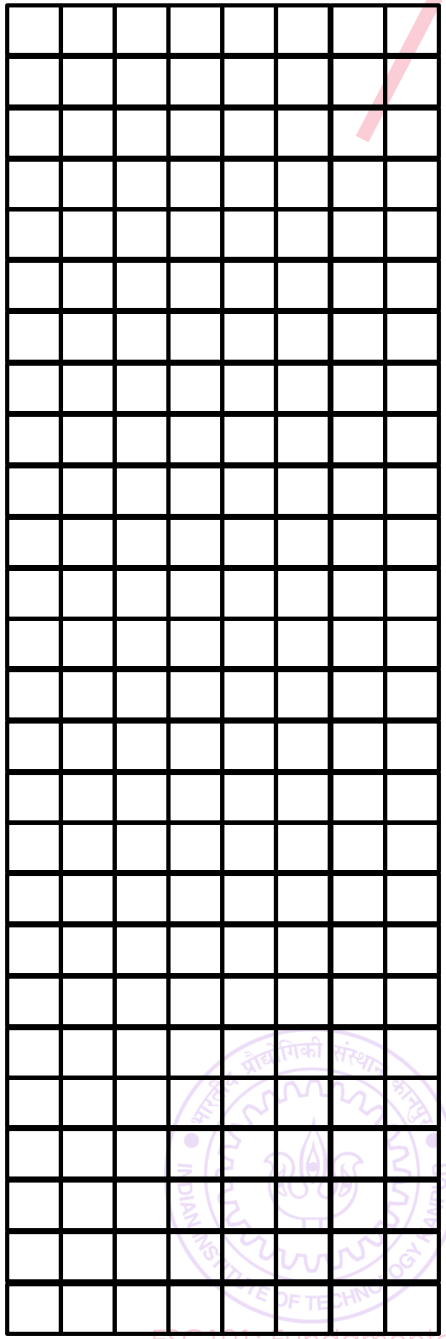

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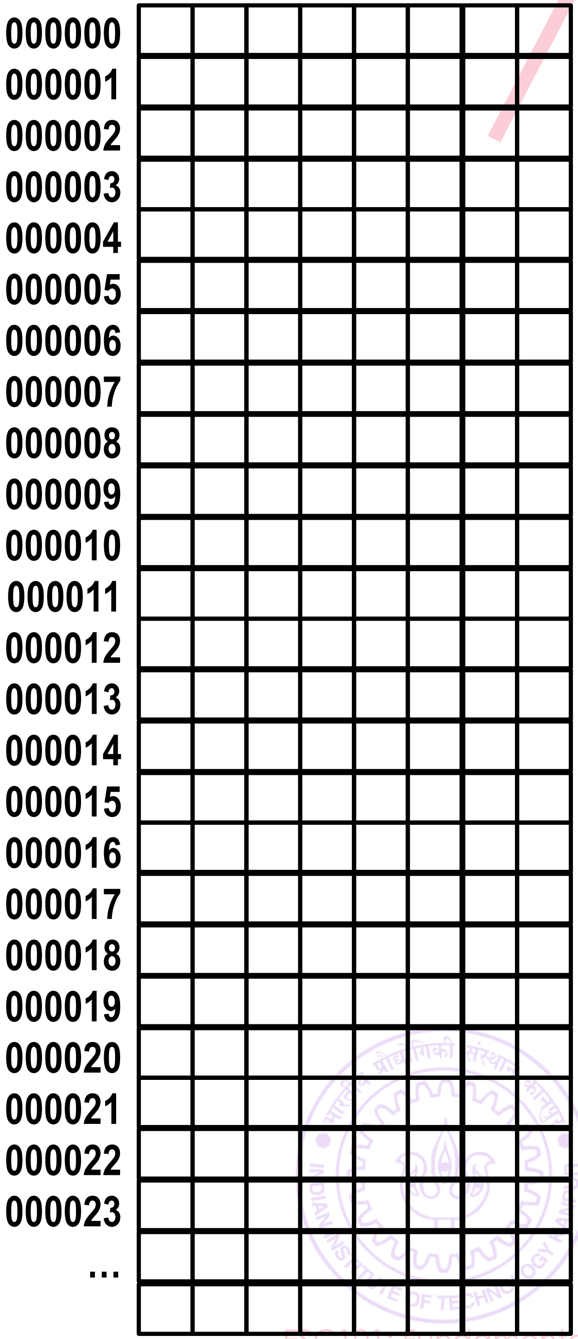

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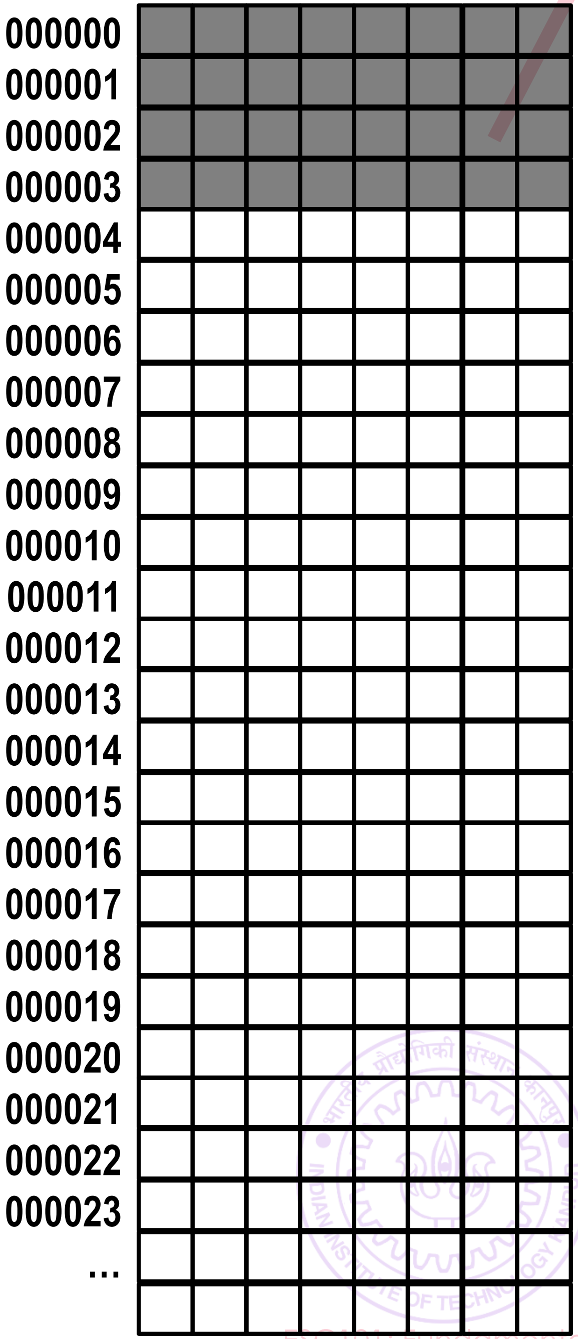

