4/15.

Today

1) P5
2) Wrap up Heap.

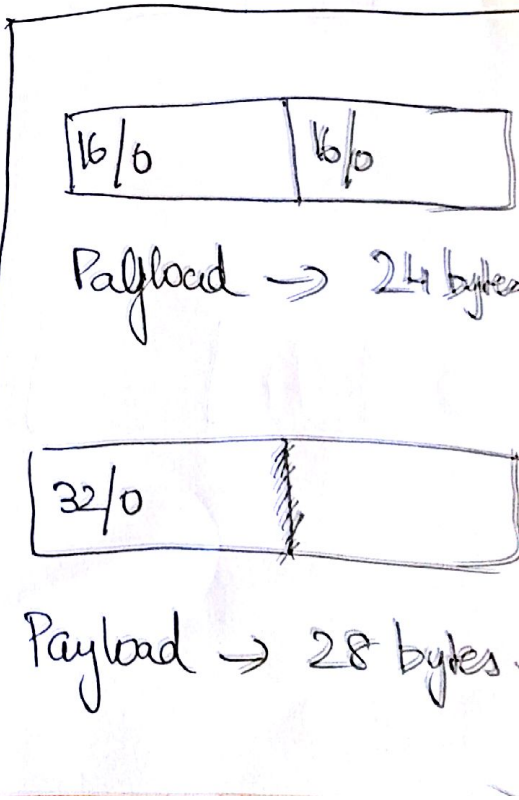
Last Class

1. Placement Policy
2. Splitting the block
3. Coalescing Free blocks.

↳ False Fragmentation.

↓ Fix ?

Merge the adjacent free blocks!



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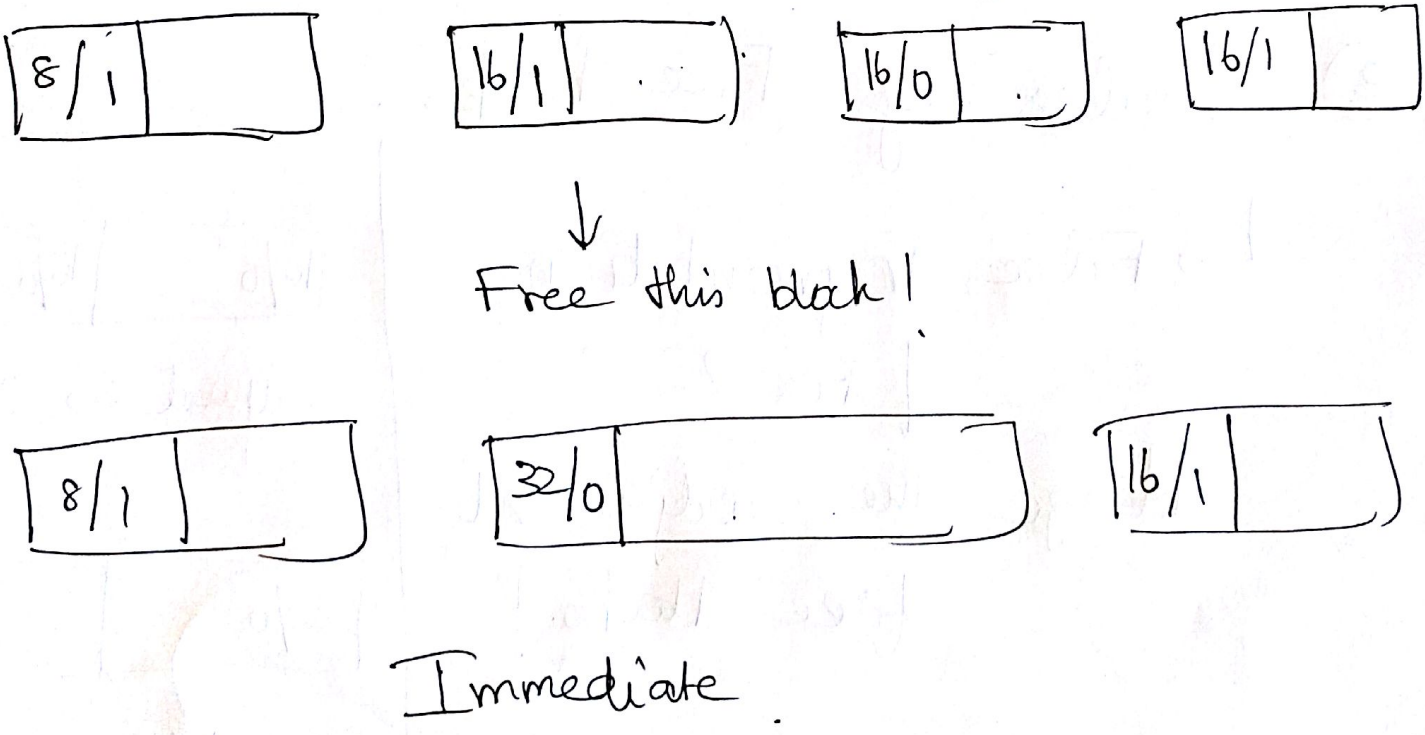
When ?

