resizable array

Resizable Array

- Think about a set of functions that provide a mechanism of resizable array of int.
  - Growable
  - Get the current size
  - Access to the elements

the Interface

- Array array_create(int init_size);
- void array_free(Array *a);
- int array_size(const Array *a);
- int* array_at(Array *a, int index);
- void array_inflate(Array *a, int more_size);

the Array

```
typedef struct {
    int *array;
    int size;
} Array;
```

Why struct not struct *?

array_create()

```
Array array_create(int init_size) {
    Array a;
    a.array = (int*)malloc(sizeof(int)*init_size);
    a.size = init_size;
    return a;
}
```

Why Array not Array *?

array_free()

```
void array_free(Array *a) {
    free(a->array);
    a->size = 0;
}
```

array_size()

```
int array_size(const Array *a) {
    return a->size;
}
```

Why not take the member directly?

array_at()

```
int* array_at(Array *a, int index) {
    if ( index >= a->size ) {
      array_inflate(a, index-a->size);
    }
    return &(a->array[index]);
}
```

Why int* not int?

use array_at()

```
Array a = array_create(10);

*(array_at(&a, 5)) = 6;

*(array_at(&a, 10)) = *(array_at(&a, 5));
```

will it be better

- to have two access functions:
  - array_get(), and
  - array_set()

use get() and set()

```
Array a = array_create(10);

array_set(&a, 5, 6);

array_set(&a, 10, array_get(&a, 5));
```

memory in block

```
int* array_at(Array *a, int index) {
    if ( index >= a->size ) {
      array_inflate(a, (index/
      BLOCK_SIZE+1)*BLOCK_SIZE-a->size);
    }
    return &(a->array[index]);
}
```

array_inflate()

```
void array_inflate(Array *a, int more_size) {
    int* p = (int*)malloc(sizeof(int)*(a-
    >size+more_size));
    for ( int i=0; i<a->size; i++ ) p[i] = a->array[i];
    free(a->array);
    a->array = p; a->size = a->size+more_size;
}
```

array_inflate()

```
void array_inflate(Array *a, int more_size) {

    int* p = (int*)malloc(sizeof(int)*(a-
    >size+more_size));

    memcpy((void*) p, (void*) a->array, a-
    >size*sizeof(int));

    free(a->array);

    a->array = p; a->size = a->size+more_size;

}
```

why not take the whole array

```
int* array_get(Array* a) {
    return a->array;
 }
```

lack of protection for both user and developer

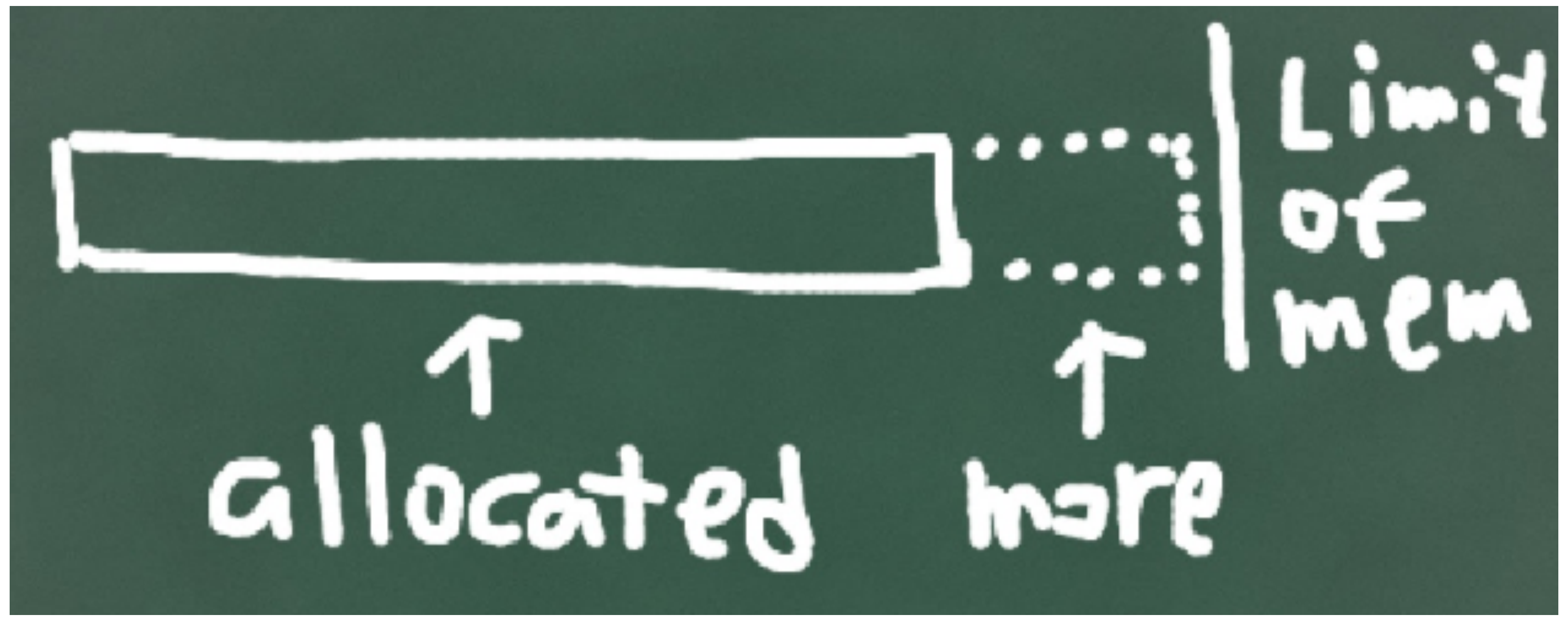
access functions

- the use of access functions seems not so elegant
  - Use operator overload in C++
  - Design specific functions for specified application
    - Do not treat it as an array