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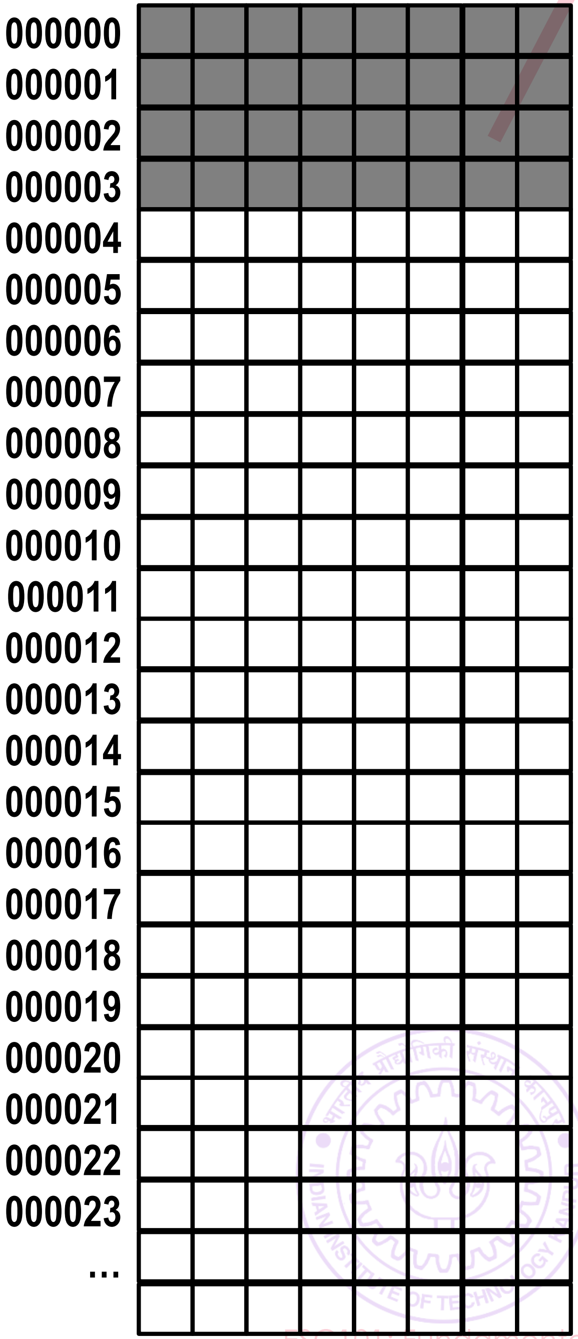

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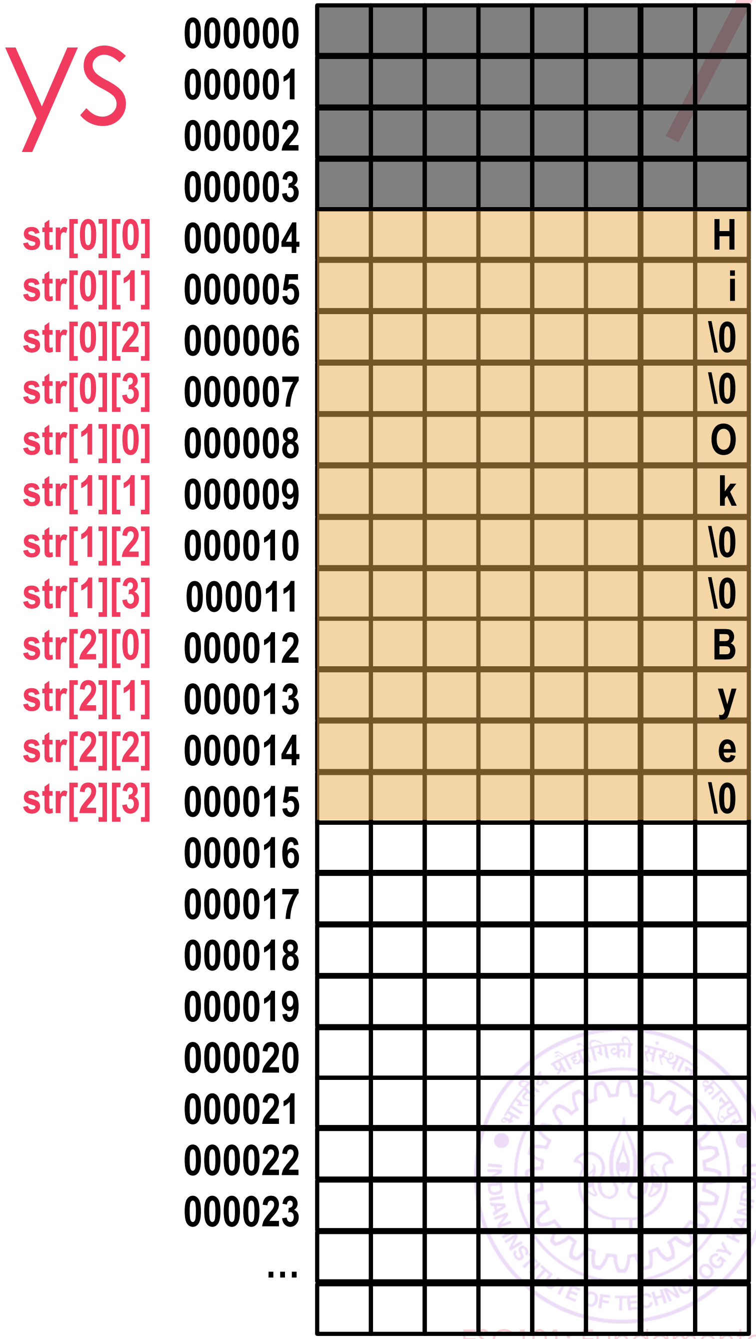

	000000	
	000001	
	000002	
	000003	
str[0][0]	000004	H
str[0][1]	000005	i
str[0][2]	000006	\0
str[0][3]	000007	\0
str[1][0]	000008	O
str[1][1]	000009	k
str[1][2]	000010	\0
str[1][3]	000011	\0
str[2][0]	000012	B
str[2][1]	000013	y
str[2][2]	000014	e
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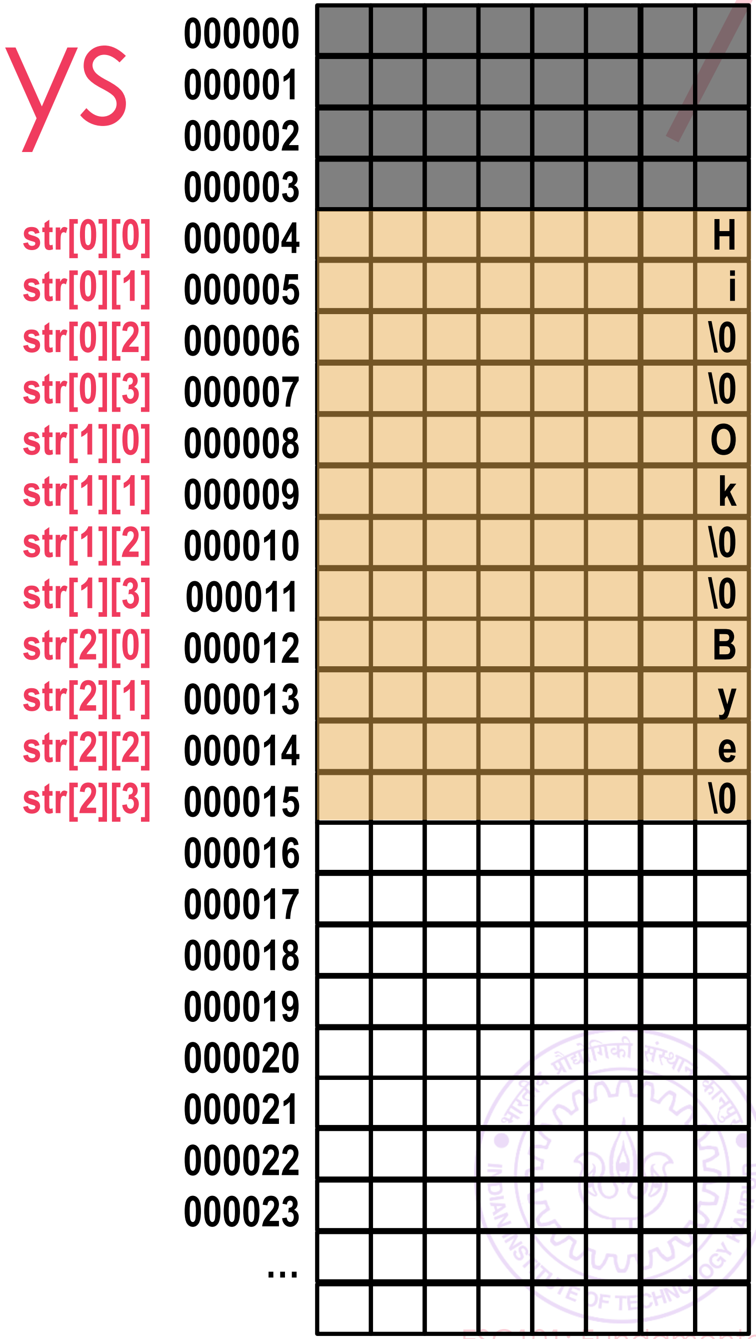