① Immediately (Immediate Coalescion)
Merge any adjacent free blocks each time a block is freed.

② Deferred
"Do it later"



Immediate

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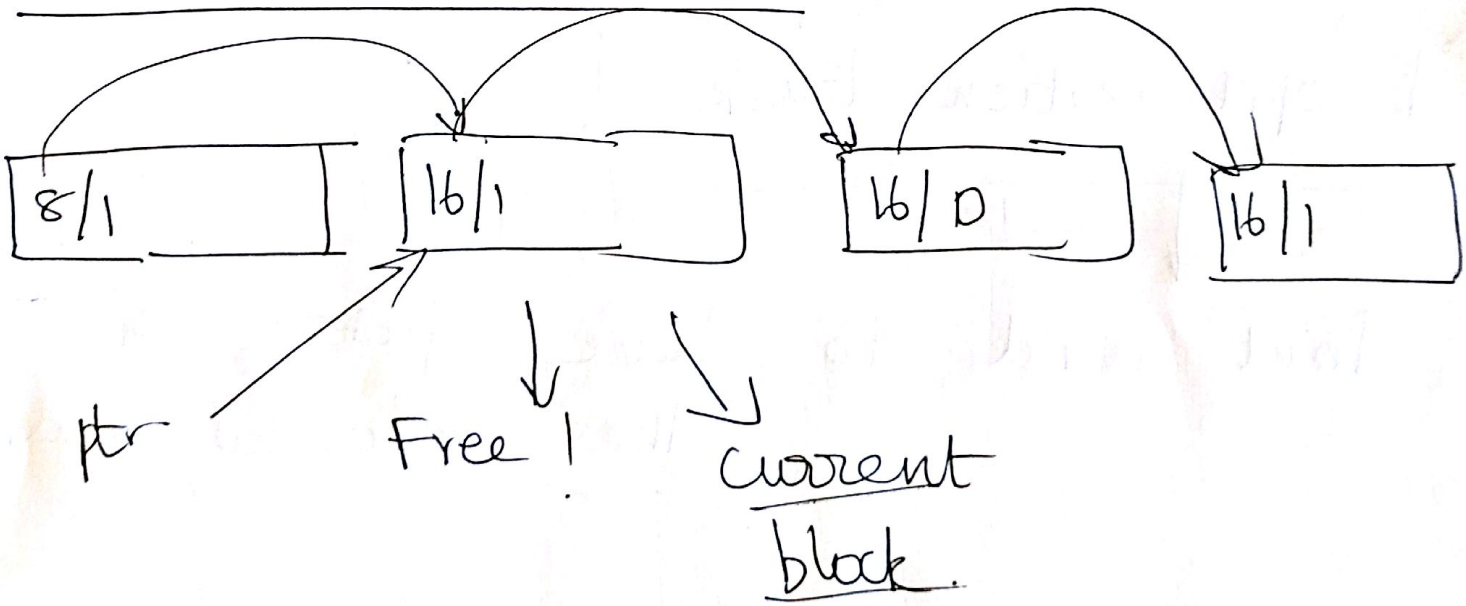
BUT !

Sequence of 3 word allocation requests and free requests.

Deferred might be better!

P5 → Immediate!