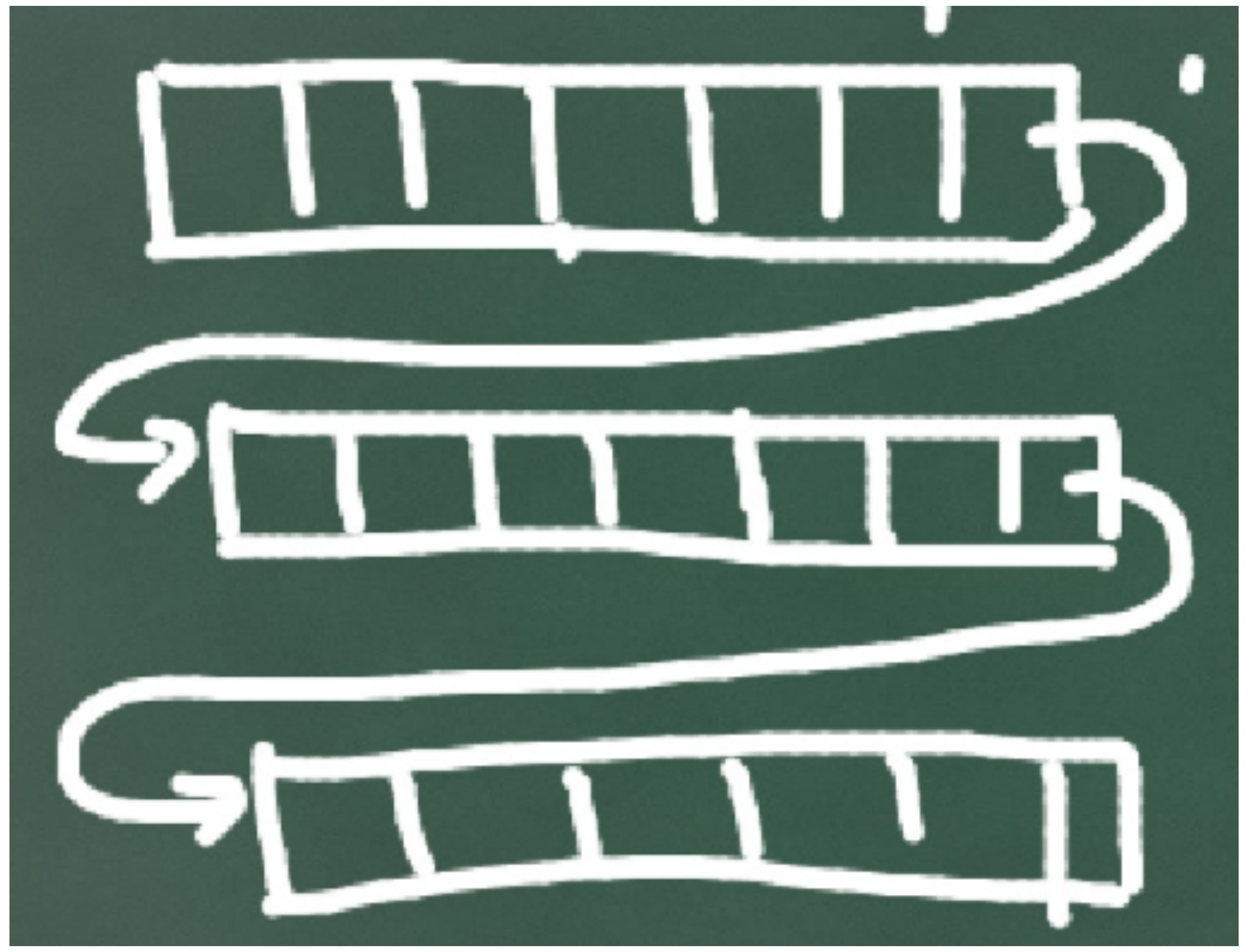
linked-array

issues

- Allocate new memory each time it inflates is an easy and clean way. But
  - It takes time to copy, and
  - may fail in memory restricted situation



linked blocks



- No copy

the Array

```
typedef struct _array{
    int *array;
    int size;
    struct _array* next;
} Array;
```

array

use a fixed block size, but keep the variable to make it more flexible

array_create()

```
Array array_create() {
    Array a;
    a.array = (int*)malloc(sizeof(int)*BLOCK_SIZE);
    a.size = BLOCK_SIZE;
    a.next = 0;
    return a;
 }
```

array_free()

```
void array_free(Array *a) {
    free(a->array);
    a->size = 0;
    if ( a->next ) {
        array_free(a->next);
        free(a->next);
    }
}
```

array_size()

```
int array_size(const Array *a) {
    if ( !a->next )
      return a->size;
    else
      return a->size+array_size(a->next);
}
```

array_at()

```
int* array_at(Array *a, int index) {
    if ( index < a->size ) {
      return &(a->array[index]);
    } else {
      ...
    }
 }
```

array_inflate()

```
void array_inflate(Array *a) {
    // find the last block
    // allocate a new block
    // link!
}
```