Mr C has Character

ESC101: Fundamentals of Computing

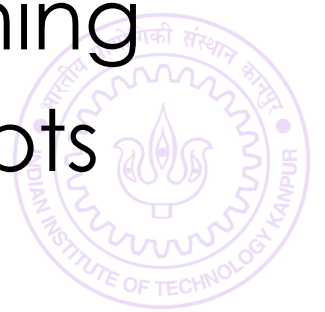
Purushottam Kar

Mid-sem Theory Exam

- September 22nd, 2018 (Saturday)
- Time: 1PM – 3PM
- Room: announced shortly
- Syllabus: till whatever is covered till Sep 14th tutorial
- No Make-up Exam – do not miss this exam
- Open handwritten notes – no printouts, mobiles, iPads.

Doubt-clearing Session

- Date: September 15th, 2018 (coming Saturday)
- Time: 5PM – 7PM
- Room: CC-02
- Students not comfortable with English are welcome
- Other students also welcome to clear doubts
- Please revise and have list of doubts before coming
- Will not cover lectures again in detail – only doubts



Advanced Track

- 29 students selected for advanced track
- If you have accepted advanced track, no need to come to lab today onwards
- Will receive mail this evening with mentor allocation
- Please contact mentors immediately and decide on project ideas
- Must have a preliminary project idea by end of this week (Friday evening September 14th, 2018)

Arrays

भारतीय प्रौद्योगिकी संस्थान कानपुर
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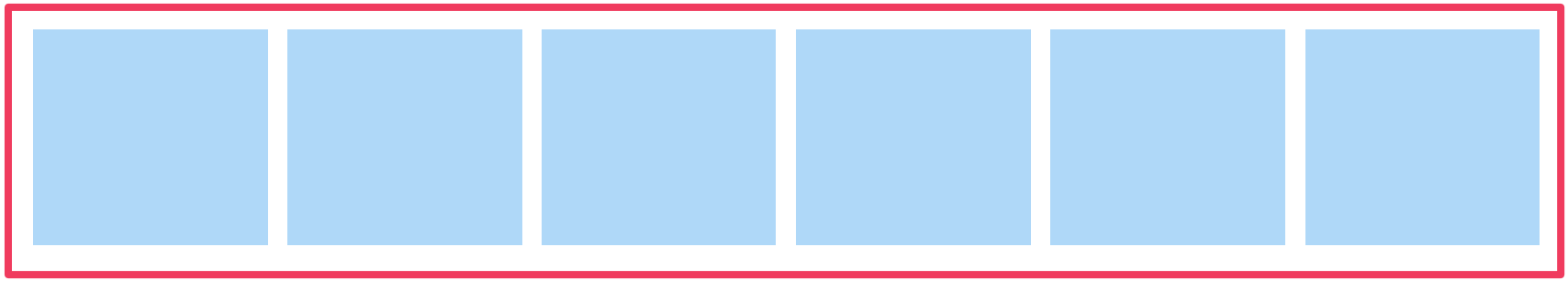

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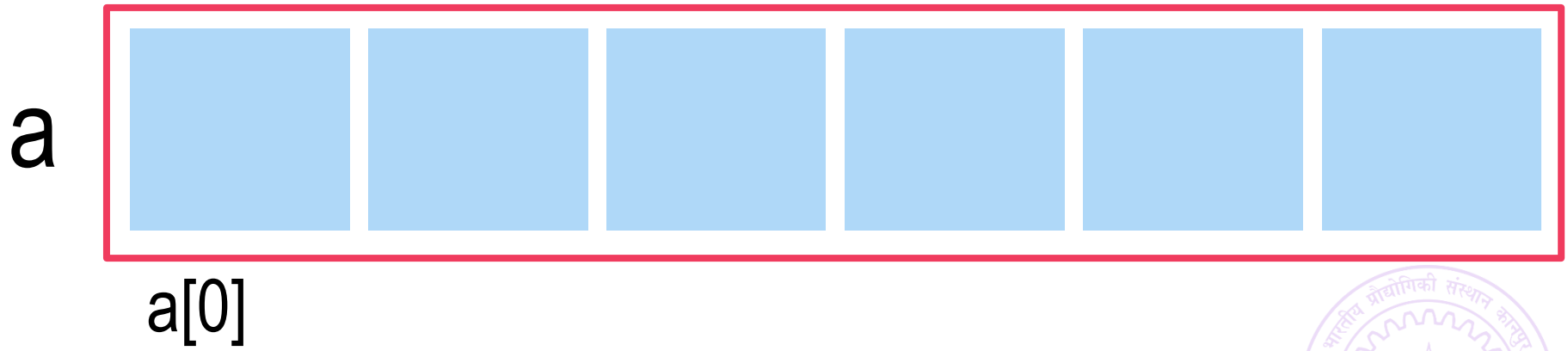

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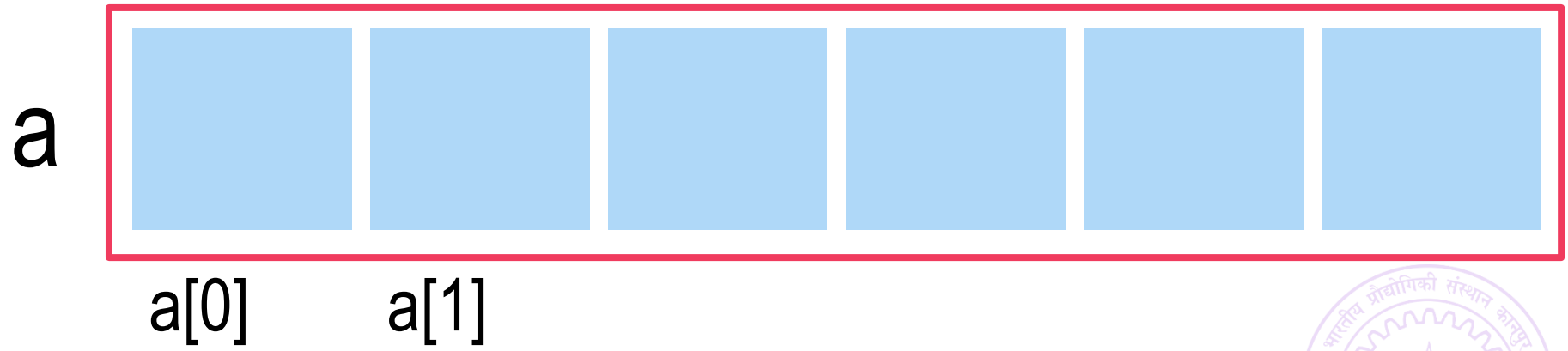

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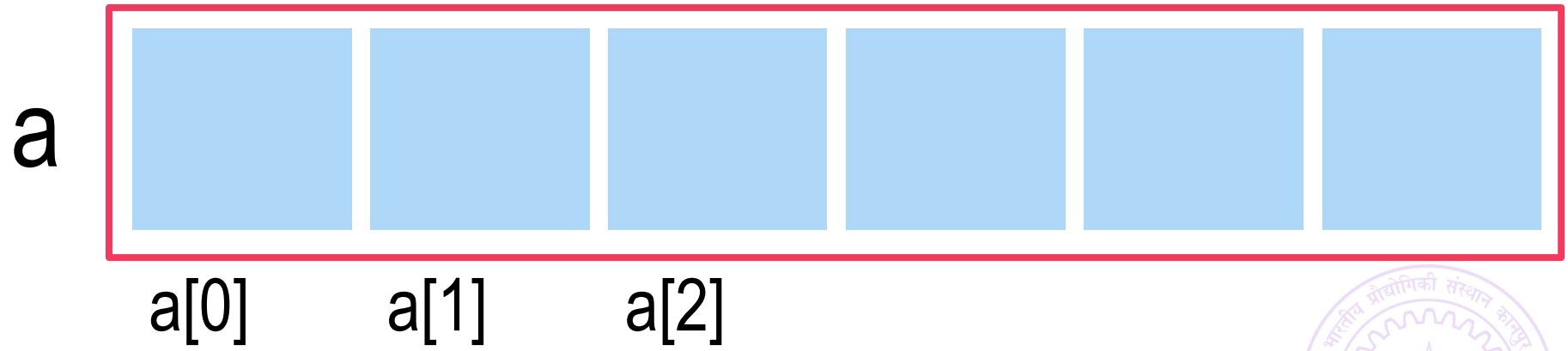

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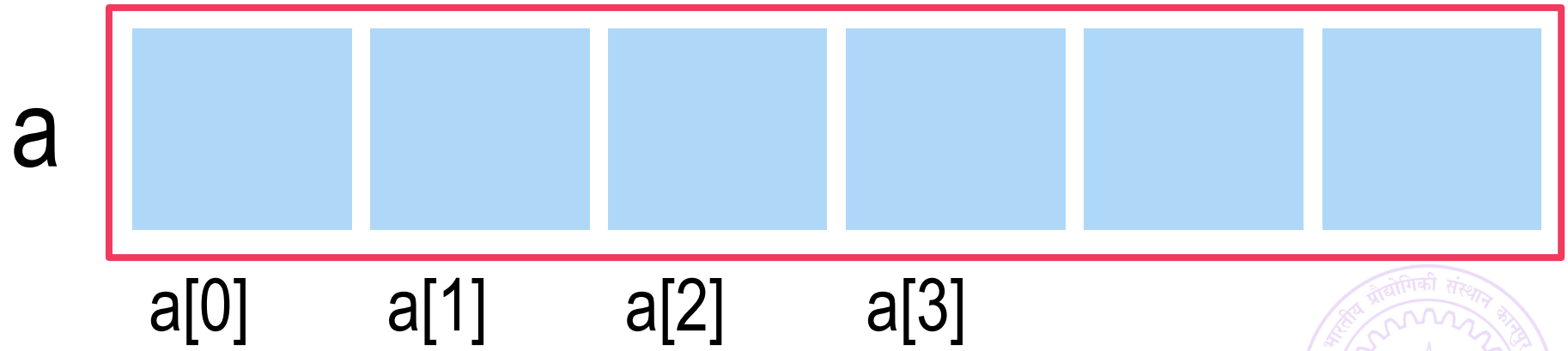

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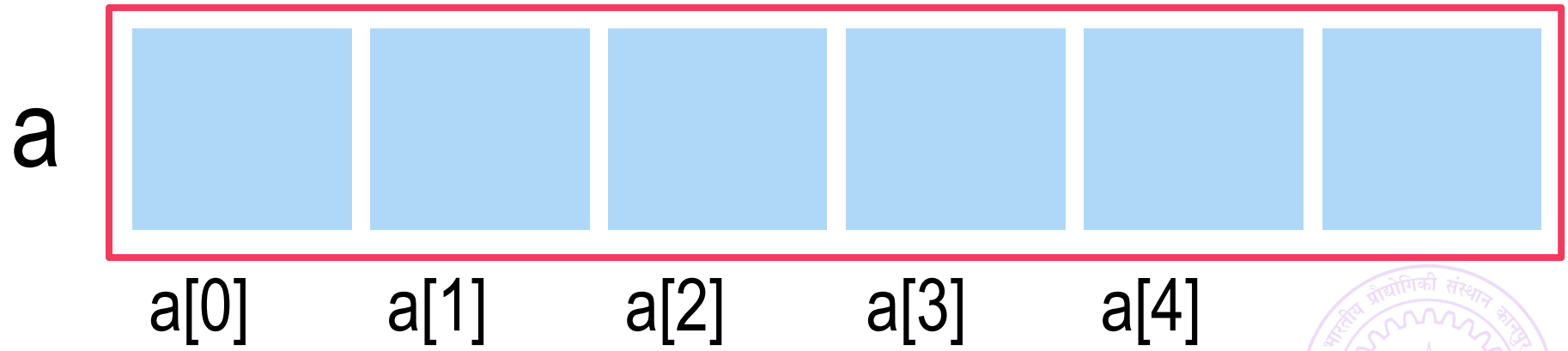

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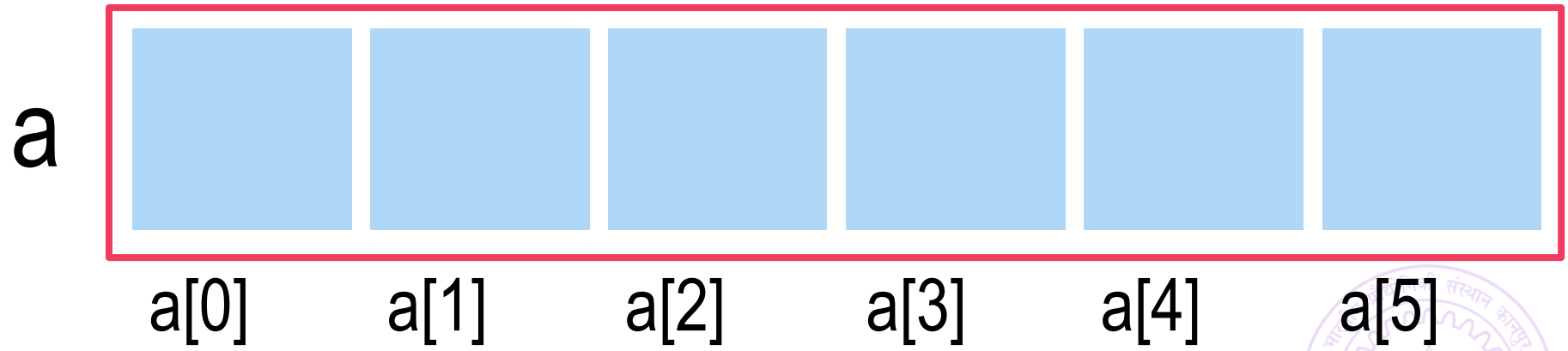