How to implement this? free(ptr)



→ check the next block's header and see if its free (and add the block sizes)

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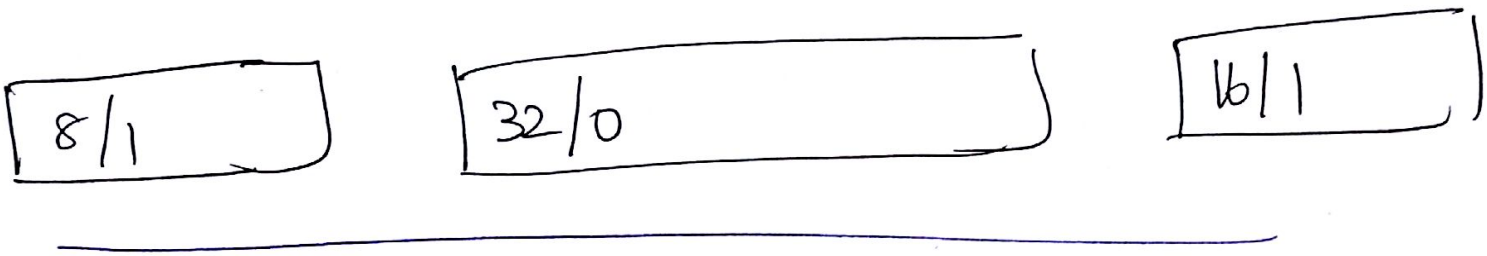
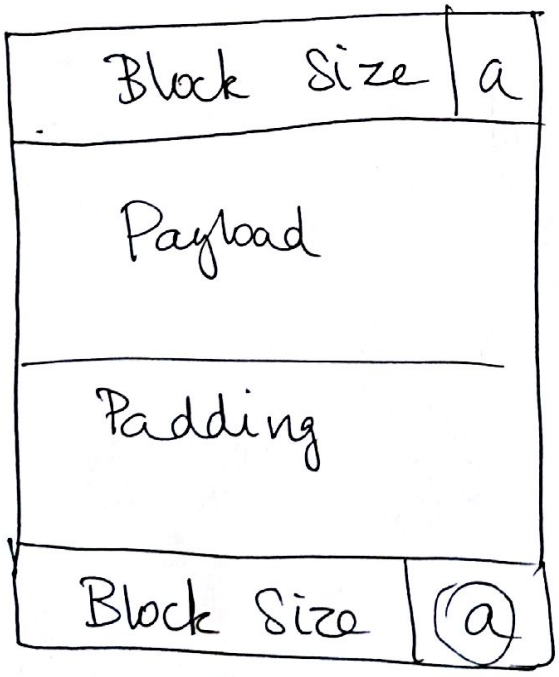


What if the previous block is free?
How to check that?

We need to traverse from the beginning! Expensive.

Add a footer! → replica of the header.

→ also called a boundary tag



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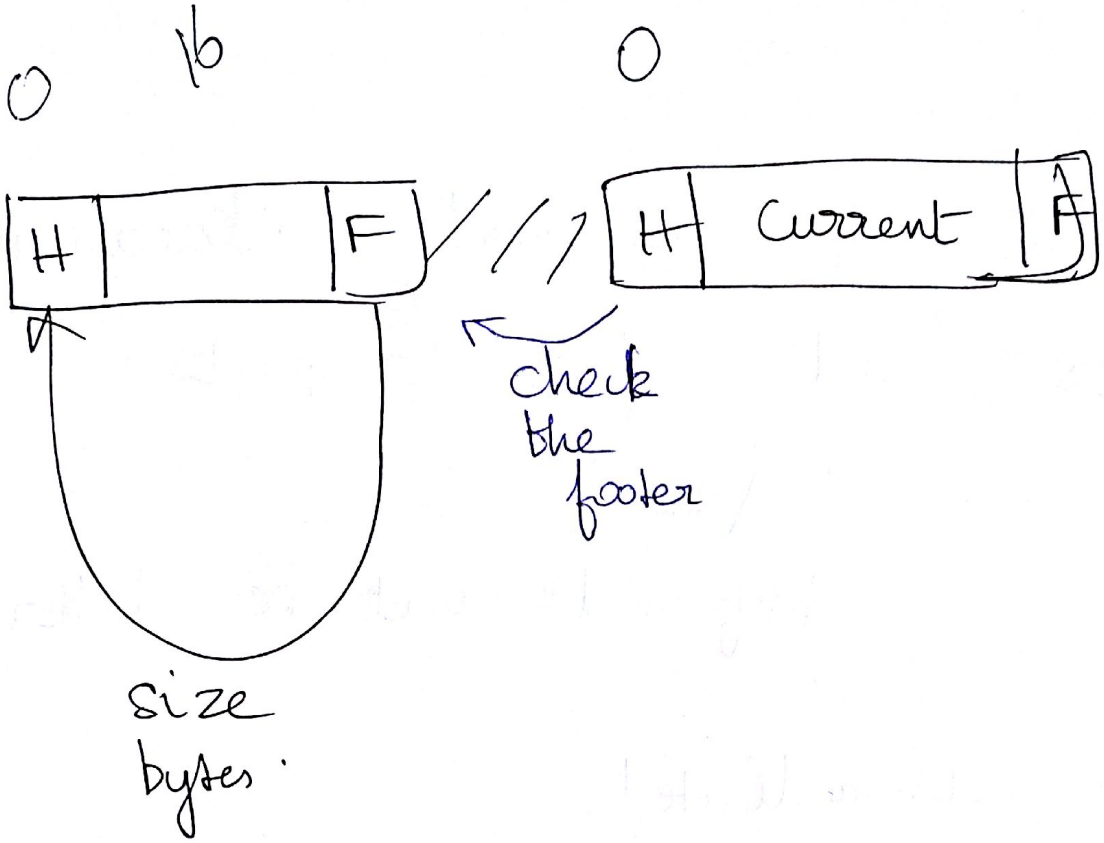