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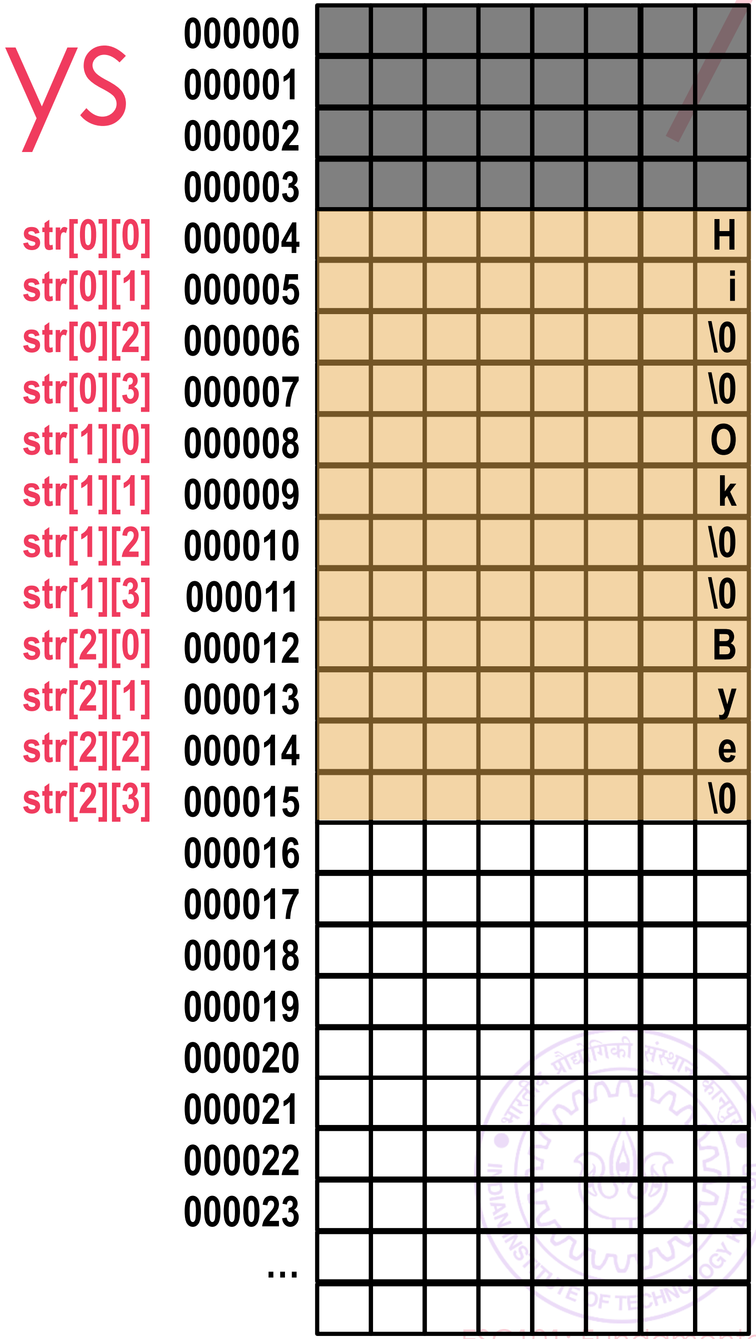
First all elements of row 0 stored in continuous sequence



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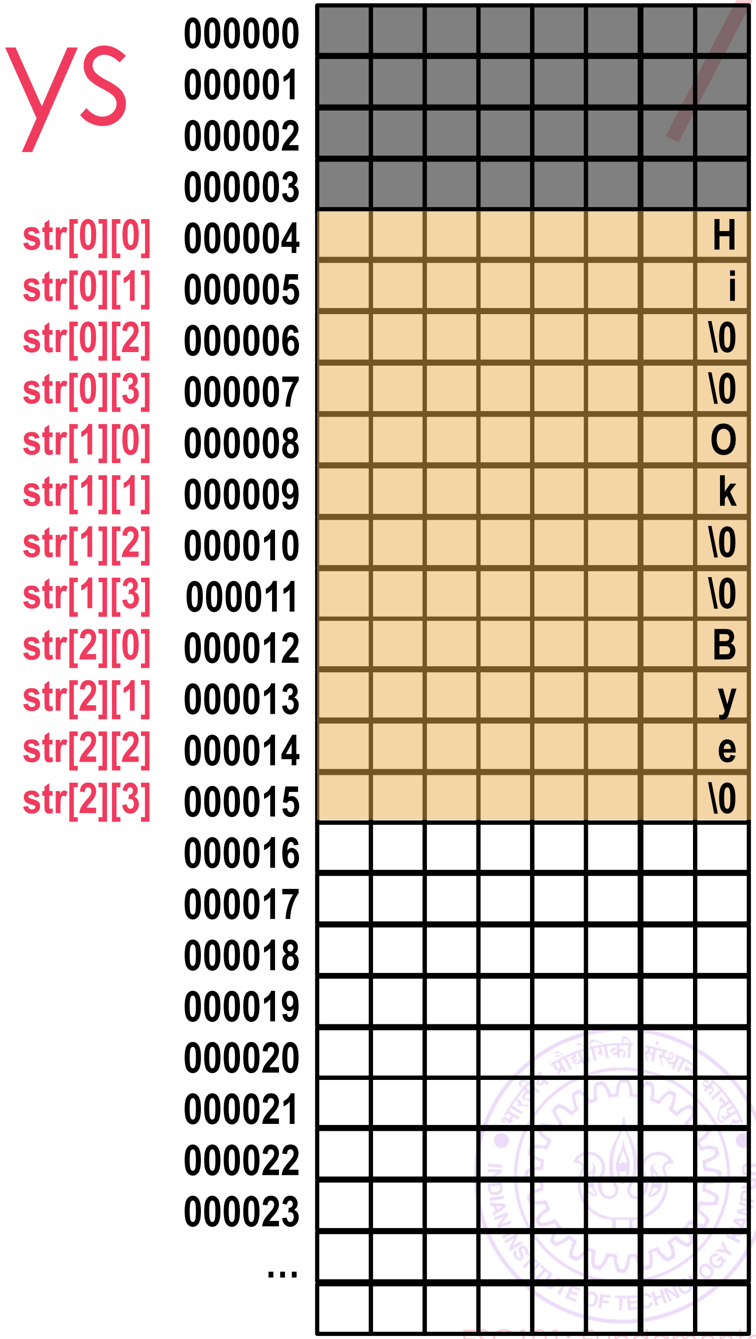