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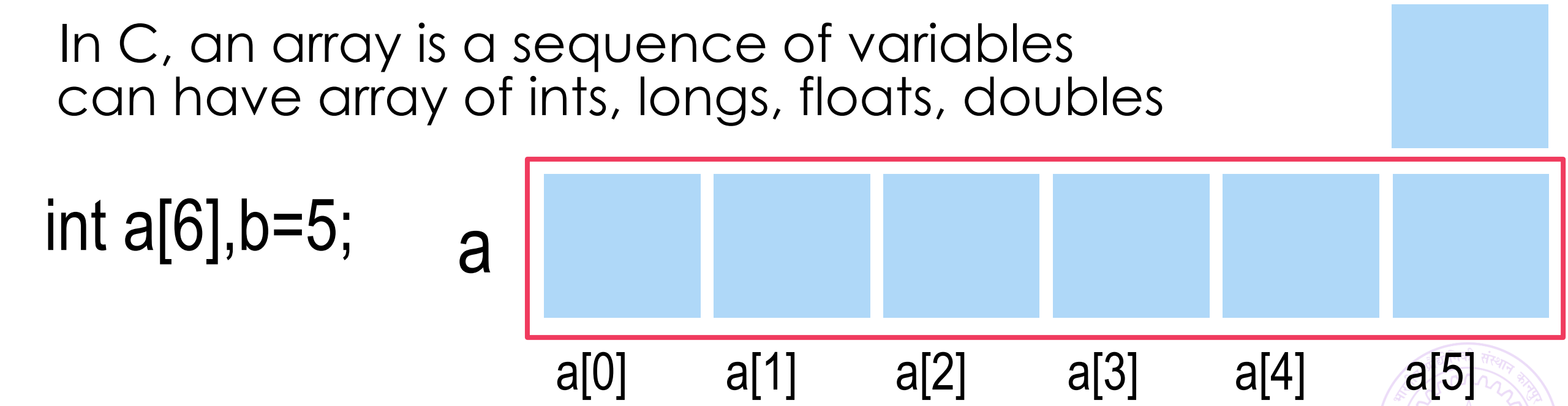

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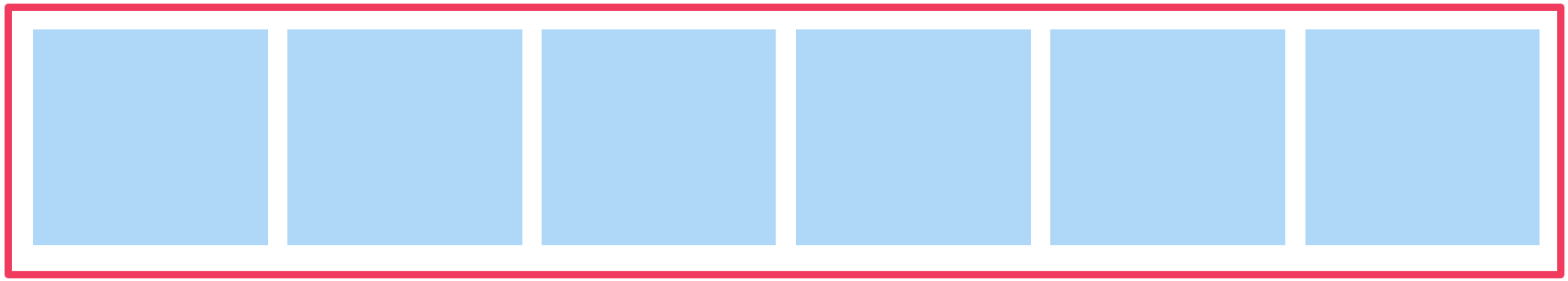

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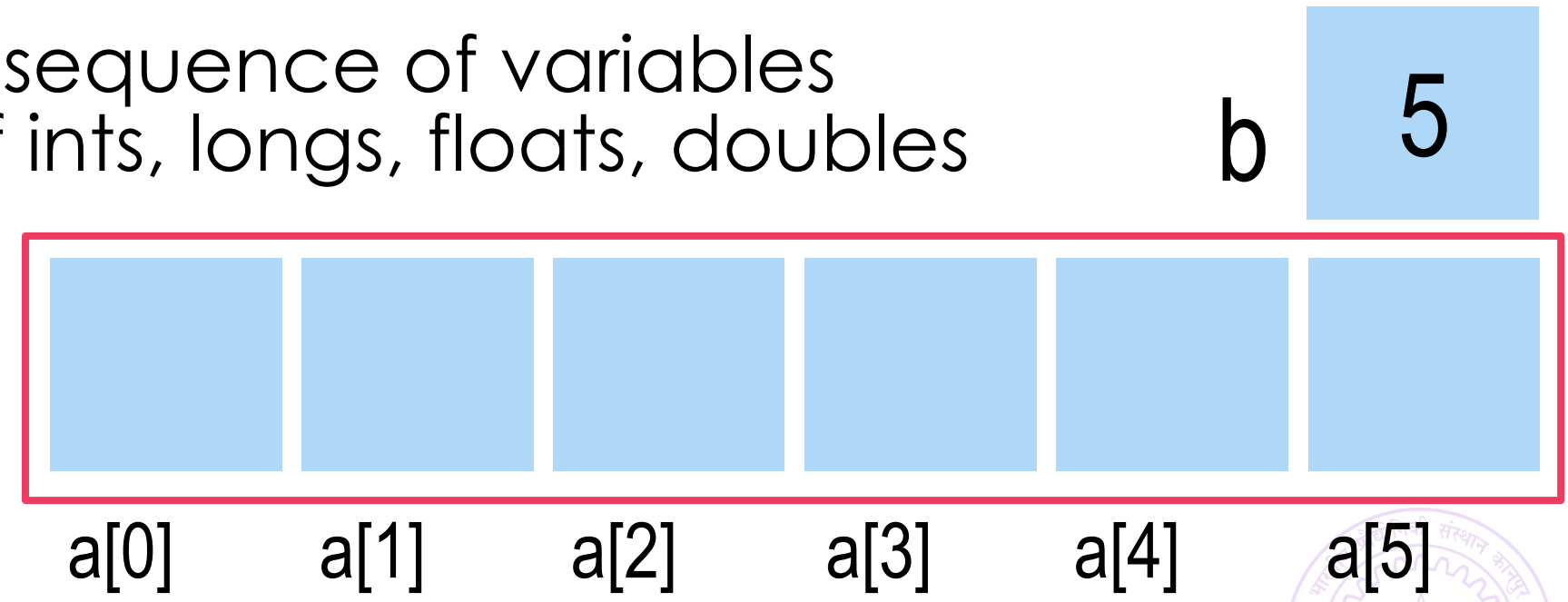

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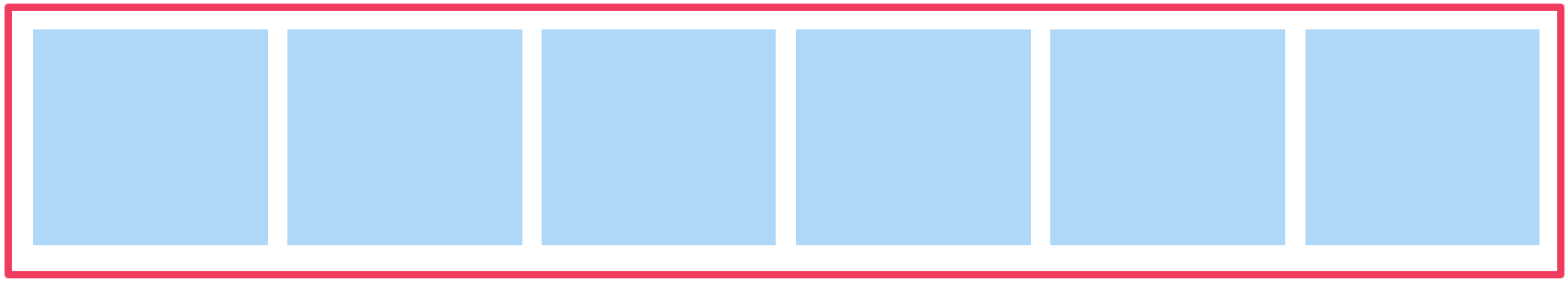

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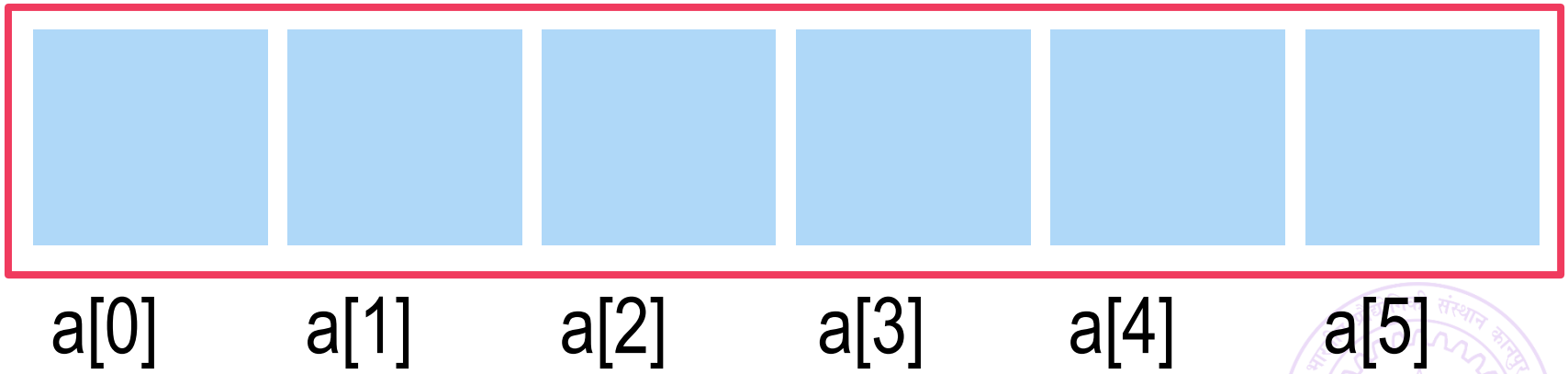

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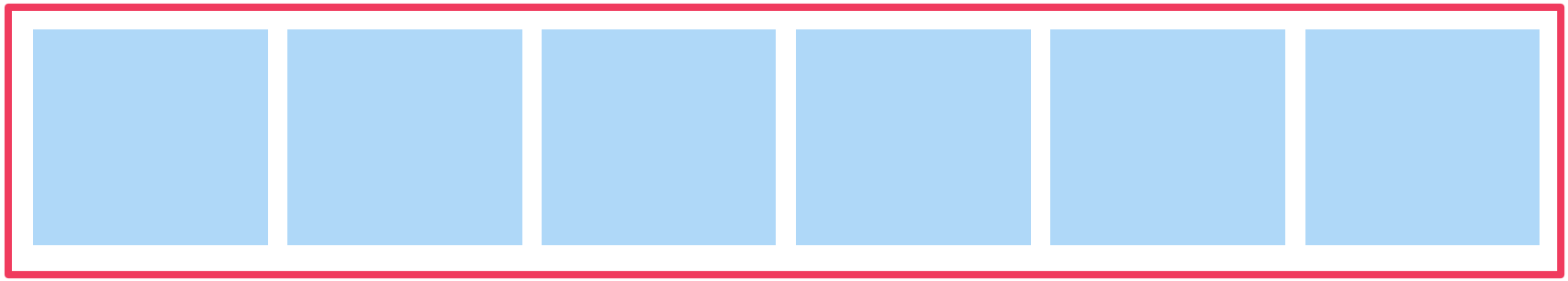

