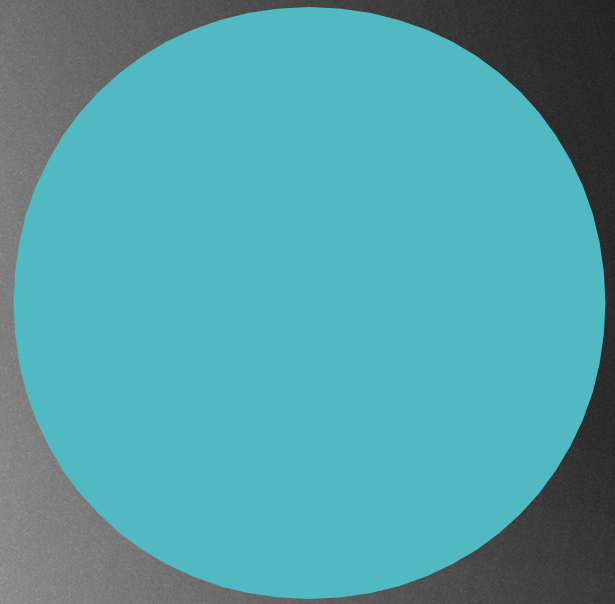
ARRAYS

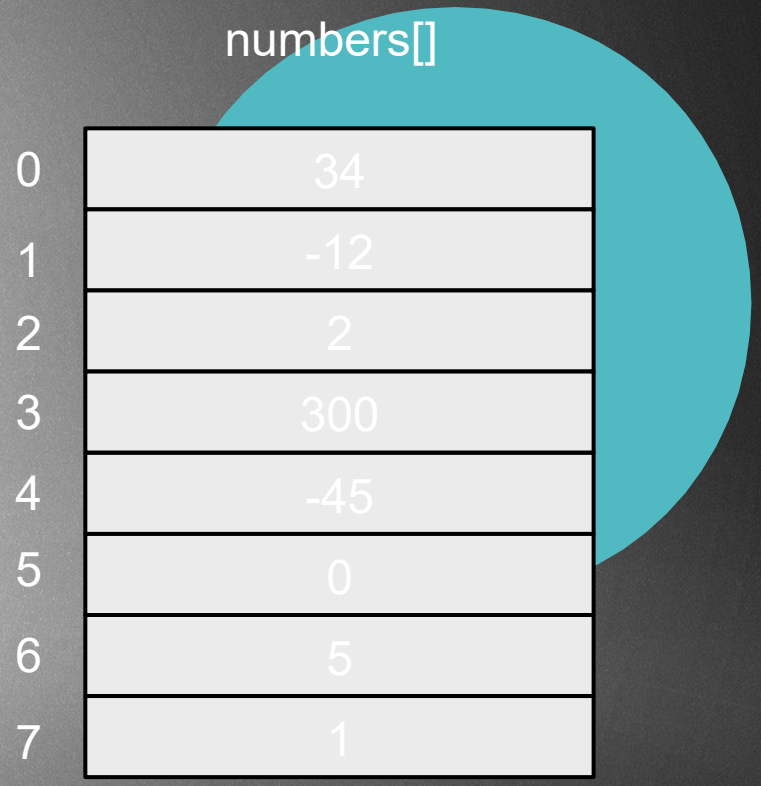


ARRAY

Arrays: data structures

A collection of elements / values
each identified by an array index or key !!!