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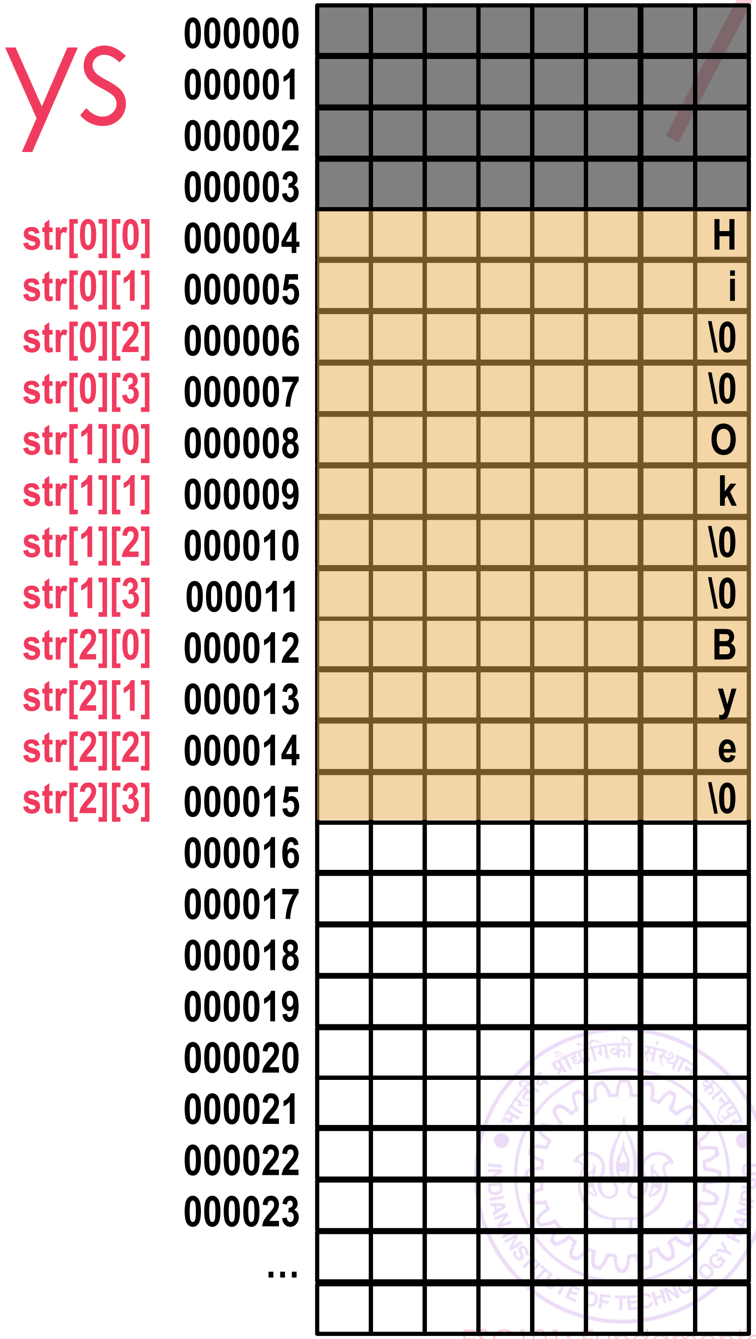
char* ptr = *str; // ptr points to str[0][0]

ptr += 4; // ptr now points to str[1][0]

ptr += 4; // ptr now points to str[2][0]

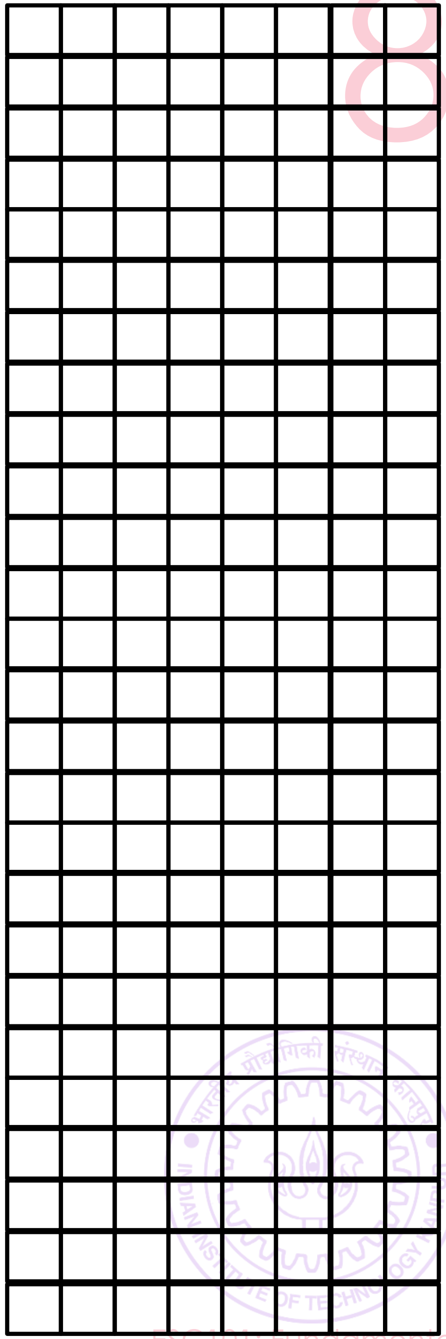
ptr += 1; // ptr now points to str[2][1]



	000000	
	000001	
	000002	
	000003	
str[0][0]	000004	H
str[0][1]	000005	i
str[0][2]	000006	\0
str[0][3]	000007	\0
str[1][0]	000008	O
str[1][1]	000009	k
str[1][2]	000010	\0
str[1][3]	000011	\0
str[2][0]	000012	B
str[2][1]	000013	y
str[2][2]	000014	e
str[2][3]	000015	\0
	000016	
	000017	
	000018	
	000019	
	000020	
	000021	
	000022	
	000023	
	…	

Layout of arrays of arrays

Layout of arrays of arrays



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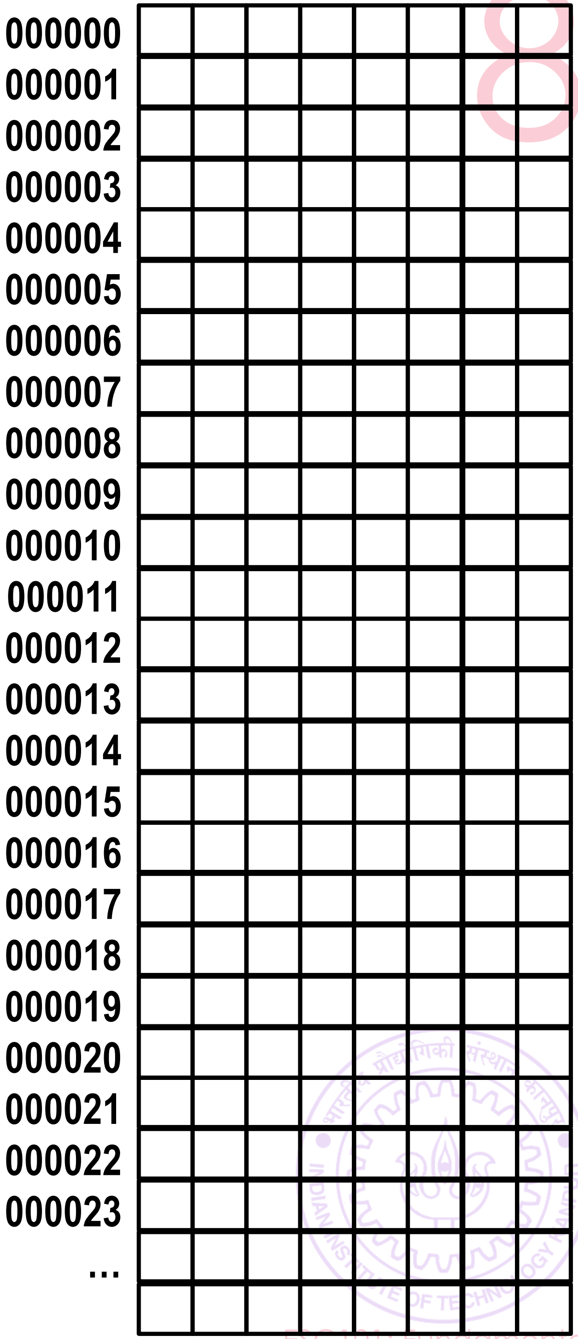

000000
000001
000002
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000009
000010
000011
000012
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000016
000017
000018
000019
000020
000021
000022
000023
...