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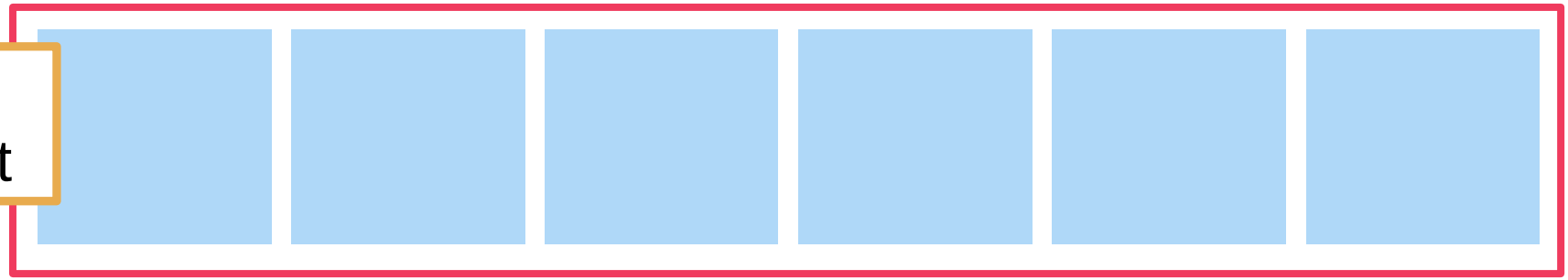

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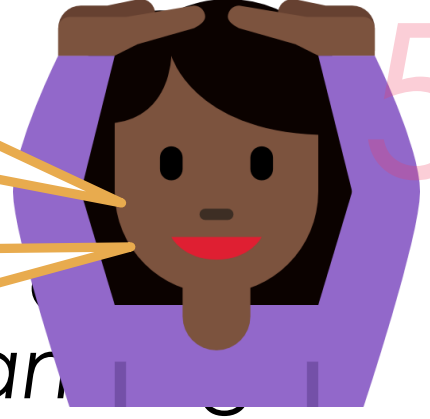

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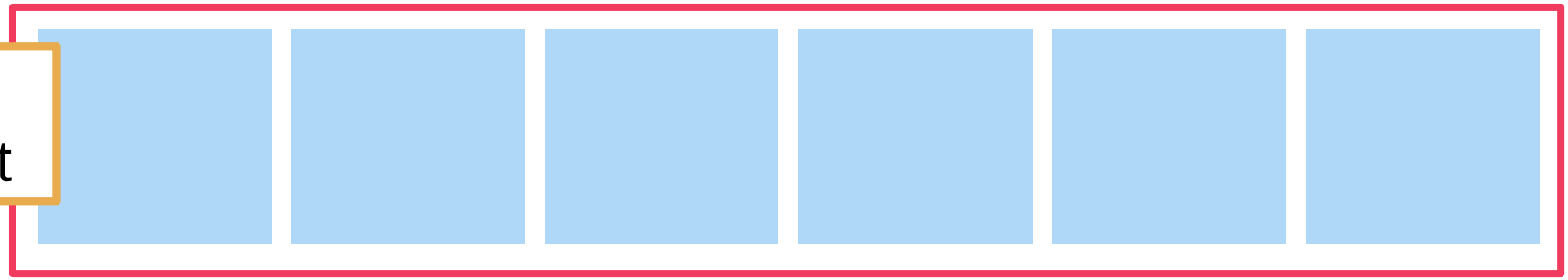

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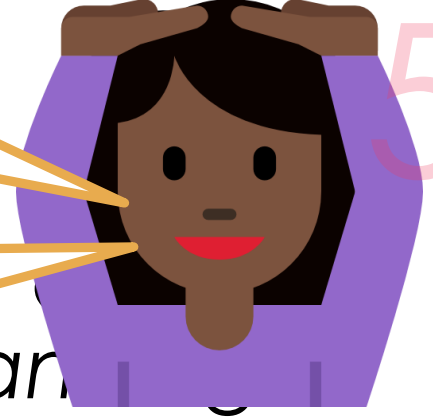

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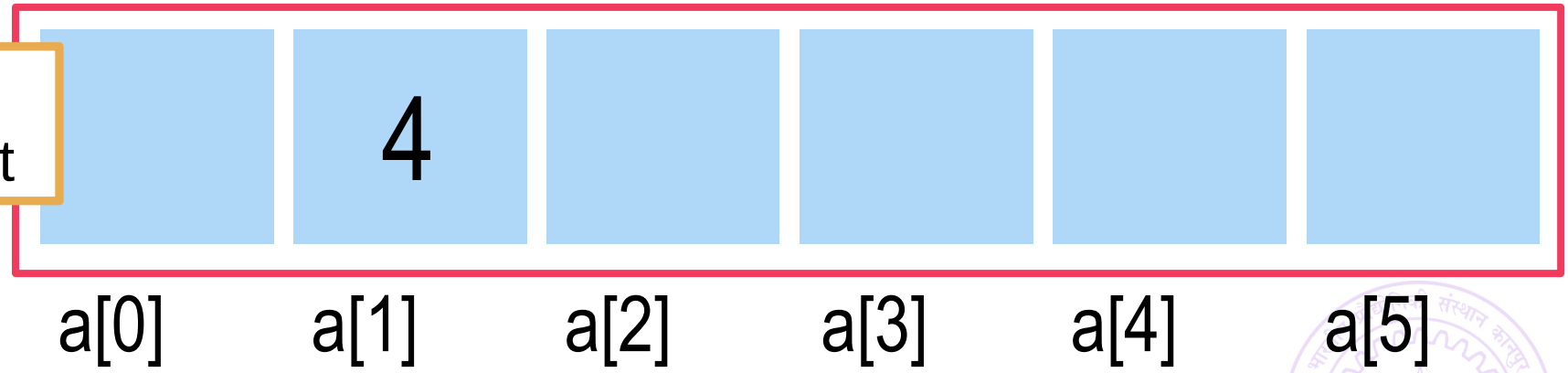

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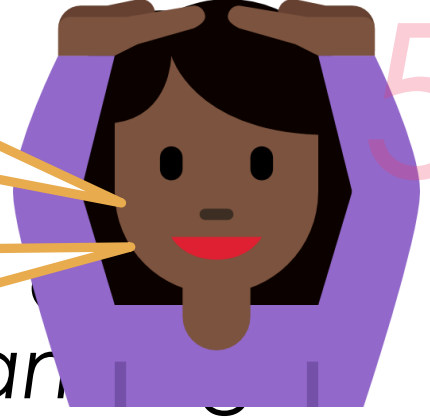

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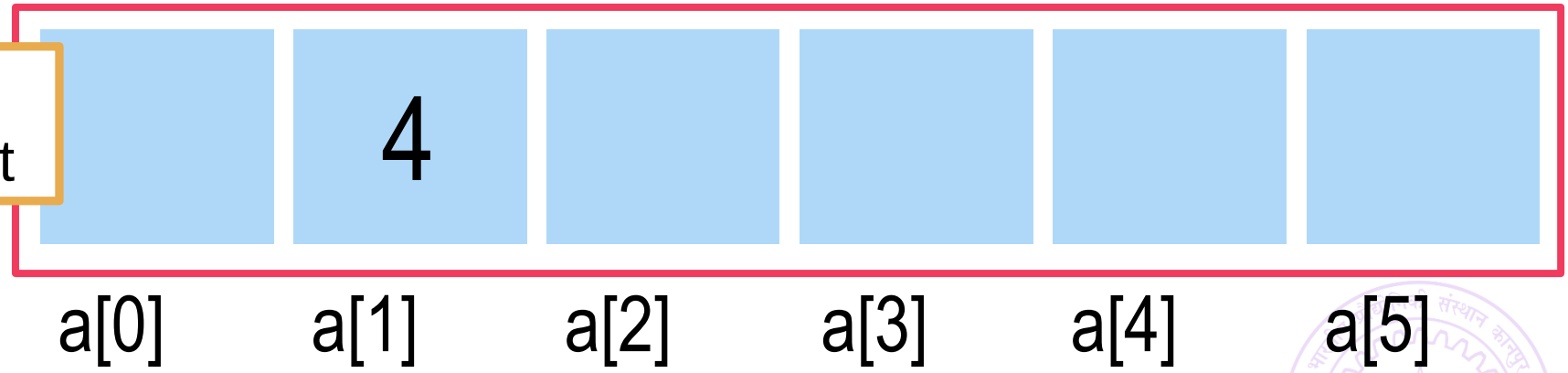

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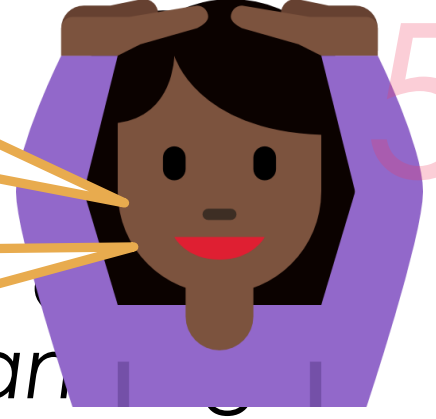

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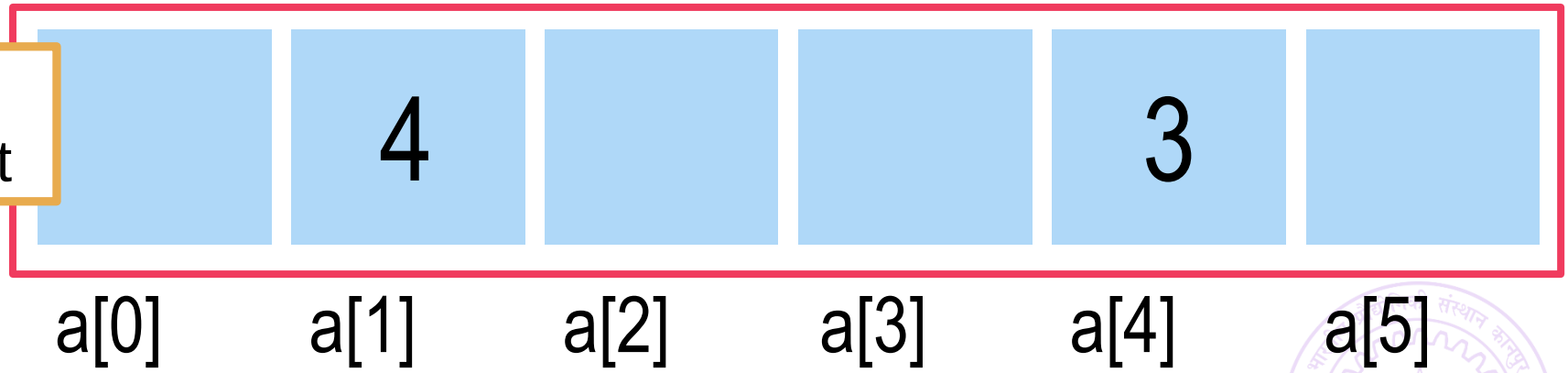

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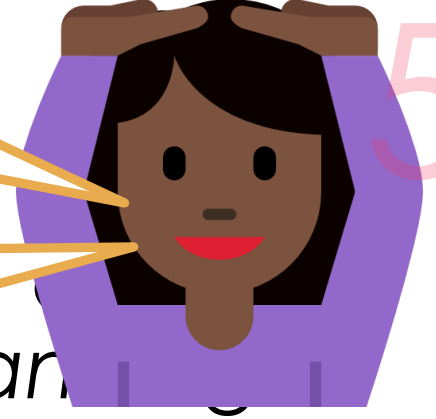

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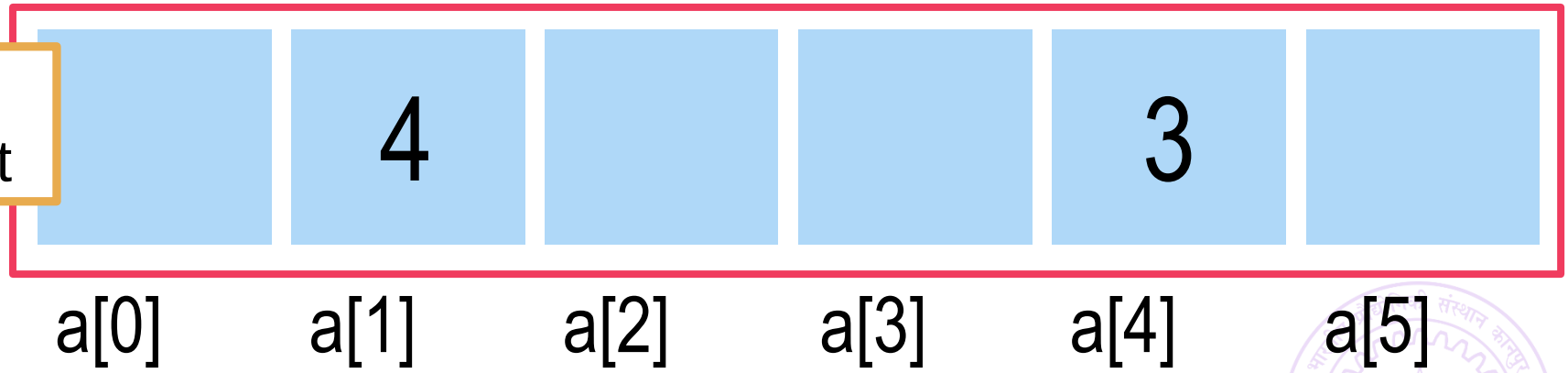