- index starts at zero
- because of the indexes: random access is possible



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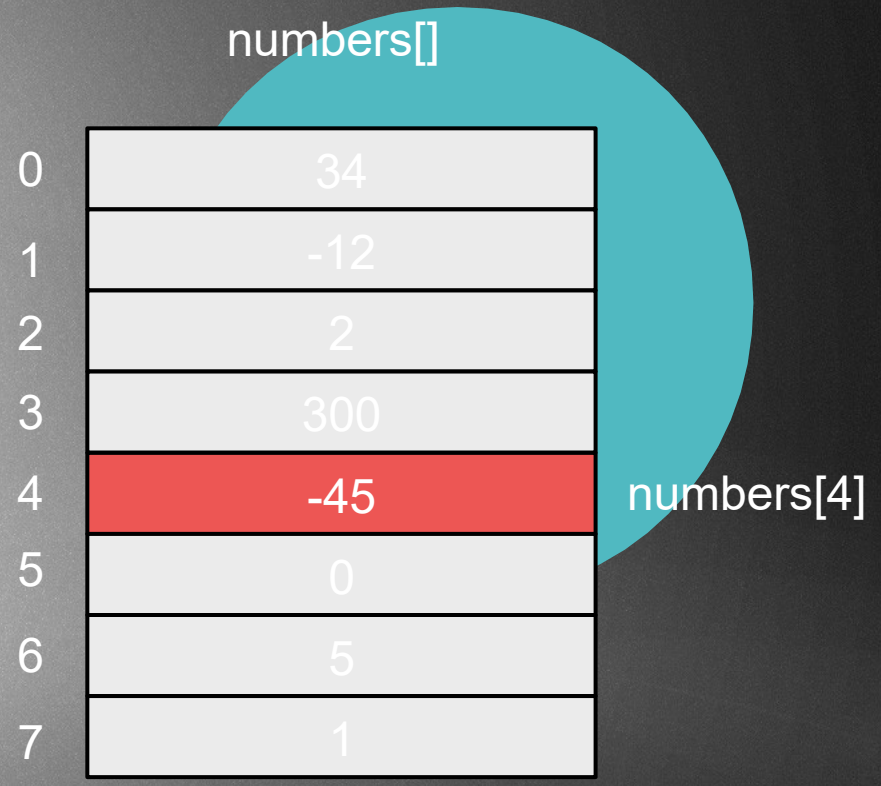
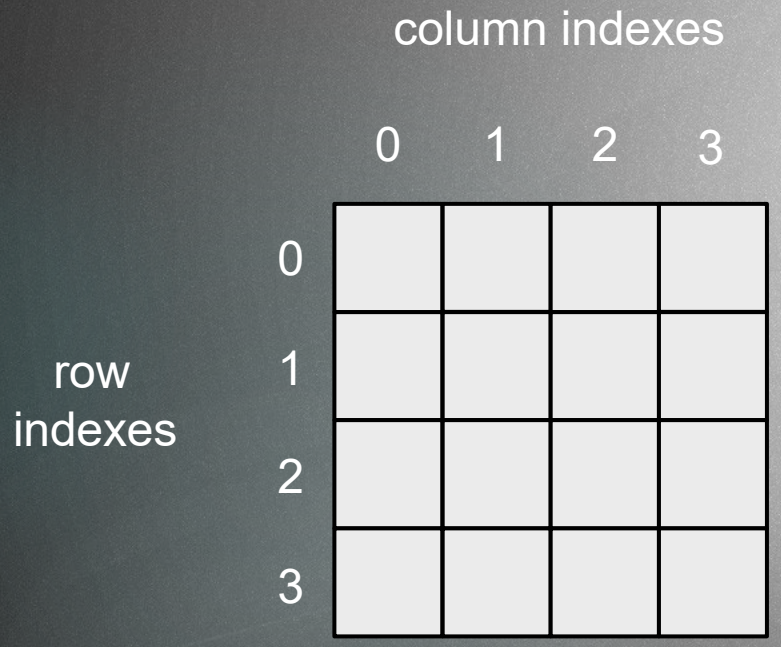


Multidimensional arrays: it can prove to be very important in mathematical related computations (matrixes)



numbers[][] two dimensional array

First paramter: row index
Second parameter: column index

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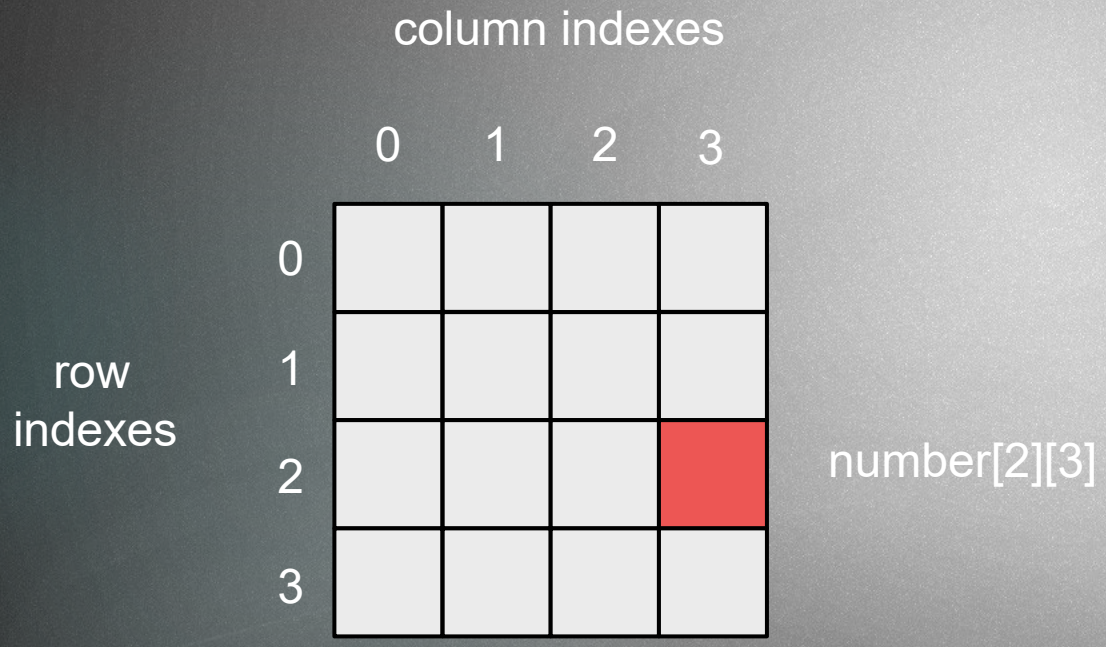

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Arrays

- Arrays are data structures in order to store items of the same type
- We use indices as keys !!!
- Arrays can have as many dimensions as we want: one or two dimensional arrays are quite popular
- For example: storing a matrix → two dimensional array
- Dynamic array: when the size of the array is changing dynamically
- Applications: lookup tables / hashtables, heaps