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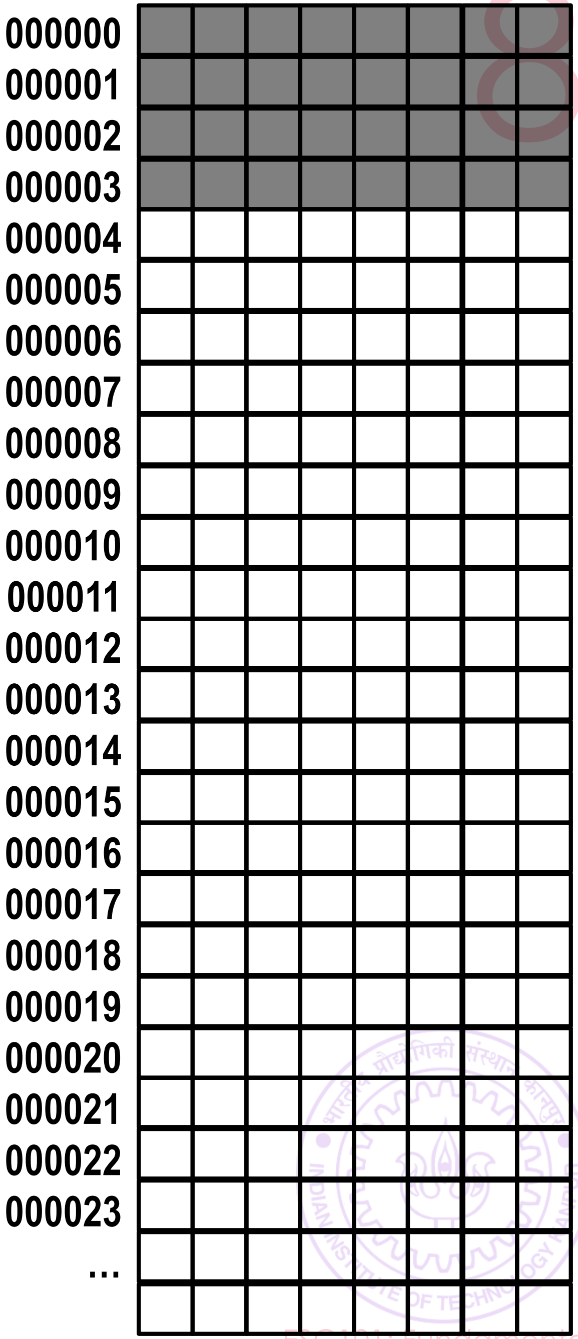

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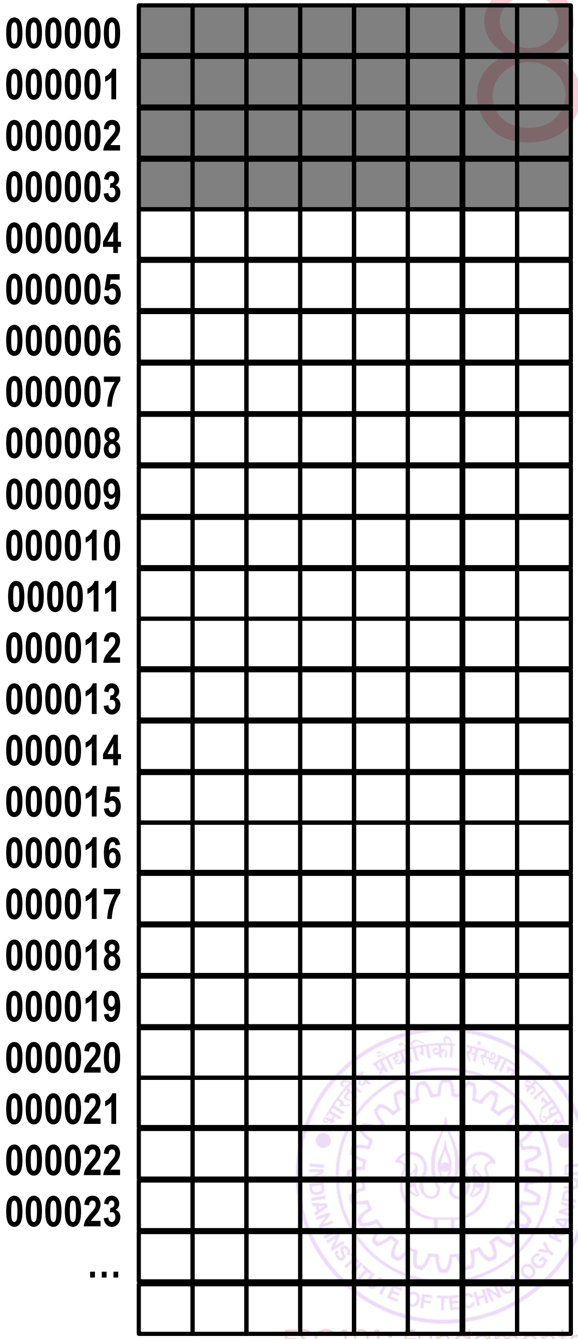

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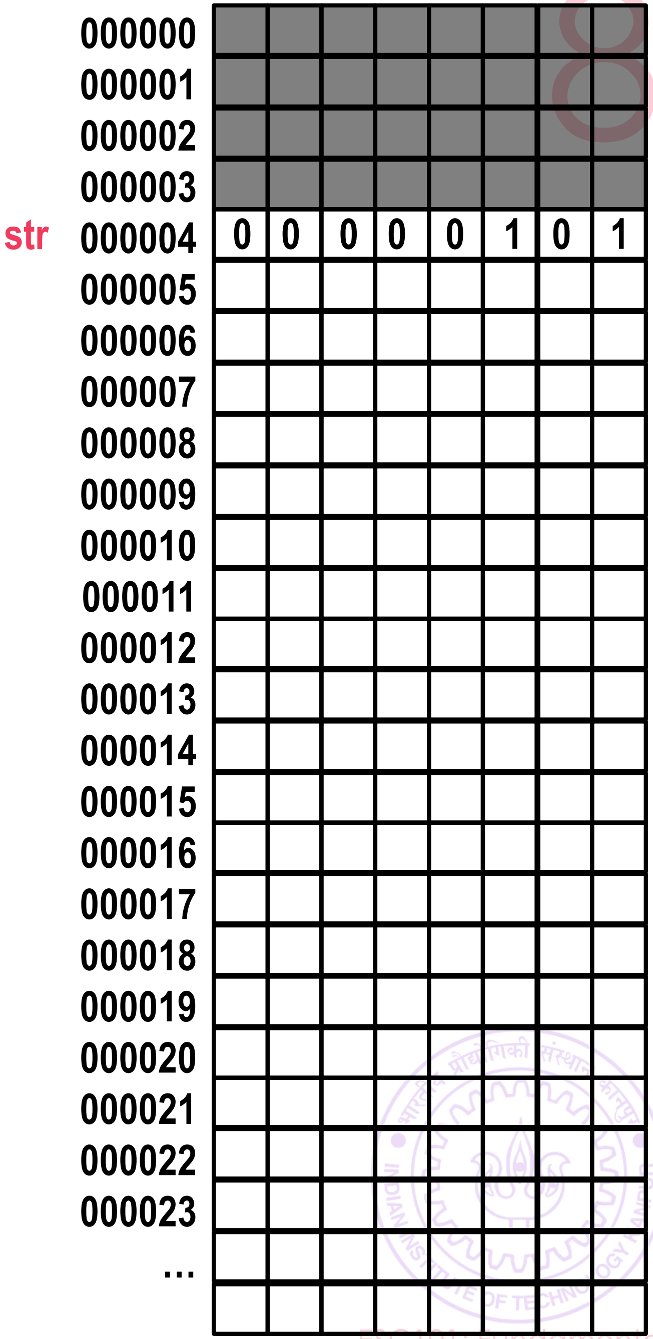