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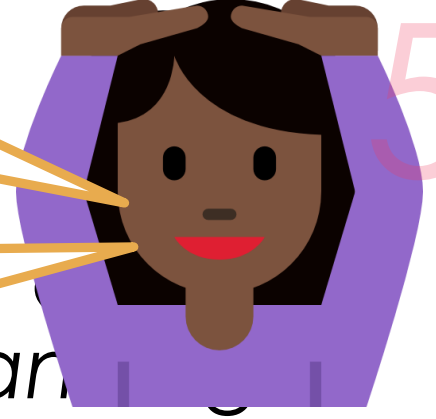

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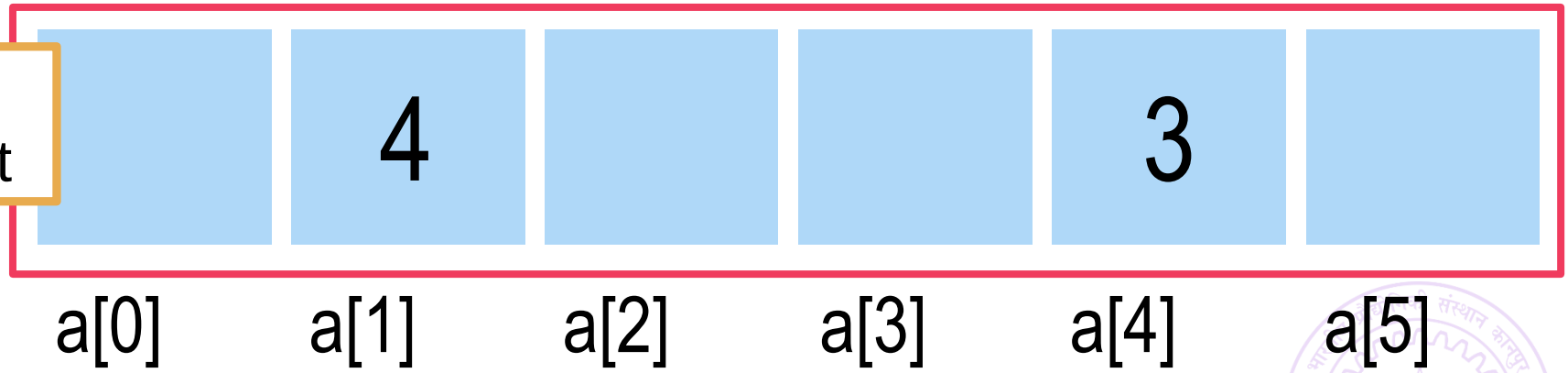

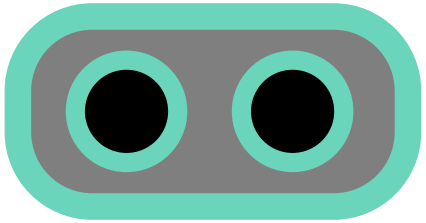

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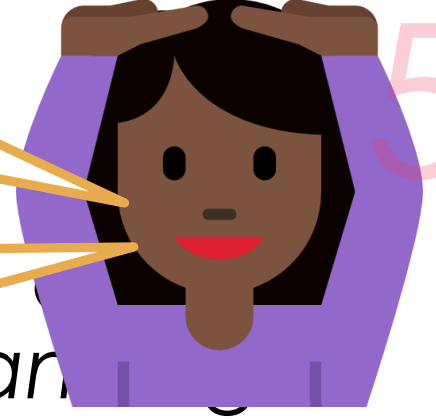

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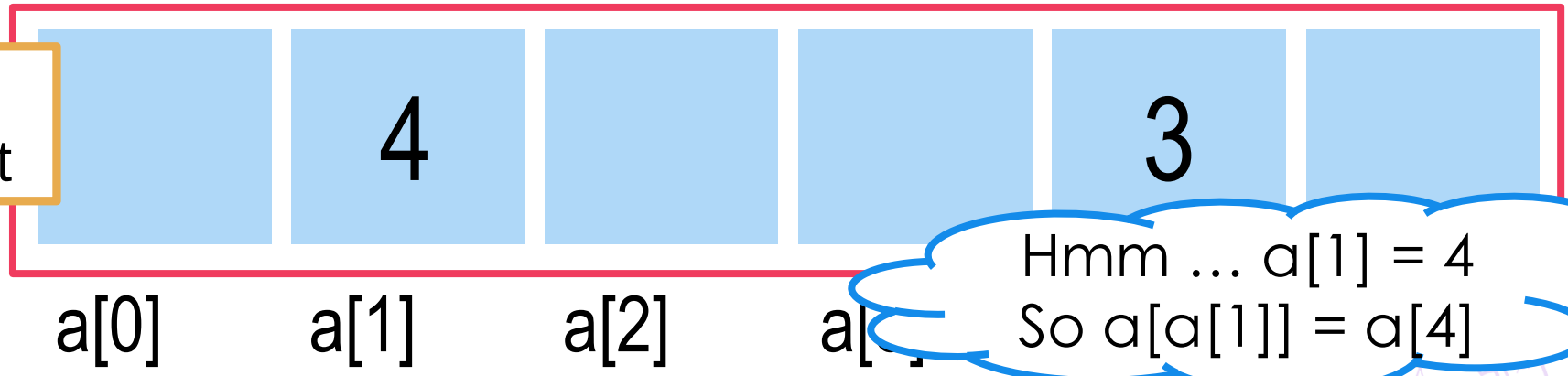

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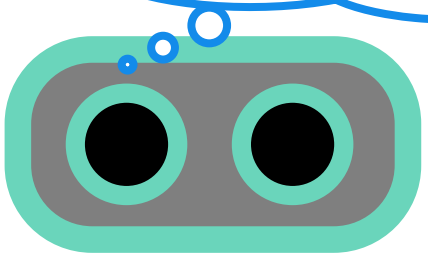

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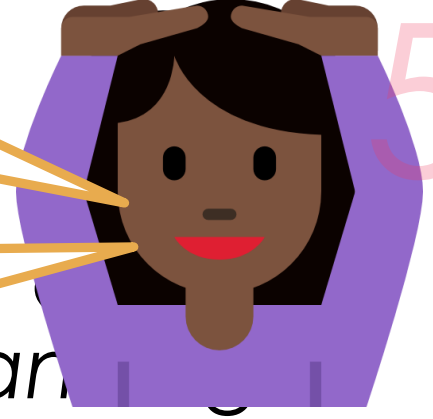

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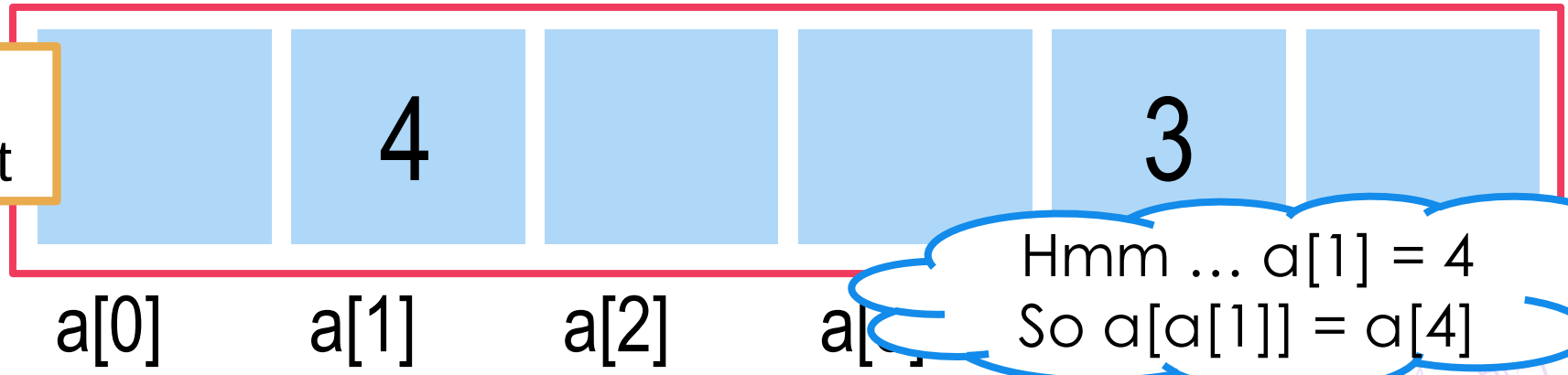

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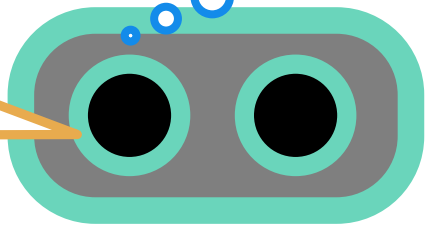

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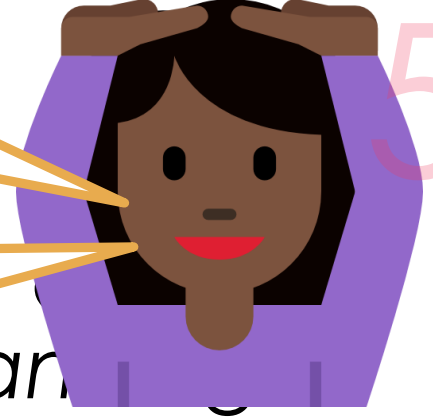

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The English word array
ordered series or arra
an array impressed the visiting head of the state on 26 Jan

In C, an array is a sequence of variables
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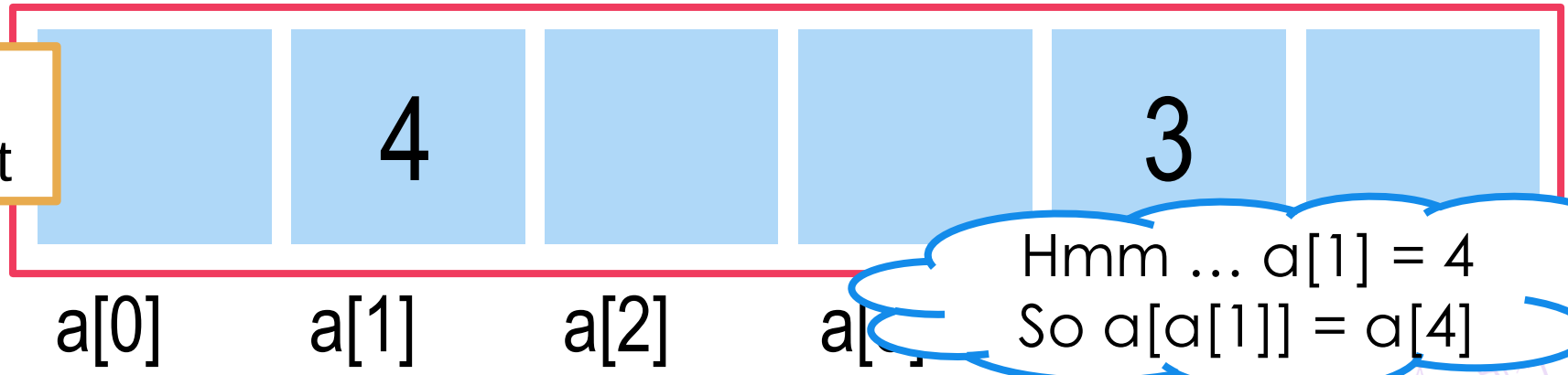

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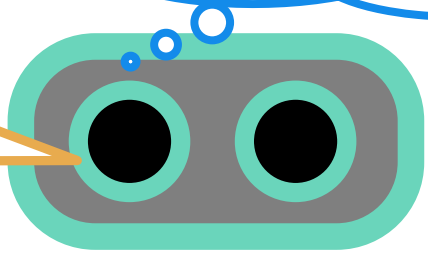

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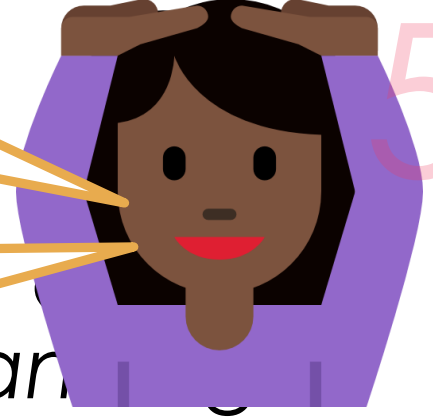