Advantages

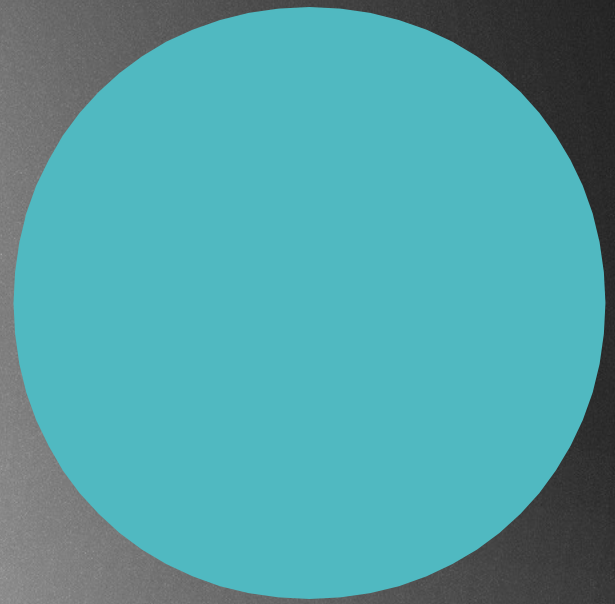
- We can use random access because of the keys: getItem(int index) will return the value with the given key very fast // **O(1)**
- Very easy to implement and to use
- Very fast data structure
- We should use arrays in applications when we want to add items over and over again and we want to take items with given indexes!!! ~ it will be fast

Disadvantages

- We have to know the size of the array at compile-time: so it is not so dynamic data structure
- If it is full: we have to create a bigger array and have to copy the values one by one // reconstructing an array is **O(N)** operation
- It is not able to store items with different types

Arrays operation: add

We can keep adding values to the array as far as the array is not full



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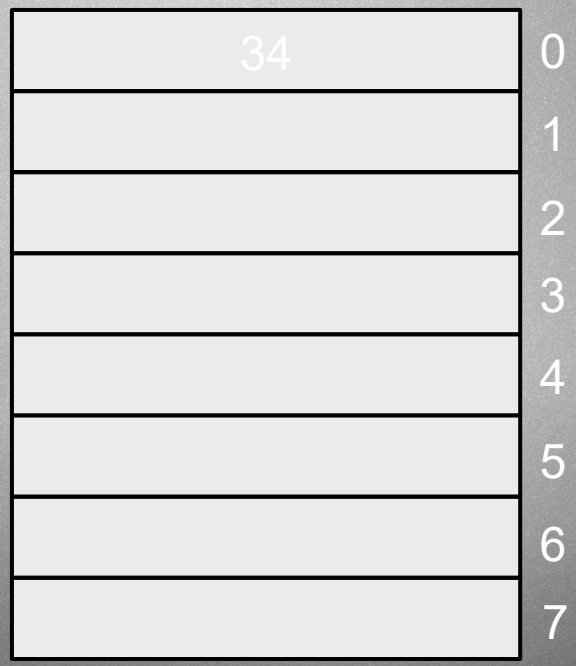

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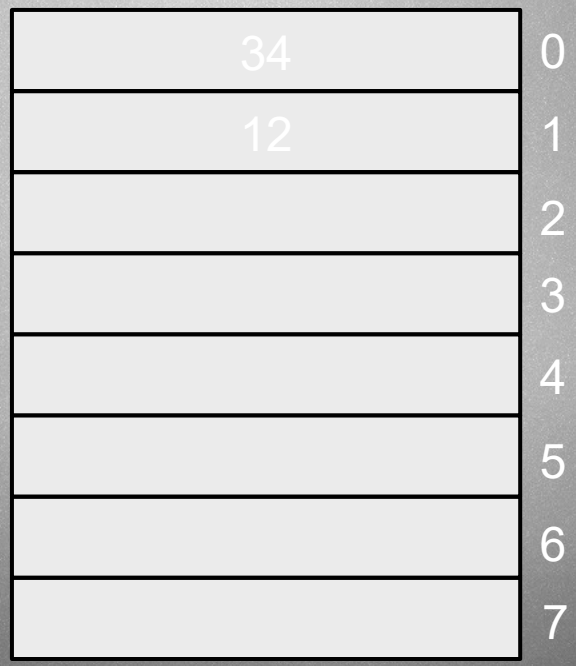
add(12)



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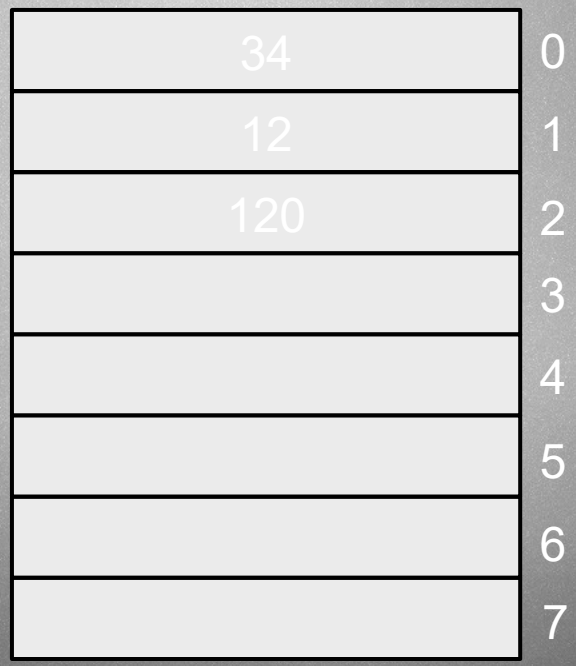
add(120)