Drawback → Extra memory!

1 optimization trick!

↓

Dont need to have footers on the allocated blocks!

Pg. 826 in CS: APP

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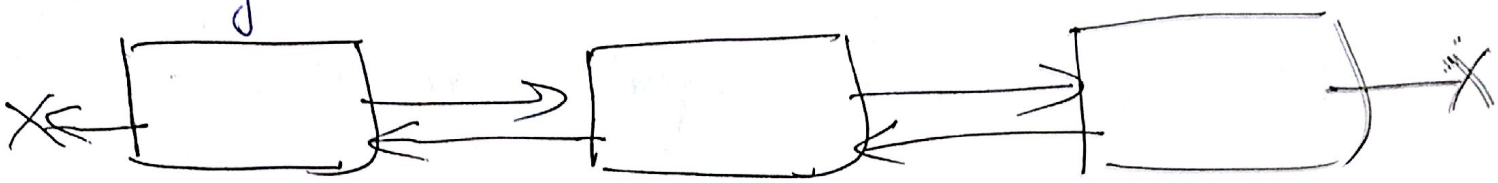
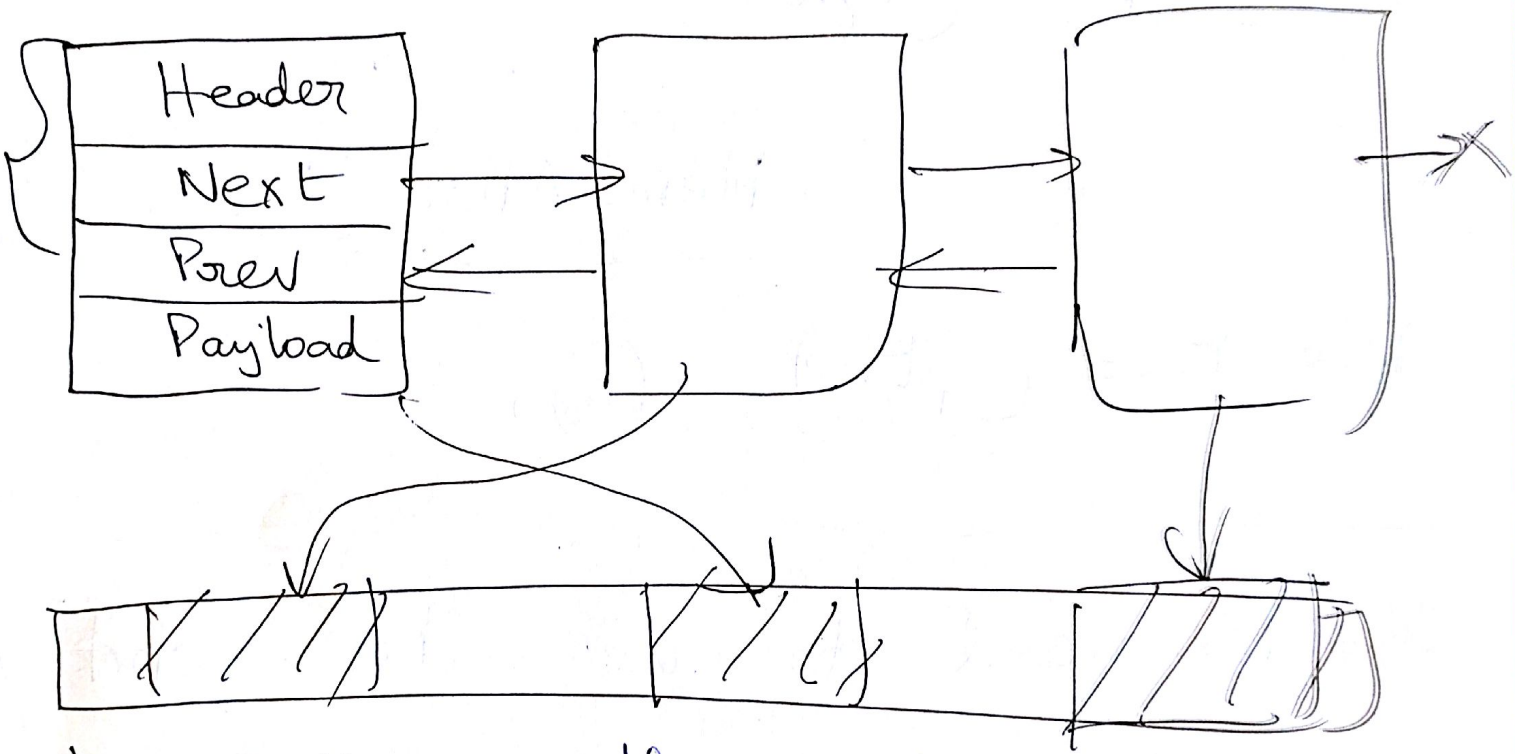
Explicitly maintaining a Free List