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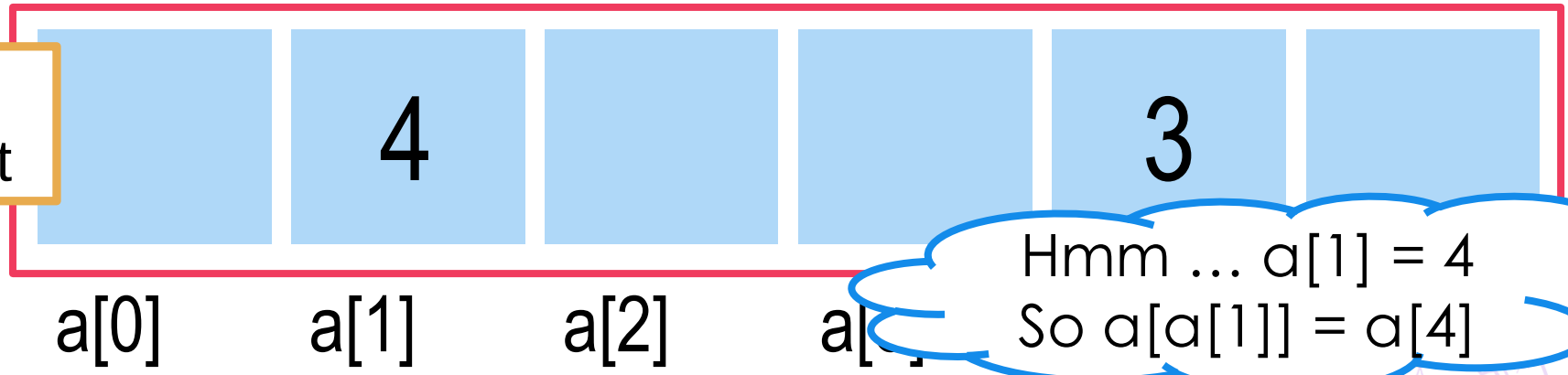

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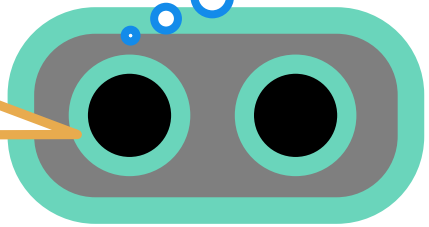

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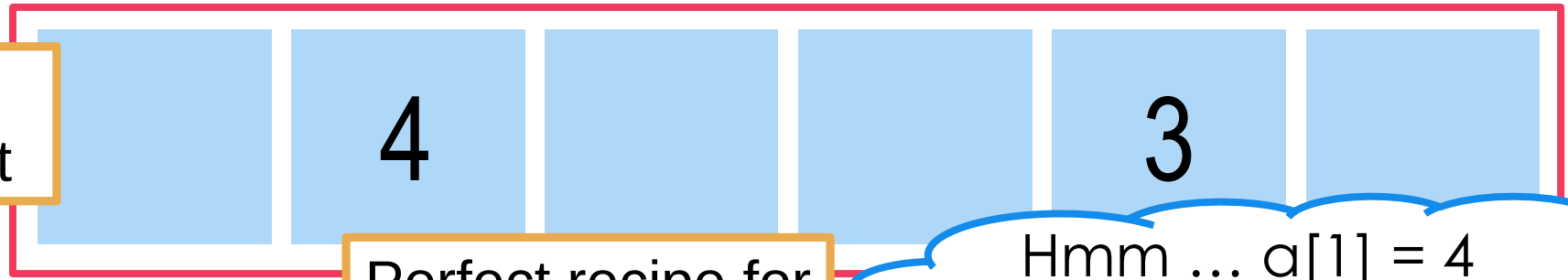

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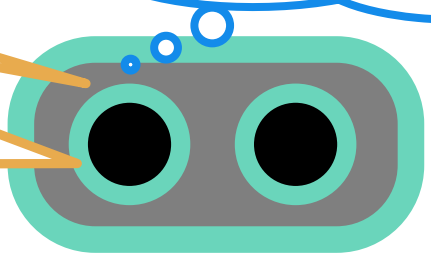

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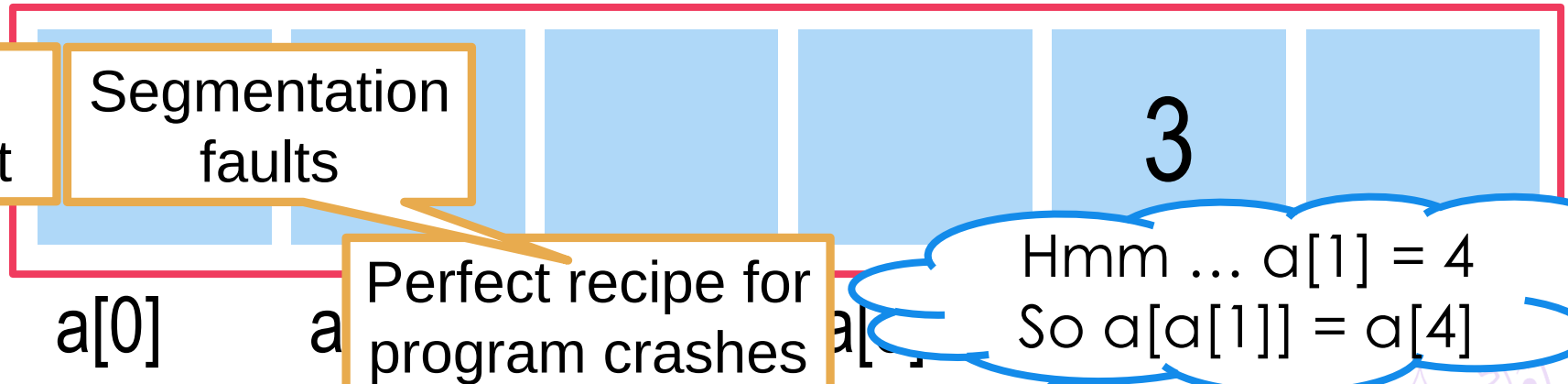

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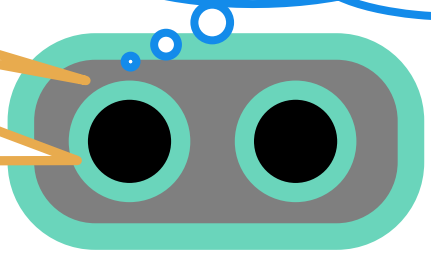

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I may not even give a warning when you compile

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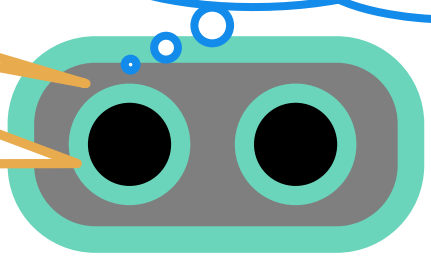

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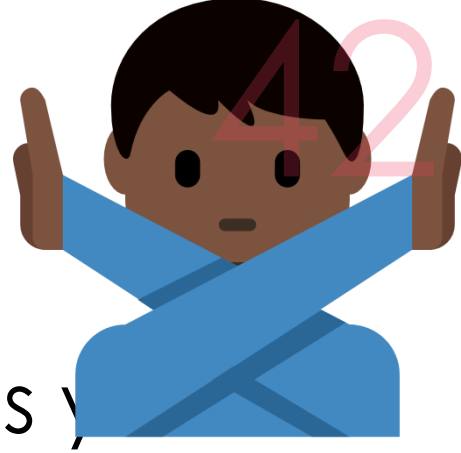

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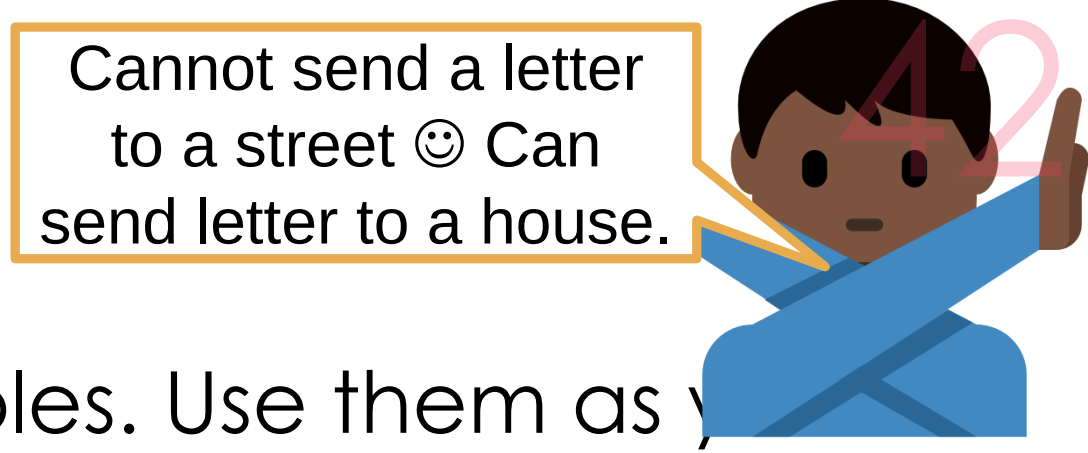


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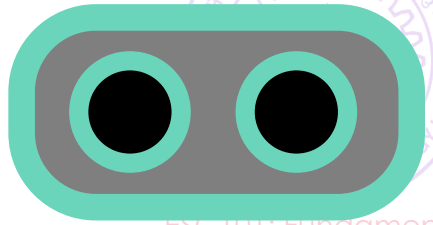

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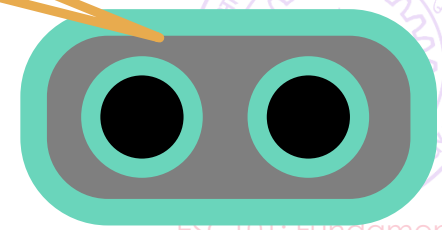

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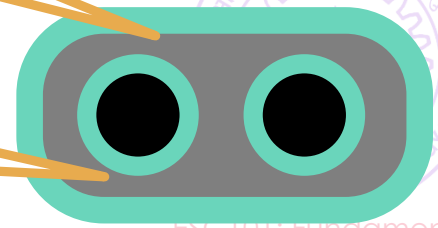

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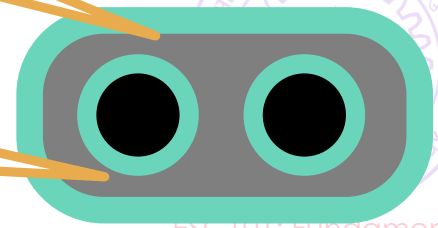

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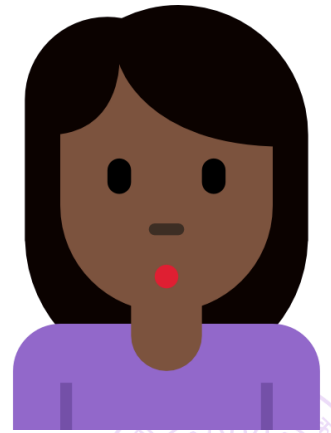

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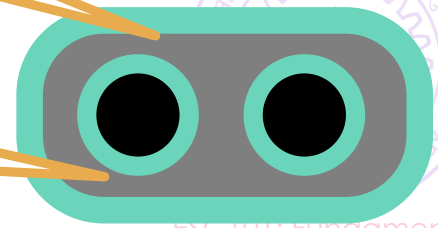

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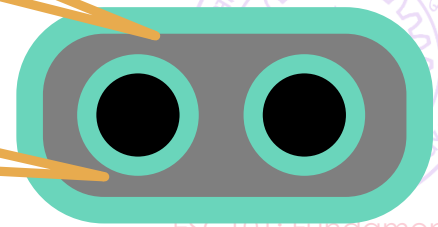

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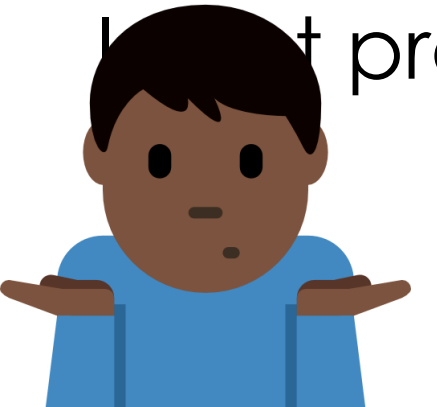

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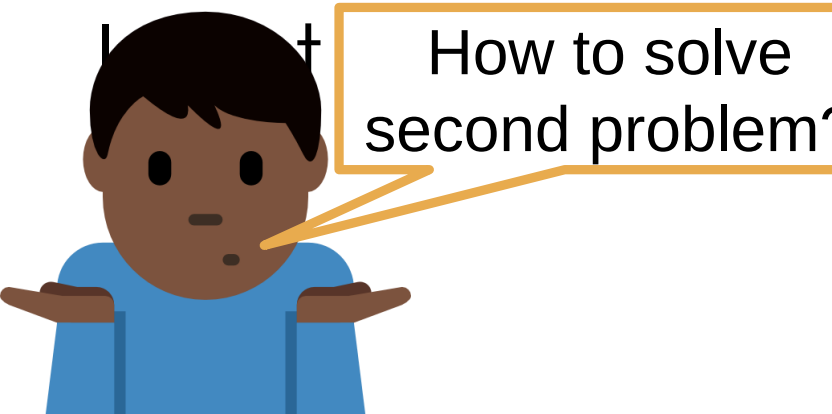

