#ASLI ENGINEERING

Why languages have Automatic Garbage Collection?

SWIPE

BY

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Why programming languages have Automatic Garbage Collection ?

Memory management :

Our programs need memory to allocate objects and access them to do the job → chatting

↙ game ↓ accounting

Every object we see on screen or "variable" we use are allocated somewhere in the memory

There are two possible places :

1. Stack ↓

```
int a=10;
```

allocates sizeof(int) on stack frame of the program

* When the function returns the variable loses its existence and is kinof cleaned up

2. Heap [Dynamic memory allocation] ↓

```
int *books = malloc(10 * sizeof(book))
```

allocates these many bytes of memory on heap

Someone has to clean this mess.

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Why we need Heap in the first place?

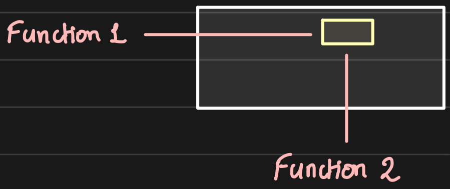
- we can have objects that are too big or too inefficient to be on Stack

  eg: object to represent a device in a kernel or customer in your CRM app

- To have dynamically growing objects

  eg: Arrays, LinkedList, Trees

- To have multiple functions using the same instance of object



- To not pass a gigantic object across function

Objects allocated in the heap are always addressed by $\boxed{\text{Reference}}$

pointer

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Garbage Collection : Explicit Deallocation

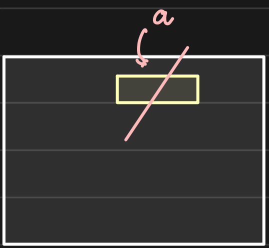
Programming language provide support for deallocating the allocated object on the heap

C++ : free()   C++: delete()

↑

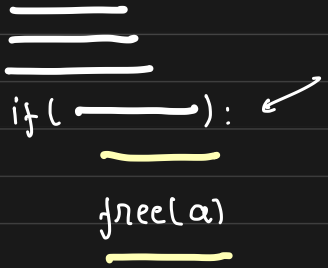
Explicit Deallocation

free(a)



It is good that languages provide a way to deallocate but we cannot rely on engineers and developers to always free the memory the allocated

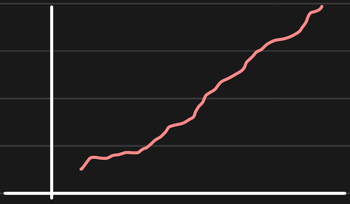
Because - they might forget to do so
- the path in which deallocation is done is not always invoked



This path is never taken

What happens if an object is not deleted & not used?

Memory leak

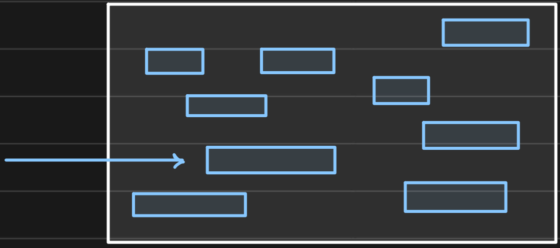


Memory consumption chart will steadily increase

And once this hits 100% and process tries to allocate a new object, the process

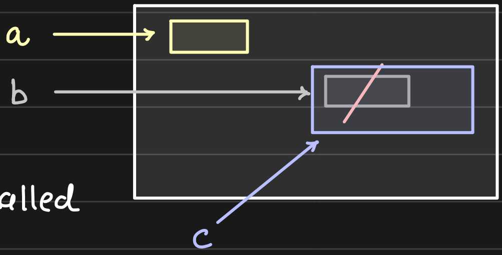
CRASH

objects allocated but not deallocated



What happens when an object is freed, but is still referenced?

Dangling Pointer



When we reference an object that does not exist, it is called a dangling pointer.

If we deference a dangling pointer the results are unpredictable

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The process might or might not crash
because of Dangling Pointer

Best case
↑
You would hope that
it crashes

Hence we get unpredictable behaviour

Because of these reasons, the runtime engines of
the programming languages provide a way
to do Automatic Garbage Collection

↓ More reliable

↓ Reduces Human Efforts

↘ Not prone to human errors