Doubly linked List





Physically → they can be anywhere on the heap

Explicit Free List

↓

only free blocks!

First Fit → Instantaneous.

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P5

Sample.c → import "mem.h"

mem.c

MEM_INIT (bytes.) ✓

ptr = ( ) Mem_Alloc (bytes) ○

Mem_Free (ptr) ○

→ No need to use brk /sbrk / mmap

Single-word aligned!

↳ payload needs to start at an address that's a multiple of 4.

↓

start at any word!

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All blocks' size is a multiple of 4. ⟹

4	→	1 00	Encode allocation status (0 a)
8	→	1000	
12	→	1100	

Mem_Alloc (size) → Allocate

→ return a pointer to the payload.

Header → Block size (+ allocation status)

+

Next pointer.

Total size of header = 8 bytes (2 words)

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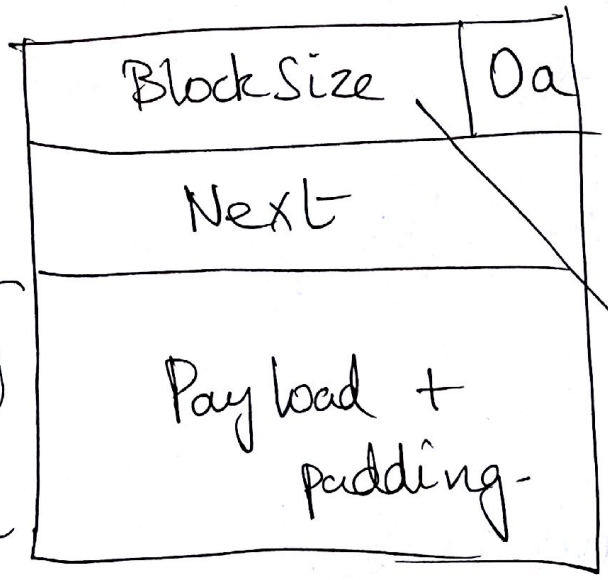
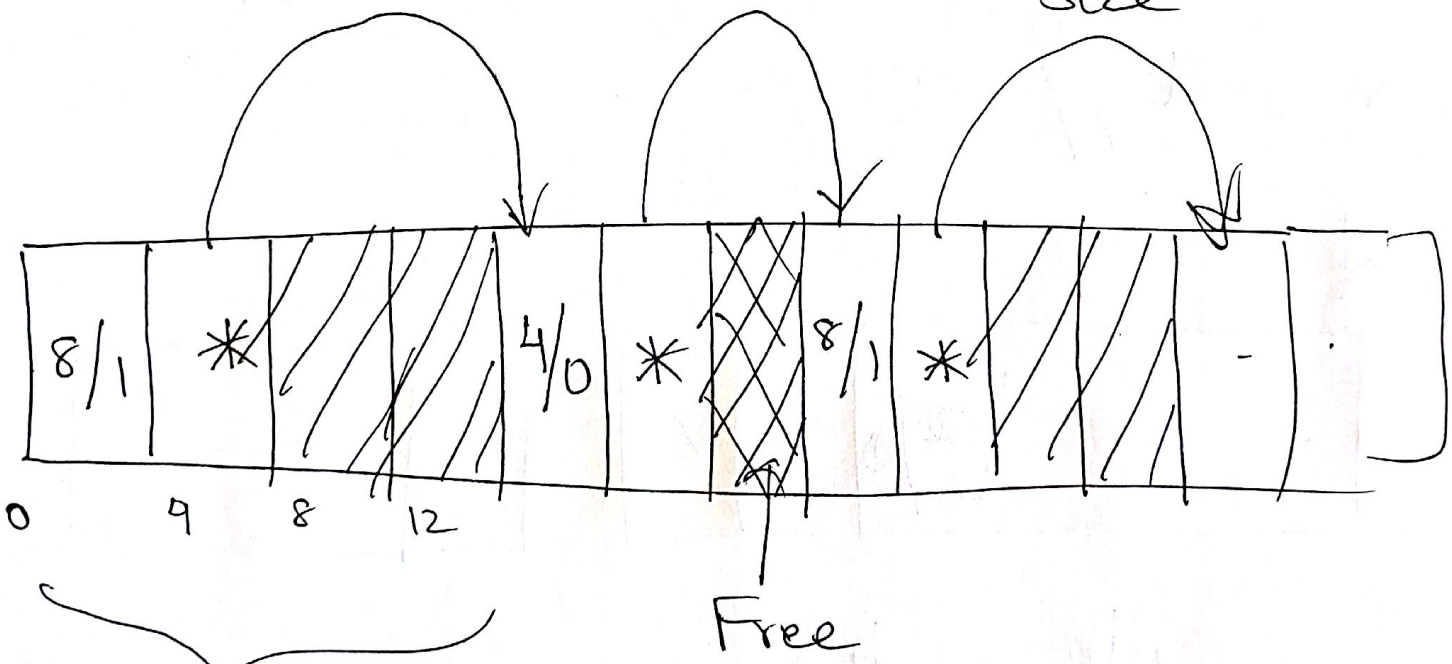