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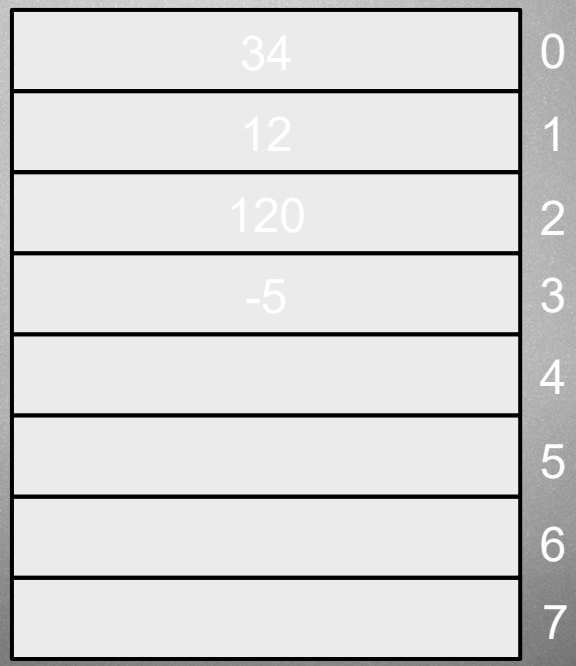
add(-5)



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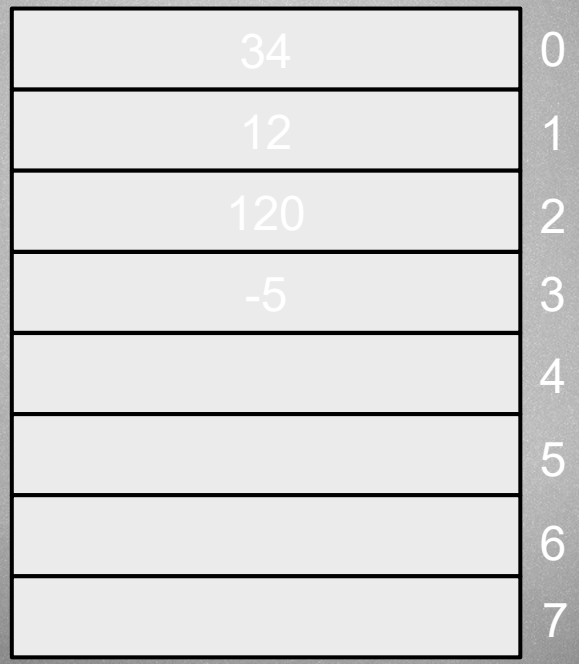
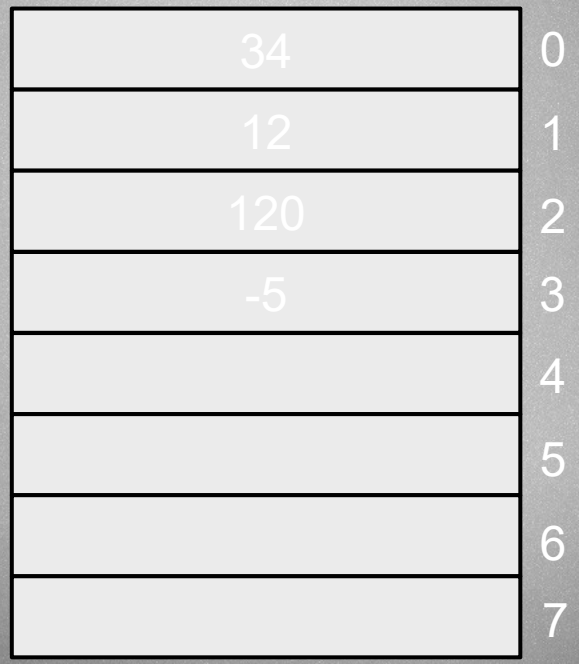


So: when adding new values to the list, we just have to insert it with the next index → very fast **O(1)** operation

Arrays operation: insert item

We would like to insert a given value with a given index

insert(23,1);



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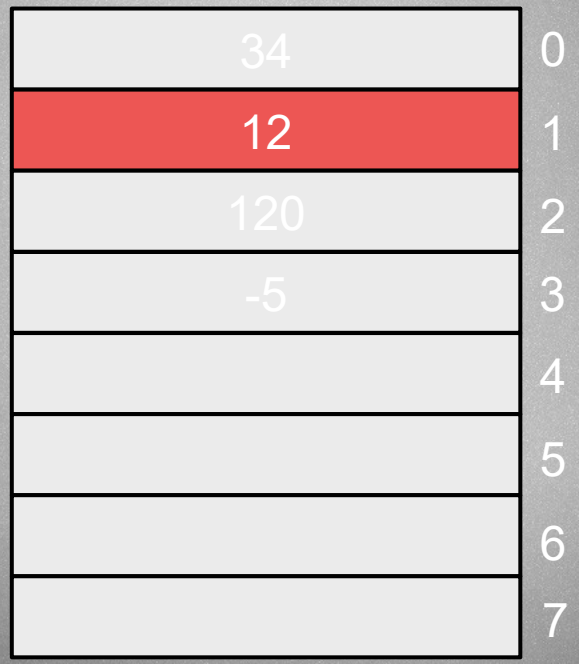