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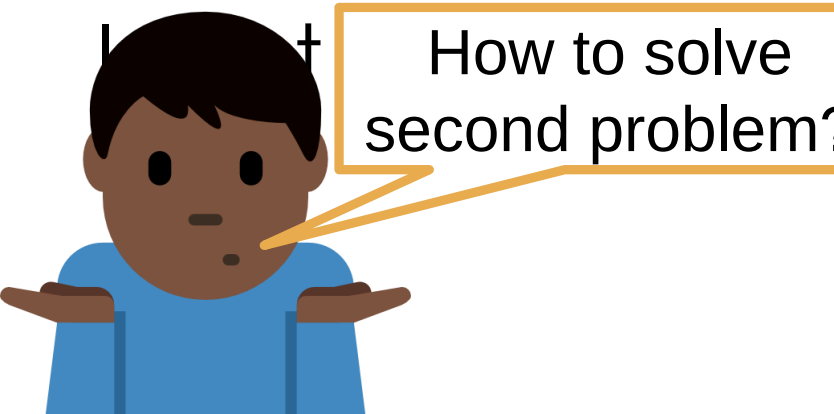

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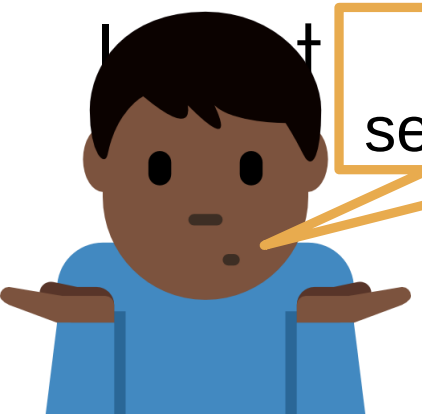

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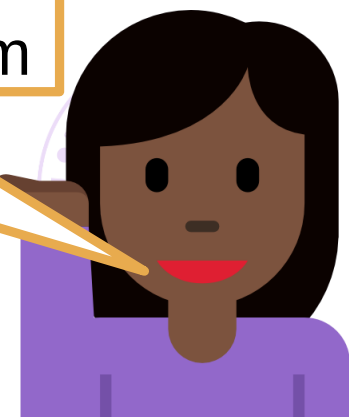

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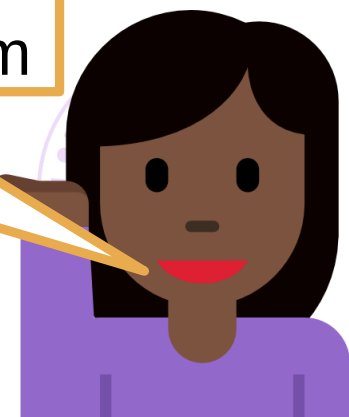

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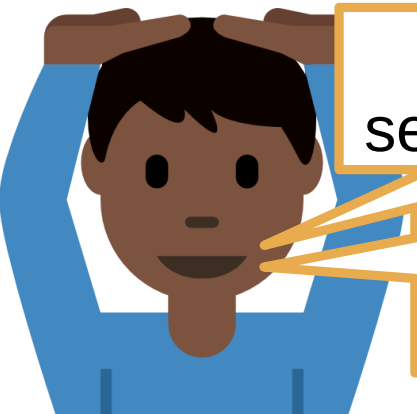

How to solve second problem?

I already know how to solve both sub-problems!

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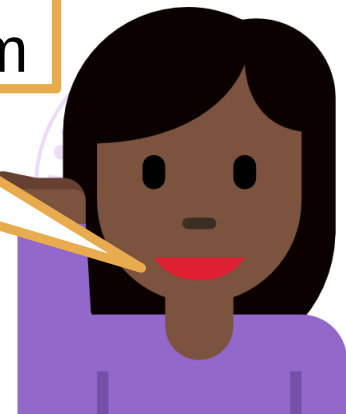
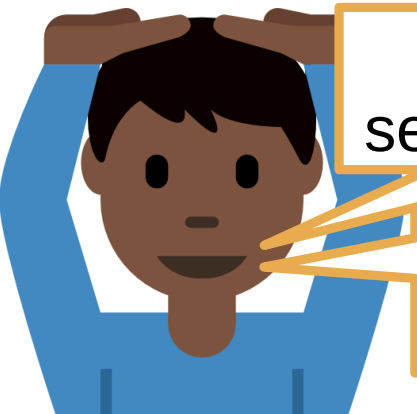


A Few Sample Problems

Given a 10 dimensional array in input, find the sum of first, third, fifth … i.e. odd location elements of the array and sum of even location elements in the array

Given two lists of integers on two separate lines, find the smallest integer in the first list that is not present in the second list.

In second problem, ho back and forth – arrays allow st ed r



How to solve second problem?

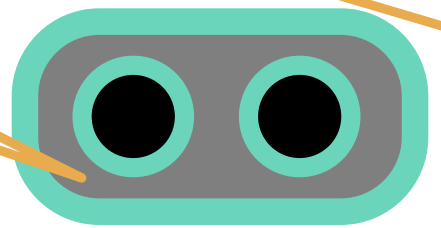
I already know how to solve both sub-problems!

Break it up into smaller sub-problems

Sub-prob 1: Find all integers in first array that are not present in second array

Sub-prob 2: Give the above numbers, find the smallest using a running-minimum

Then let's code!



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- etc, etc …

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- Companies like Google cannot afford to store all data
- Get data, process it, and throw it away
- Entire areas devoted to this: data streaming, online machine learning

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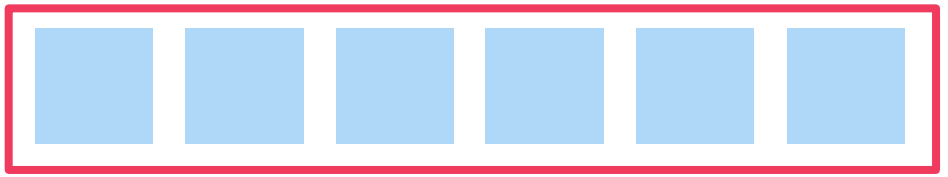

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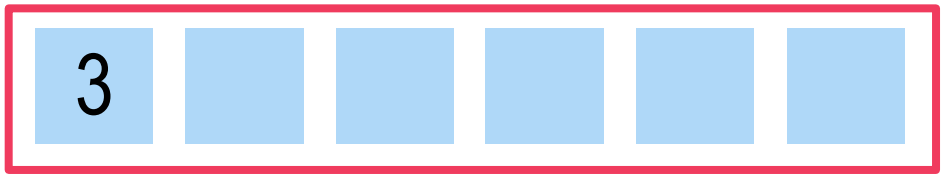

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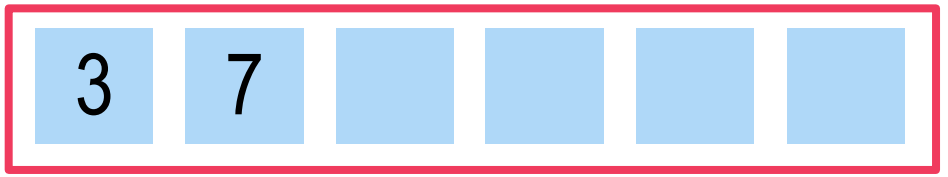

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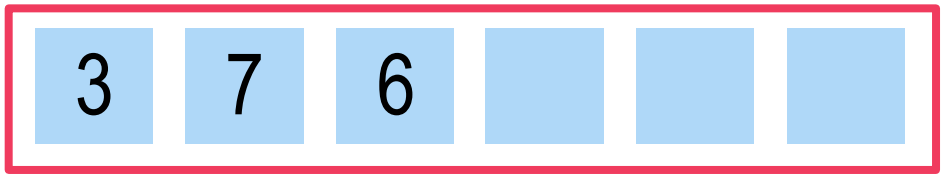

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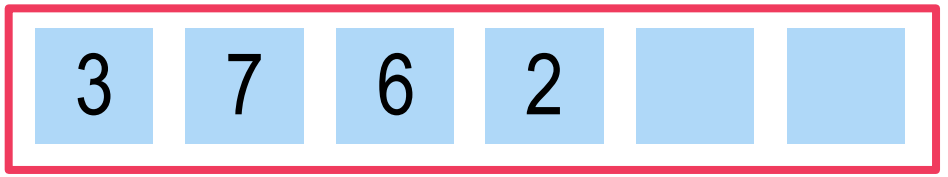

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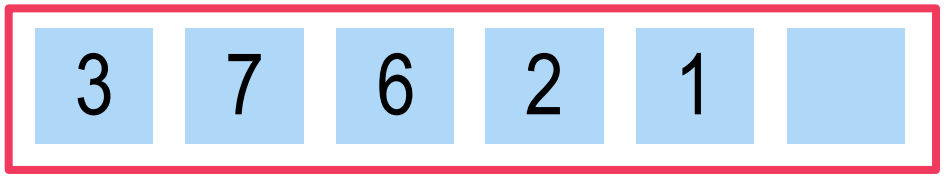

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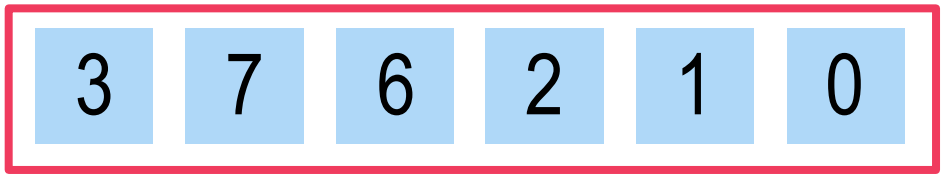

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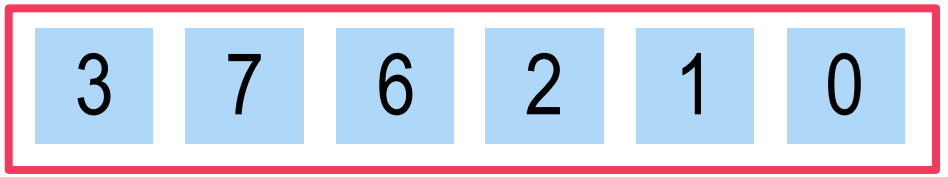

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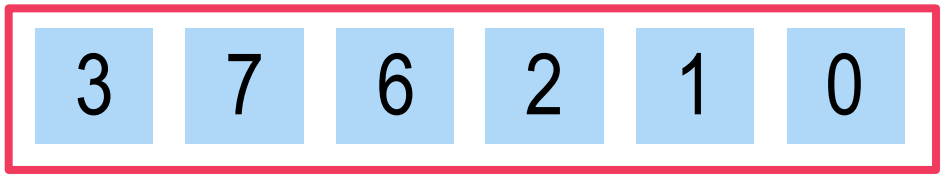

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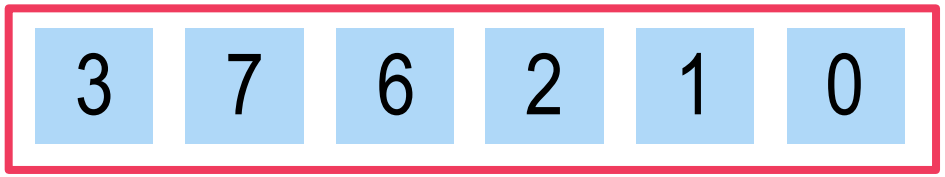

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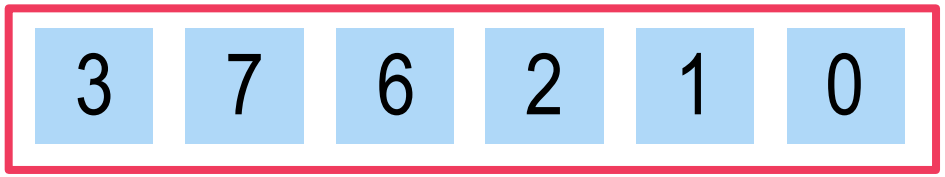

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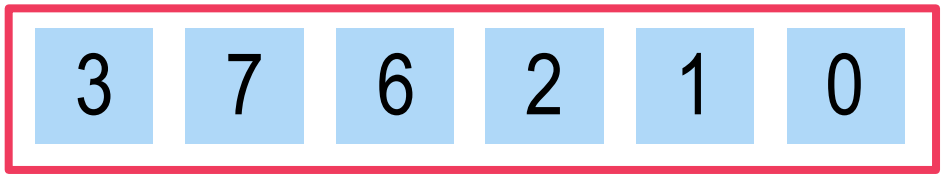

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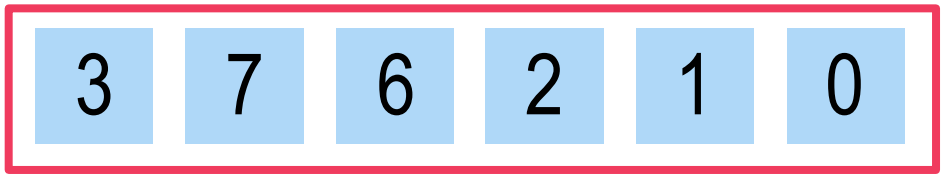