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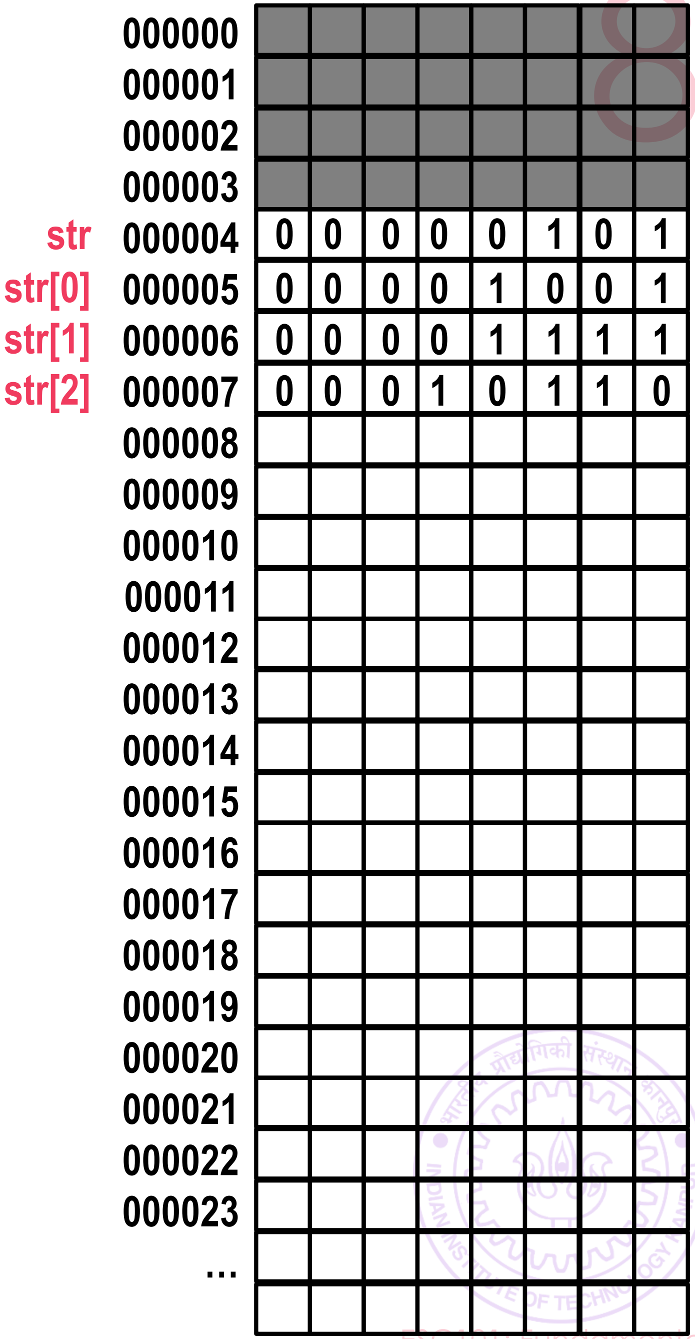

	000000								
	000001								
	000002								
	000003								
str	000004	0	0	0	0	0	1	0	1
str[0]	000005	0	0	0	0	1	0	0	1
str[1]	000006	0	0	0	0	1	1	1	1
str[2]	000007	0	0	0	1	0	1	1	0
	000008								
	000009								
	000010								
	000011								
	000012								
	000013								
	000014								
	000015								
	000016								
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	000018								
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	000023								
	...								

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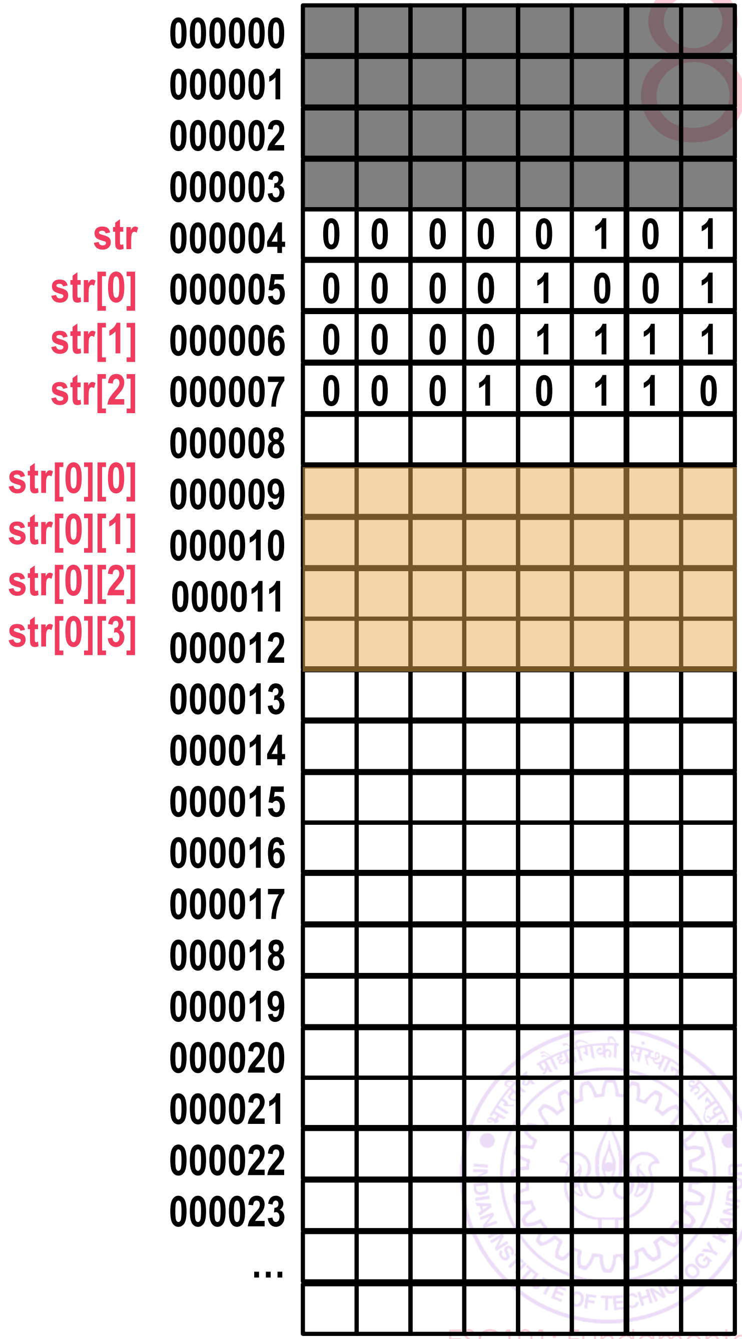