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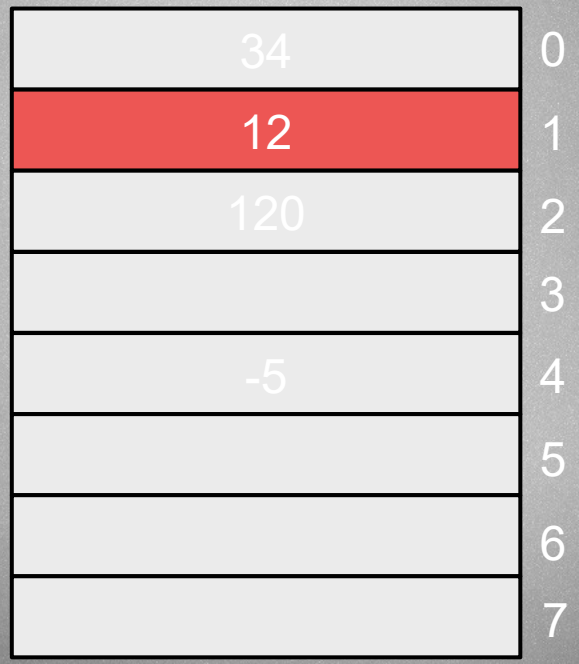

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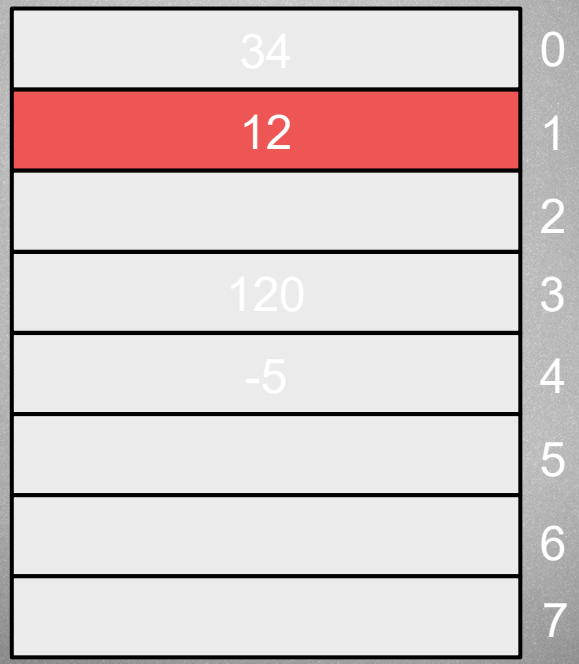

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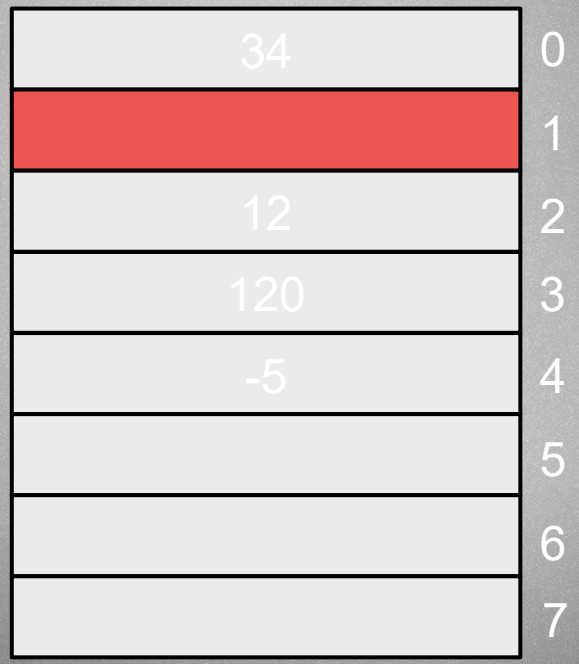

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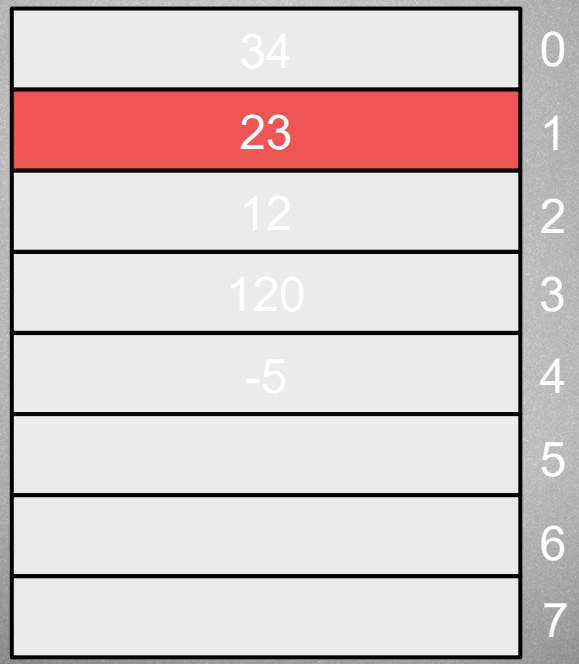