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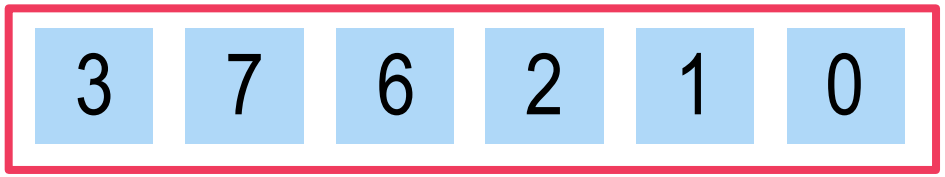

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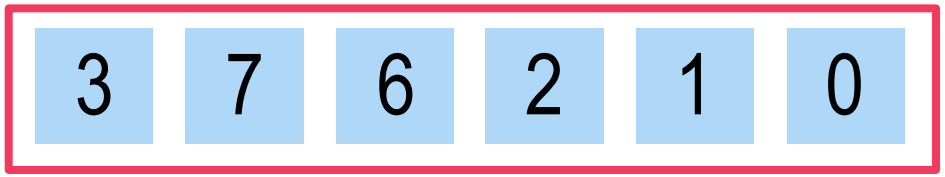

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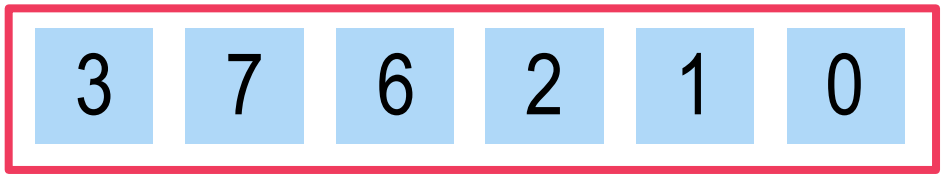

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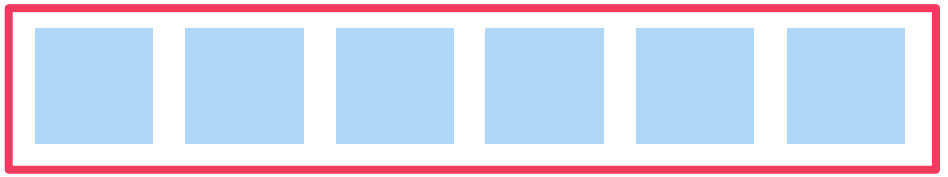

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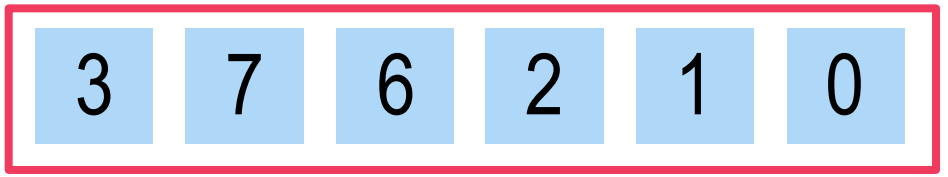

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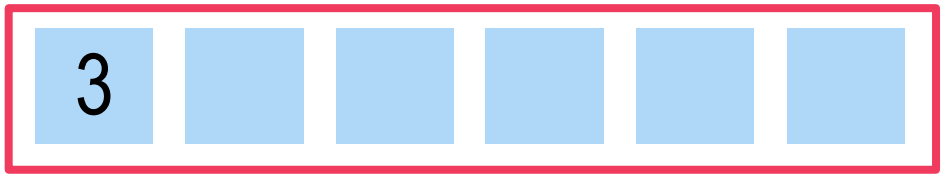

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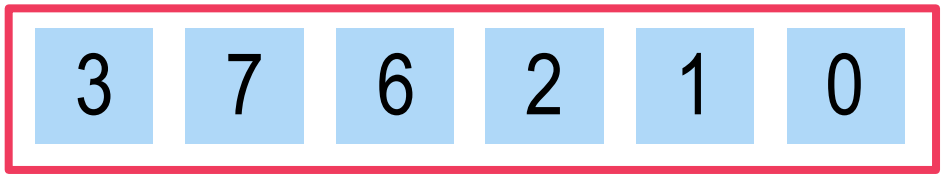

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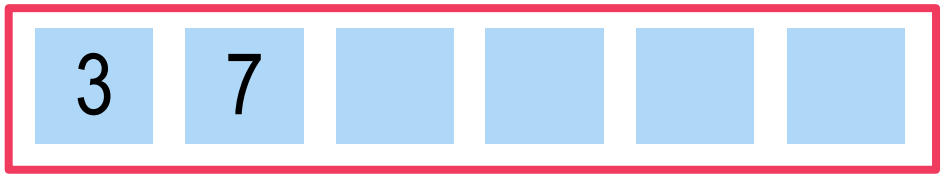

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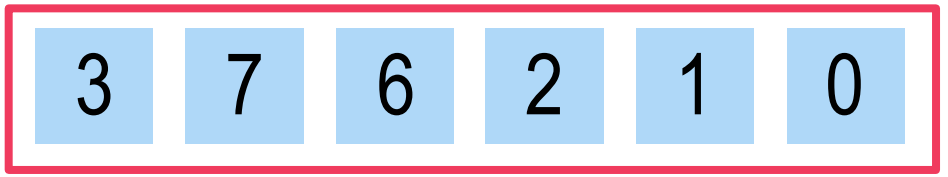

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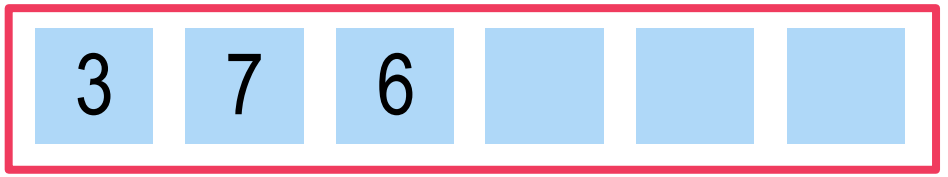

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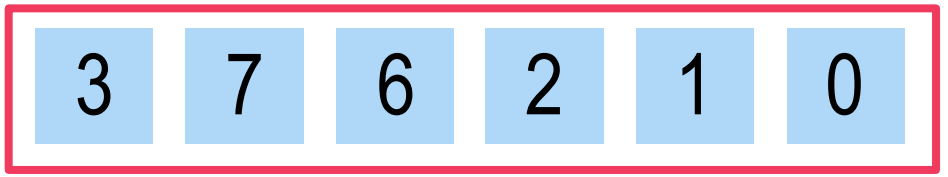

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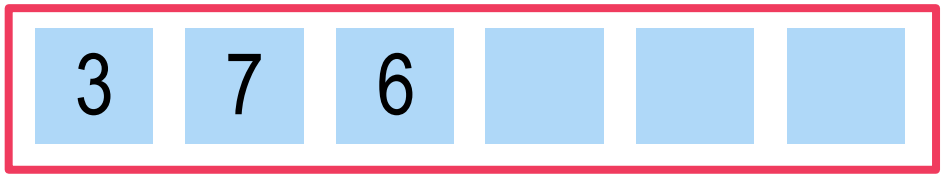

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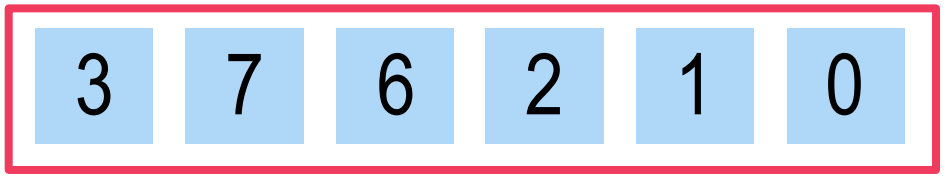

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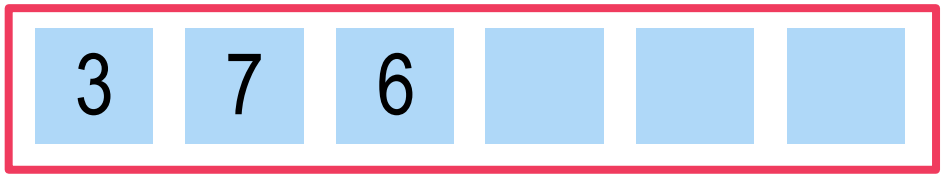

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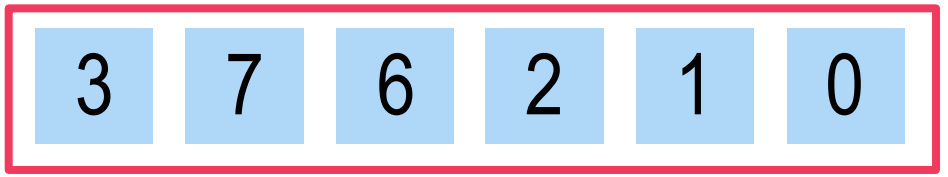

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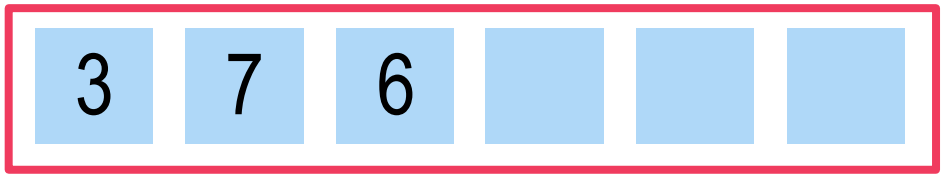

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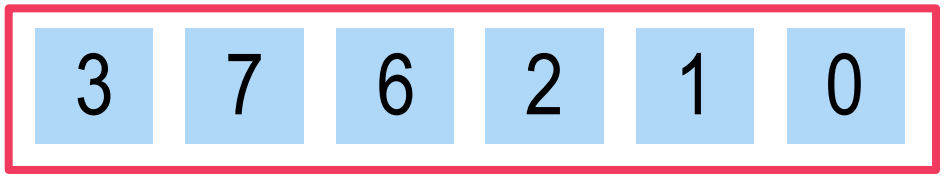

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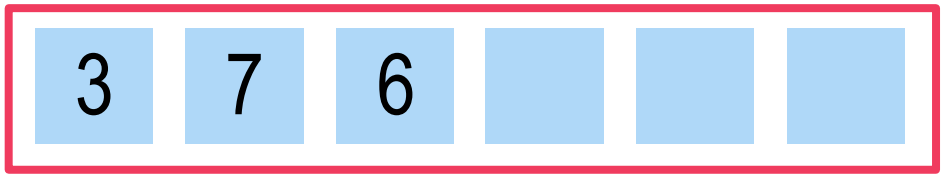

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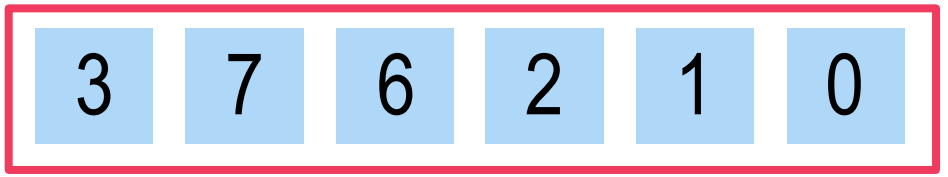

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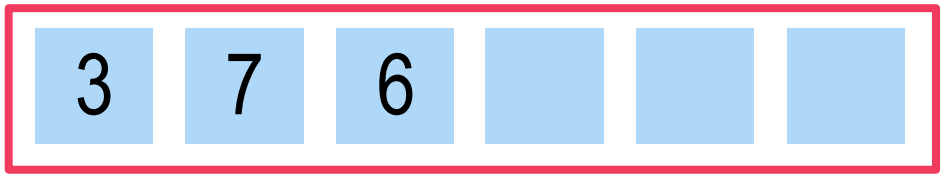

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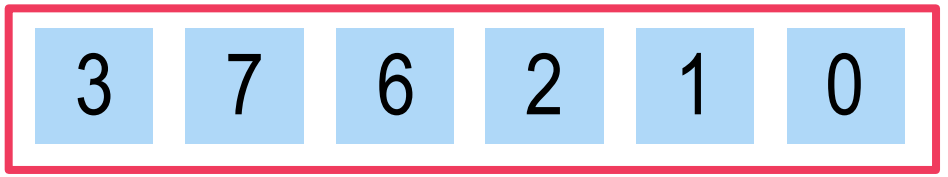