	000000								
	000001								
	000002								
	000003								
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str[0]	000005	0	0	0	0	1	0	0	1
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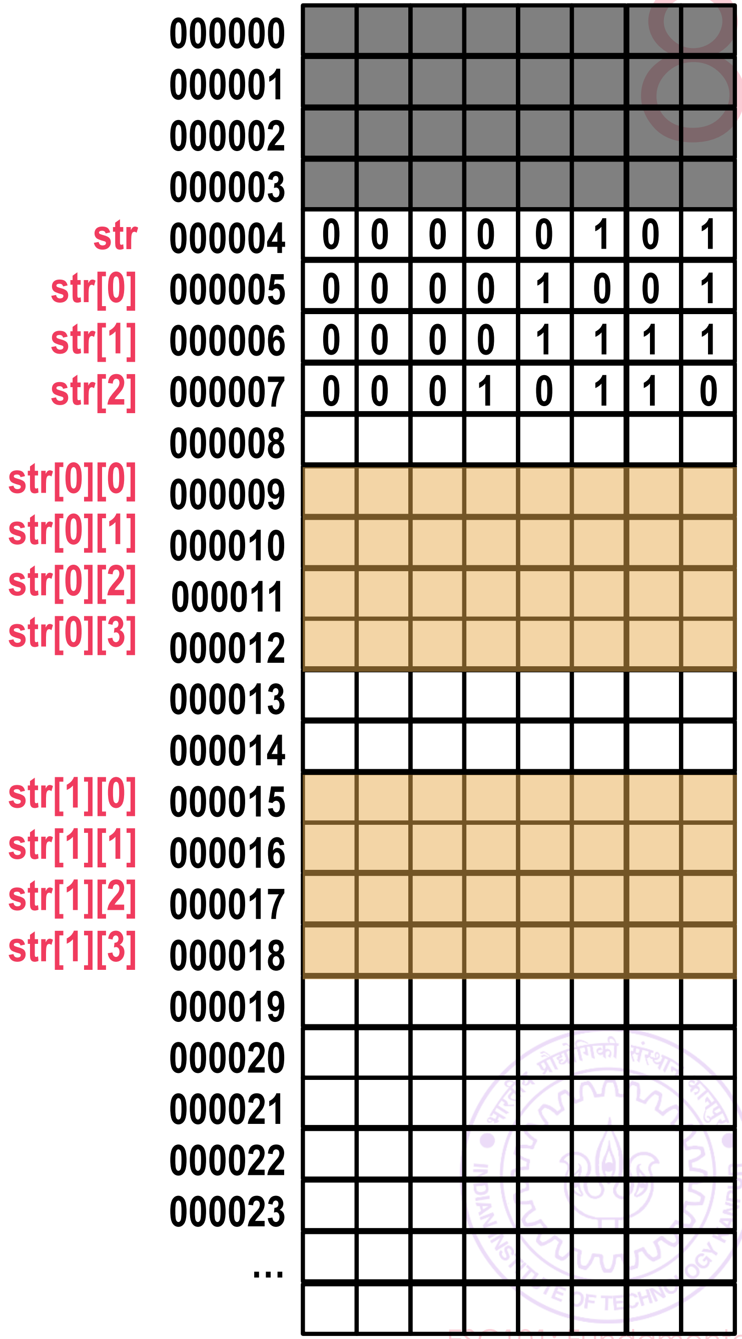

	000000								
	000001								
	000002								
	000003								
str	000004	0	0	0	0	0	1	0	1
str[0]	000005	0	0	0	0	1	0	0	1
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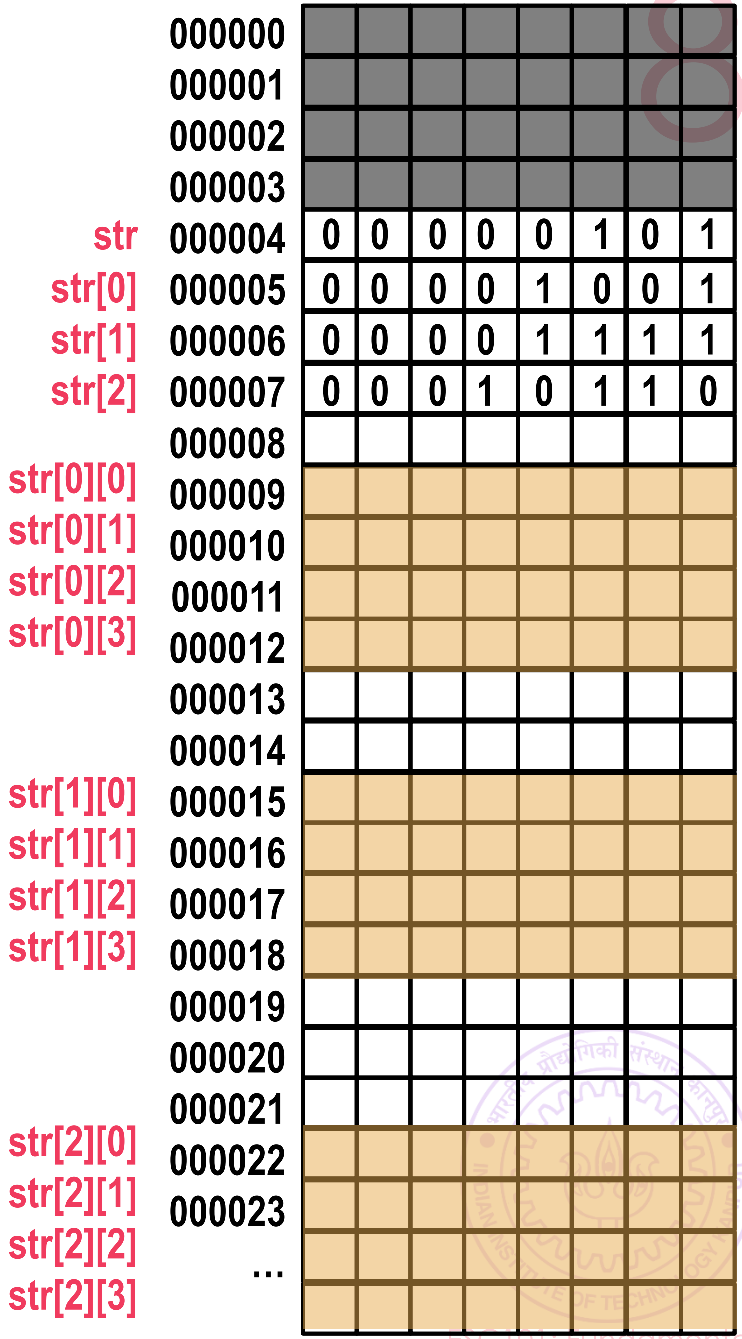