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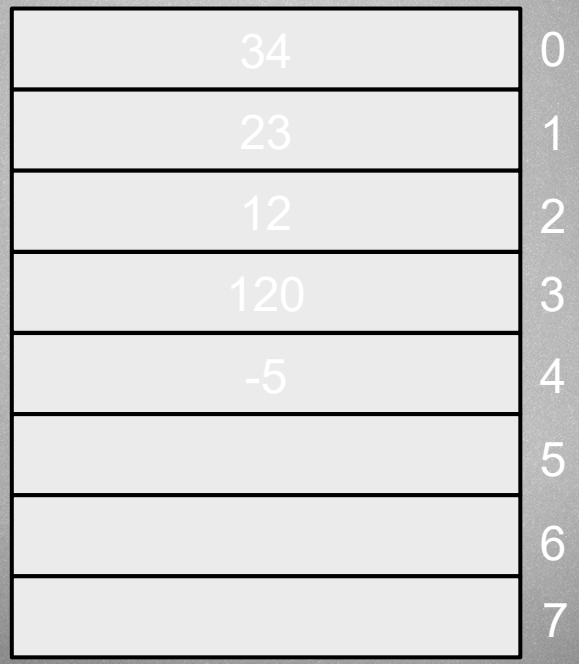

So: it is a bit more problematic, sometime we have to shift lots of values in order to be able to insert the new one !!! ~ **O(N)** time complexity

Arrays operation: insert item

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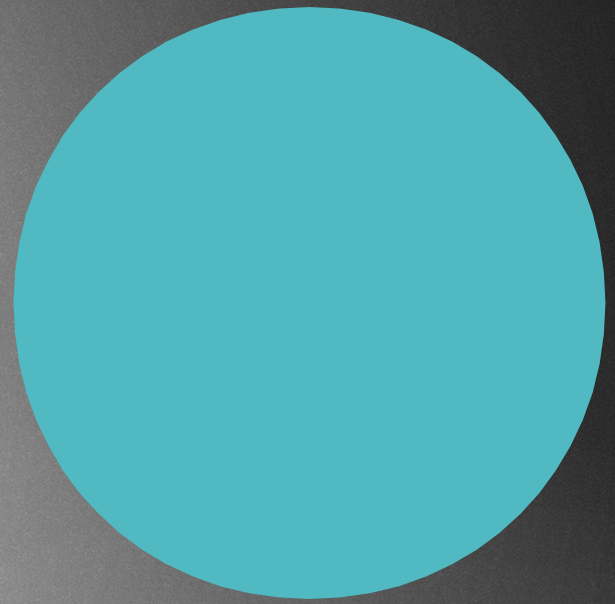
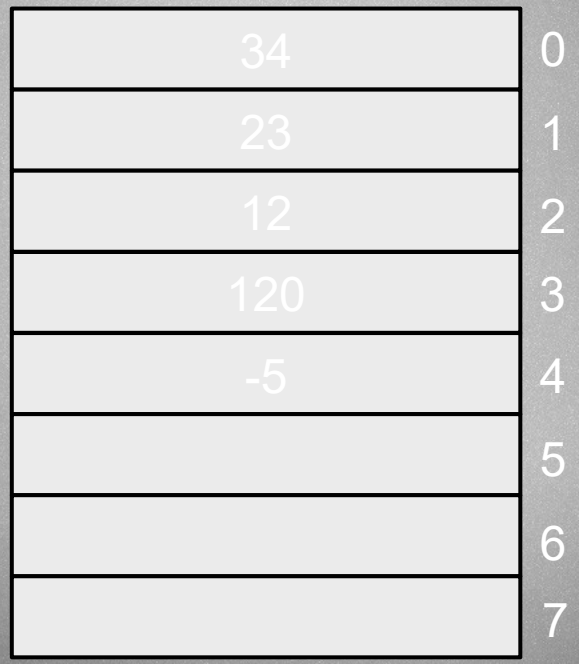
Add new item:	**O(1)**
Insert item to a given index:	**O(N)**



Arrays operation: remove items

We would like to remove the last item, it is very simple,

just remove it // **O(1)** time complexity



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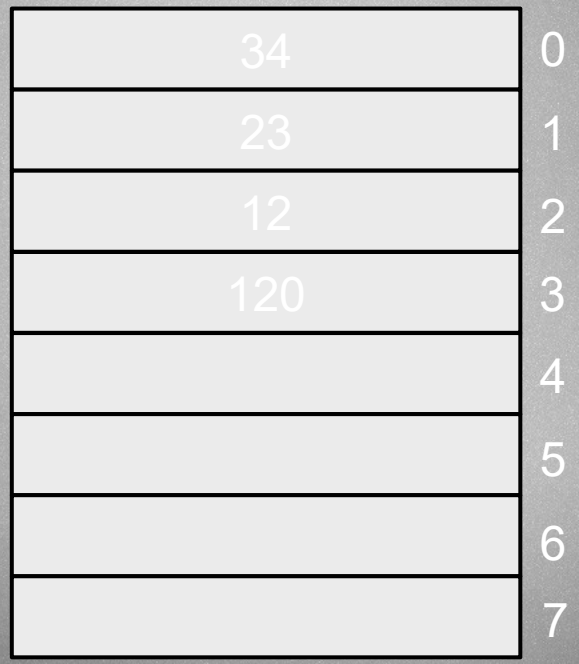