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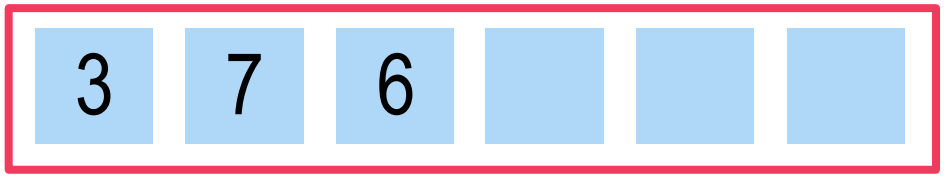
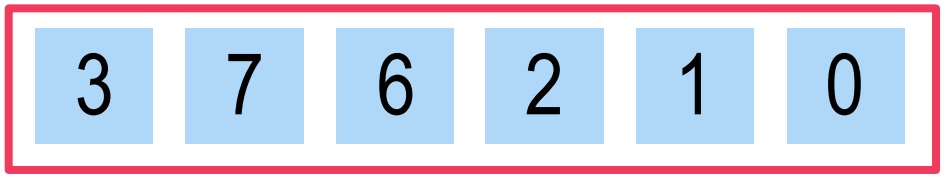


More on initializing arrays

Can be initialized at time of declaration itself

```
int a[6] = {3,7,6,2,1,0};
```

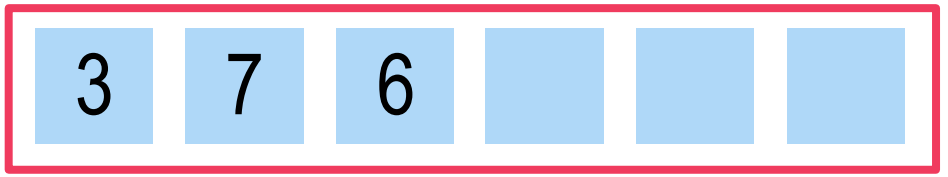
a



Can be partly initialized as well

```
int a[6] = {3,7,6};
```

a



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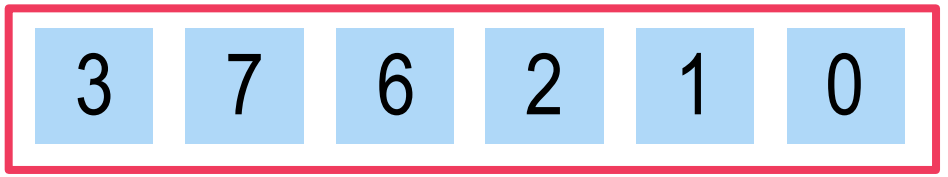

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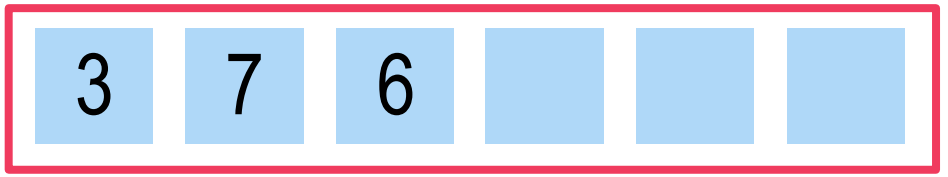

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int a[6] = {1,2,3,4,5,6,7,8,9};
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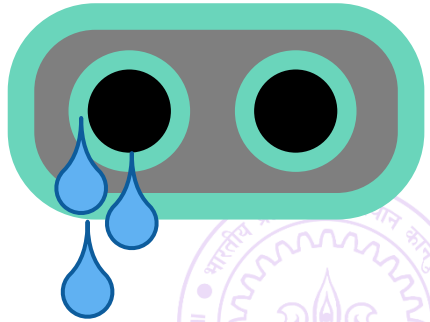

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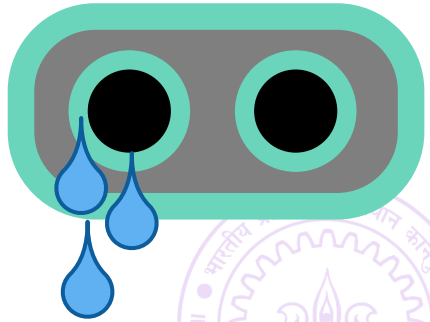

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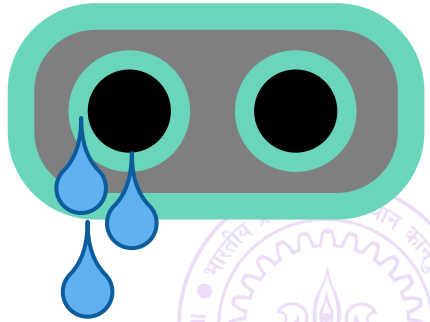

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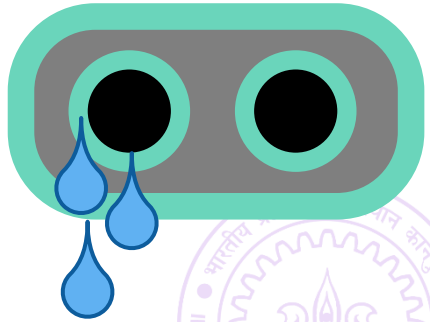

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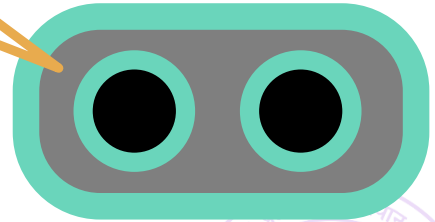
I will figure out how much space needed



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Highly compiler dependent feature

More about arrays

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Arrays can not be copied like normal variables

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Will not result in error but b == a will always be false

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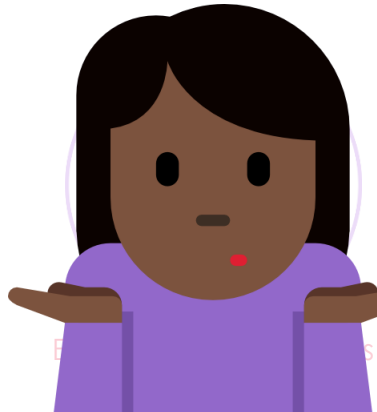

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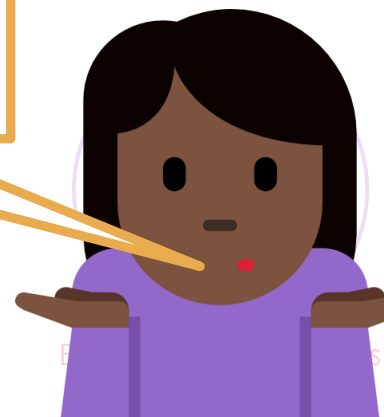

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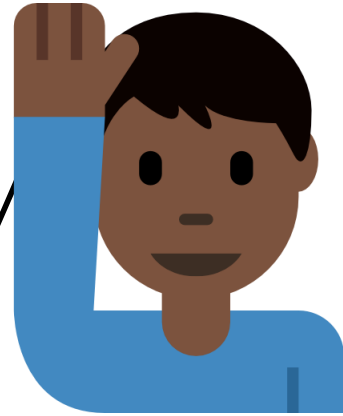

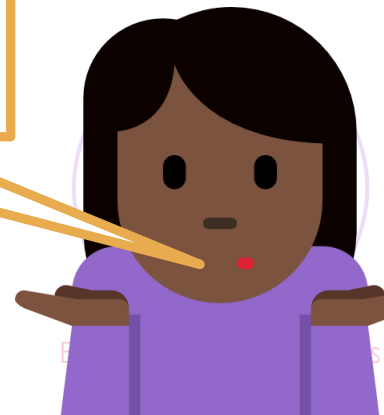

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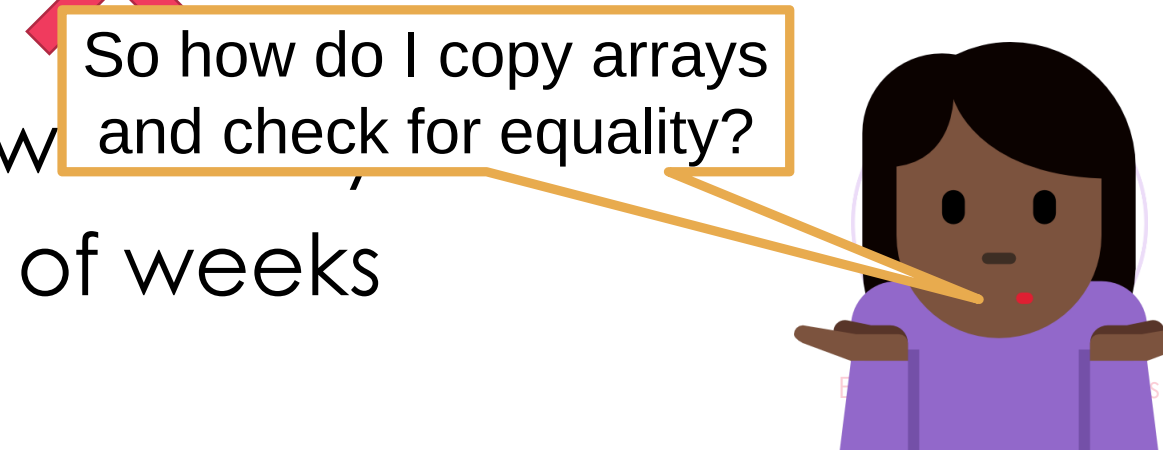

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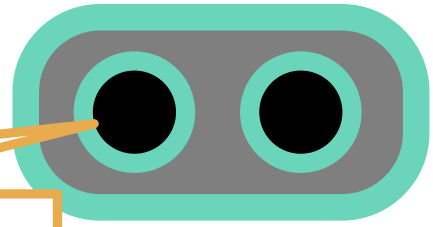
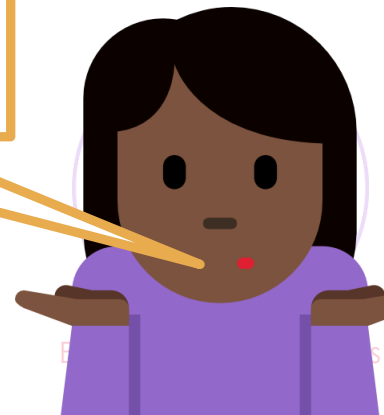


For strings (basically char arrays), nice library functions exist to do assignment, equality checks

Do it yourself, element by element, using a for loop

So how do I copy arrays and check for equality?



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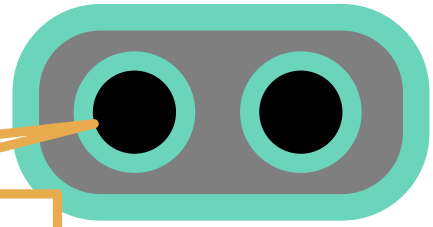

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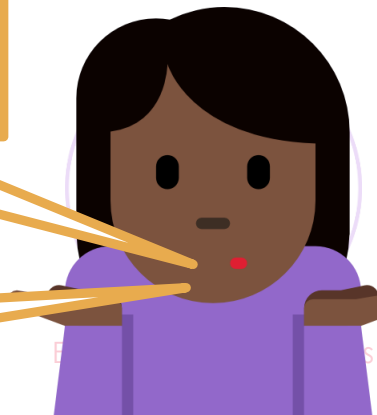

What is a char?

Char: new datatype

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Close cousin of the int and long datatypes

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Internally stored as an integer between 0 and 127

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int main(){
char a = 'p';
scanf("%c", &a);
printf("My first char %c", a);
return 0;
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Integer arithmetic applies to char as well +, -, /, *, %, ()

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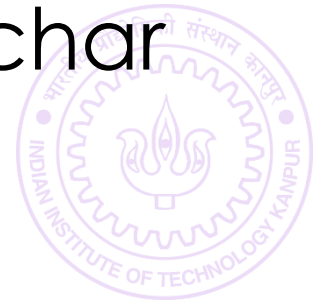
Can typecast to/from char



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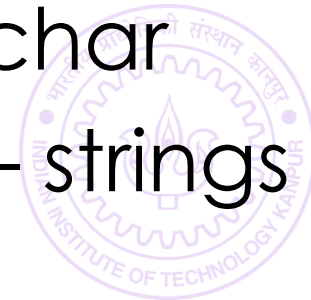
Can have char arrays – strings



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Can have char arrays – strings

Case sensitive 'a', 'A' different

IMAGE COURTESY WIKIPEDIA.ORG

ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

IMAGE COURTESY WIKIPEDIA.ORG

ASCII TABLE

American Standard Code for Information Interchange

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
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22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
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25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
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27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
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13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
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25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
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IMAGE COURTESY WIKIPEDIA.ORG

Take care with char

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`char a = p;` Mr C will search for a variable named p.

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`char a = p;` Mr C will search for a variable named p.

To assign character constant ‘p’ to a, `char a = ‘p’;`

Note that ‘5’ and 5 are different according to Mr C

- ‘5’ is a character constant stored internally as the integer 53
- 5 is an integer constant stored internally as the integer 5 itself

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When using characters in arithmetic, relational, logical expressions, integer (ASCII) value of character gets used