	000000								
	000001								
	000002								
	000003								
str	000004	0	0	0	0	0	1	0	1
str[0]	000005	0	0	0	0	1	0	0	1
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str[2]	000007	0	0	0	1	0	1	1	0
	000008								
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str[0][1]	000010								
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	000019								
	000020								
	000021								
str[2][0]	000022								
str[2][1]	000023								
str[2][2]	...								
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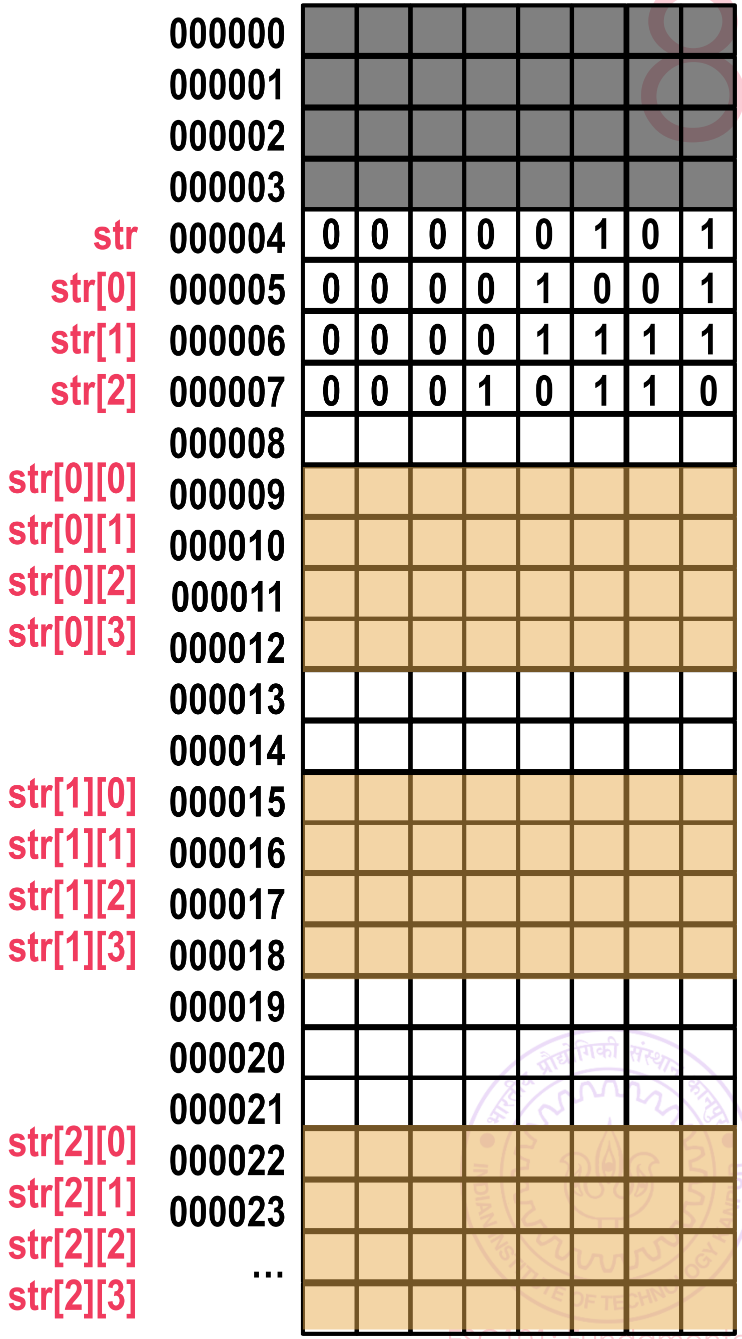
```

Element within a single array always stored in sequence



	000000								
	000001								
	000002								
	000003								
str	000004	0	0	0	0	0	1	0	1
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	000008								
str[0][0]	000009								
str[0][1]	000010								
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```
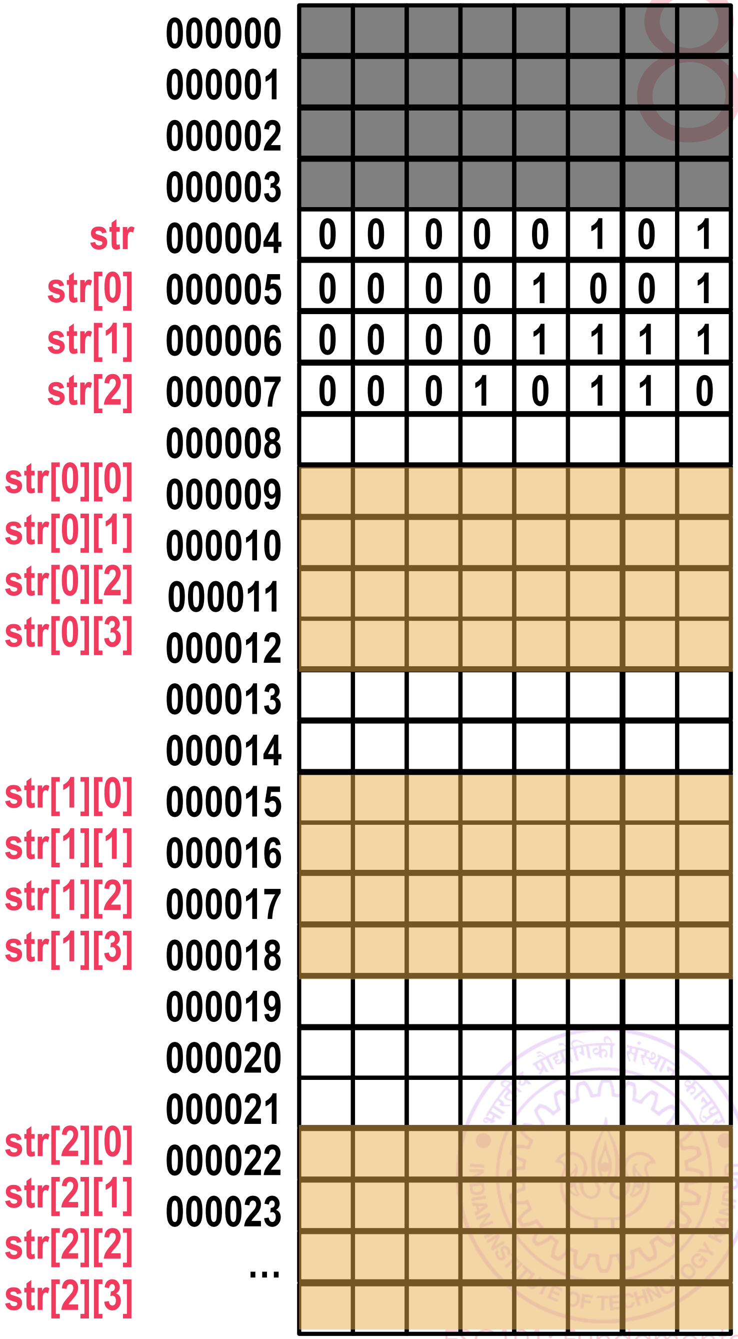

Element within a single array always stored in sequence

Different arrays may be stored far away from each other



	000000								
	000001								
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str	000004	0	0	0	0	0	1	0	1
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str[0][3]	000012								
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str[1][1]	000016								
str[1][2]	000017								
str[1][3]	000018								
	000019								
	000020								
	000021								
str[2][0]	000022								
str[2][1]	000023								
str[2][2]	...								
str[2][3]									

Mr C takes a Math Lesson

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Mathematics is full of functions - we define more powerful functions using simple functions

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$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$

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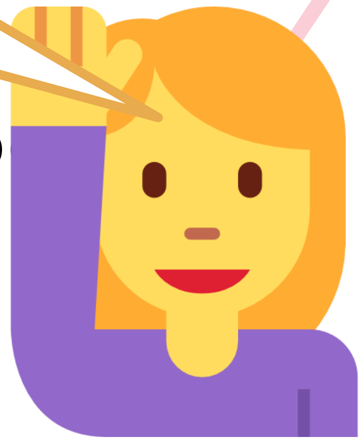
Although we can write tan(x) in terms of addition, subtraction, multiplication and division, we almost never do that. We always write tan(x) = sin(x)/cos(x)



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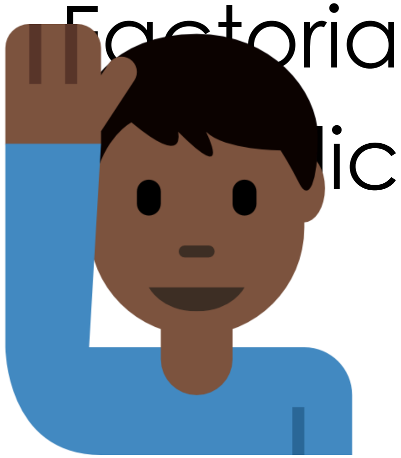

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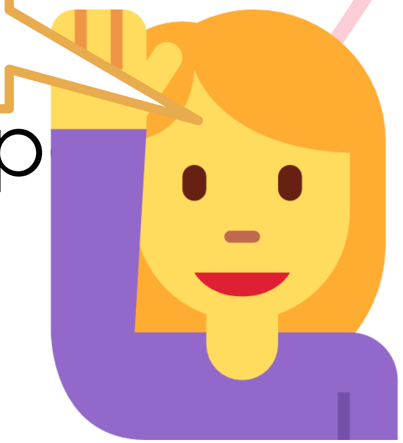

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Facto ltiplication ☺

f addition ☺

Helps us write much cleaner math expressions, as well as we do not make mistakes very often

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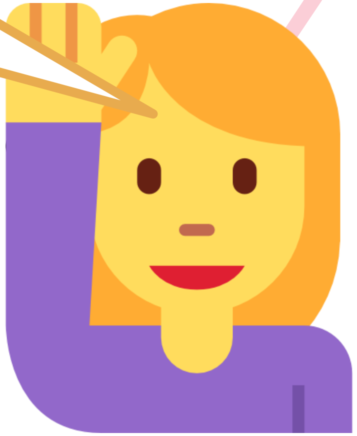

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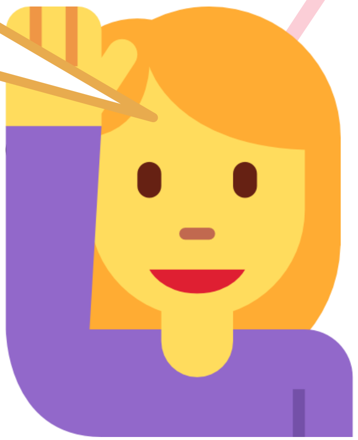

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I too allow you to write your own functions for your comfort and to make your code easier to read and easier to debug!