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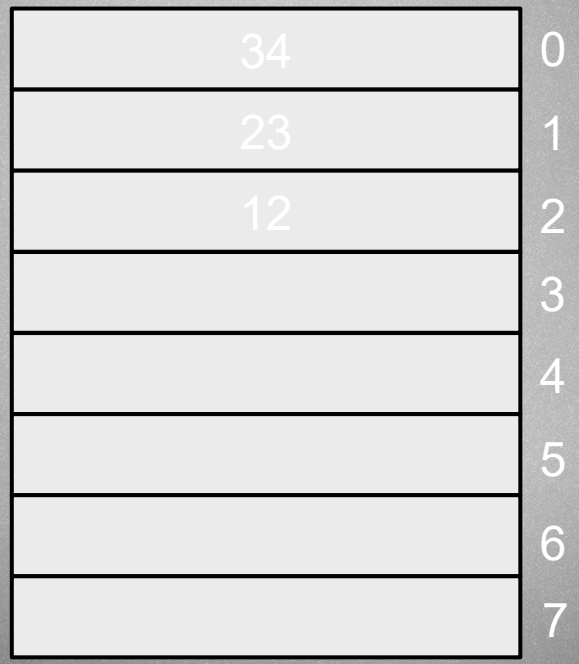

Arrays operation: remove items with given index

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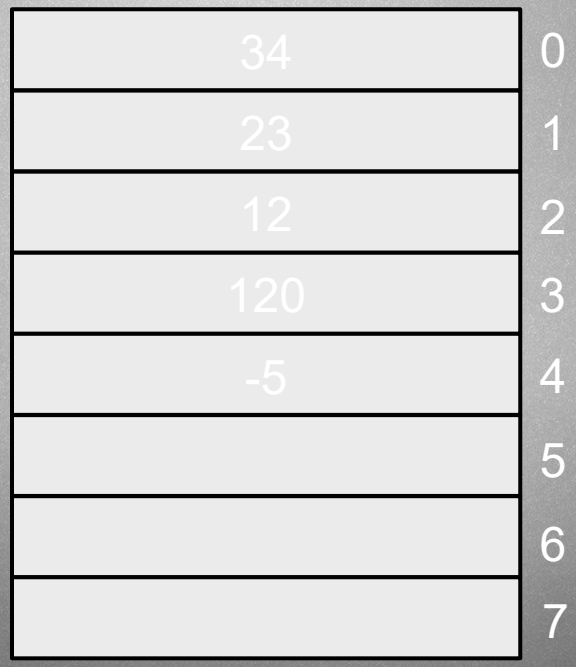
// **O(N)** time complexity



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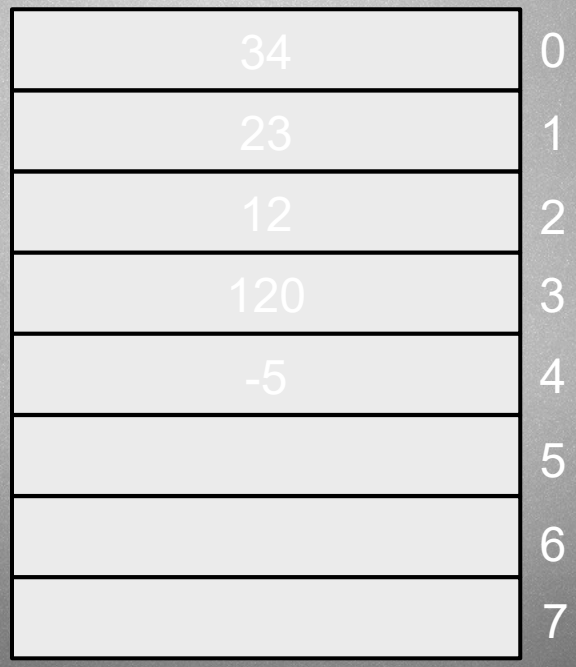

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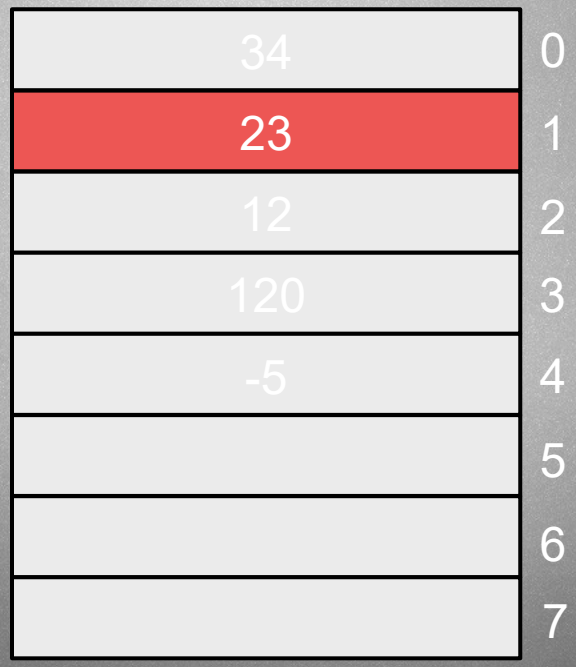

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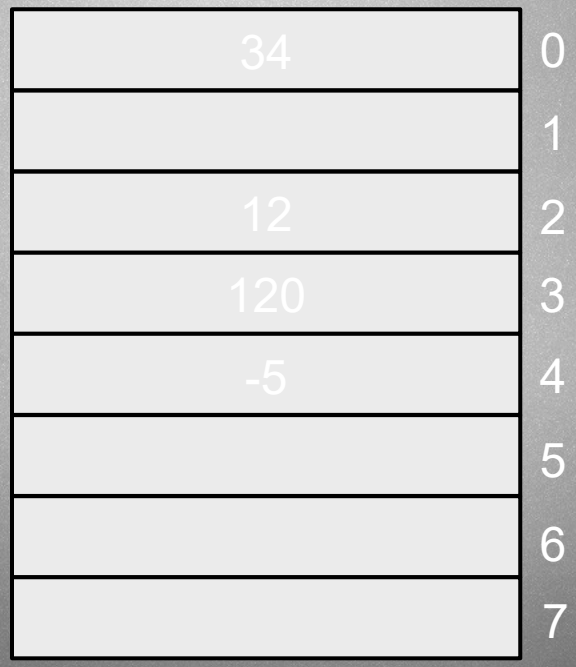

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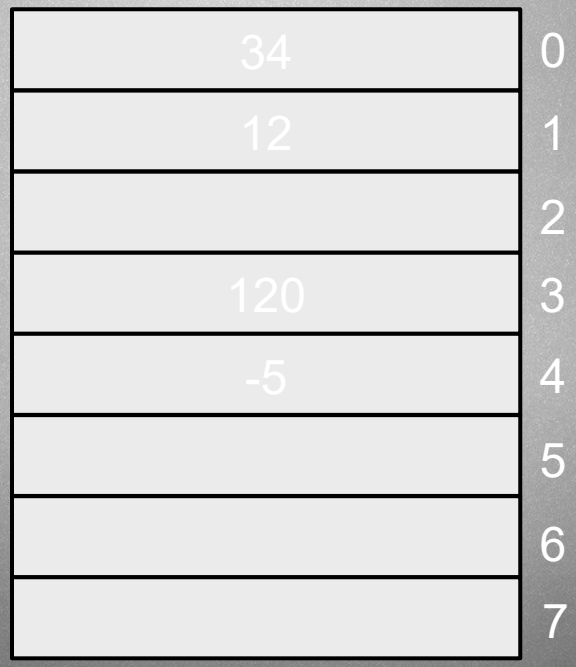

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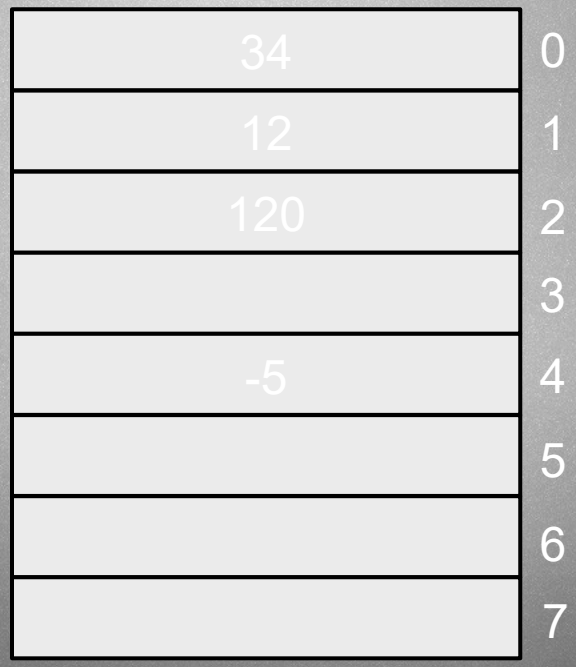

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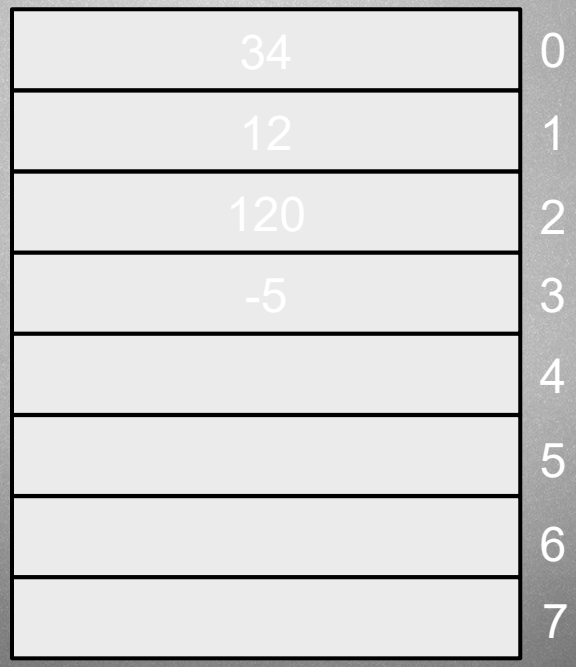

So: overall complecity will be linear **O(N)**

Arrays operation: remove items with given index

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// O(N) time complexity

Removing last item: **O(1)**

Removing f.e. middle item: **O(N)**