} Header.

Only the (payload + padding) size.

Block size!



16 bytes

↓

8 → Header

8 → Payload

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Mem_Alloc (size)

① Round up!

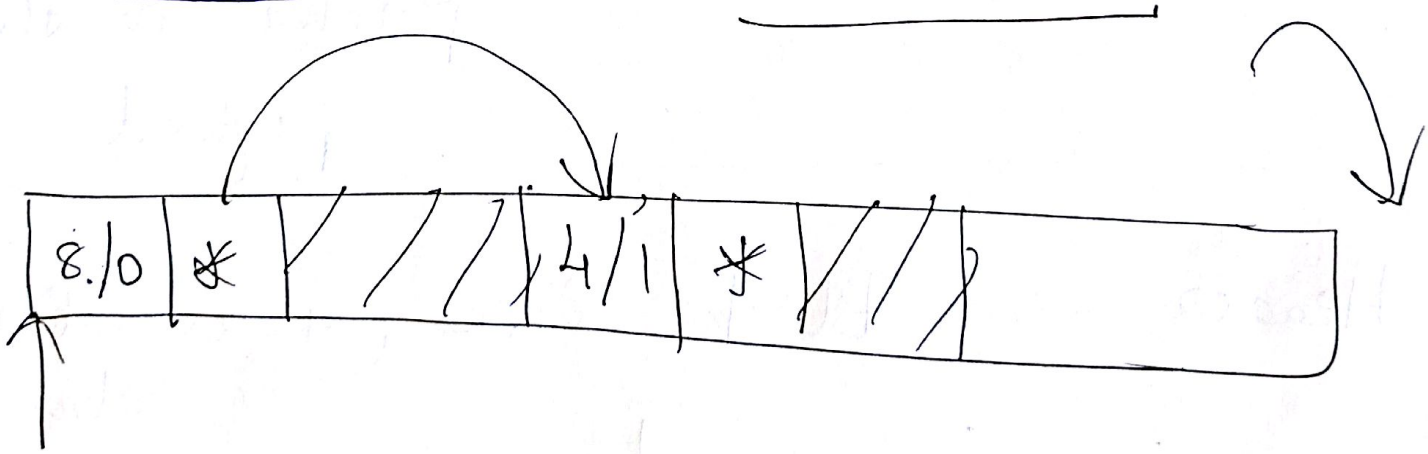
② Traverse the list to find the block thats the best fit.

Next Pointer

null at beginning.

ptr runner

ptr best_fit



global variable (list_head)

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runner is at end

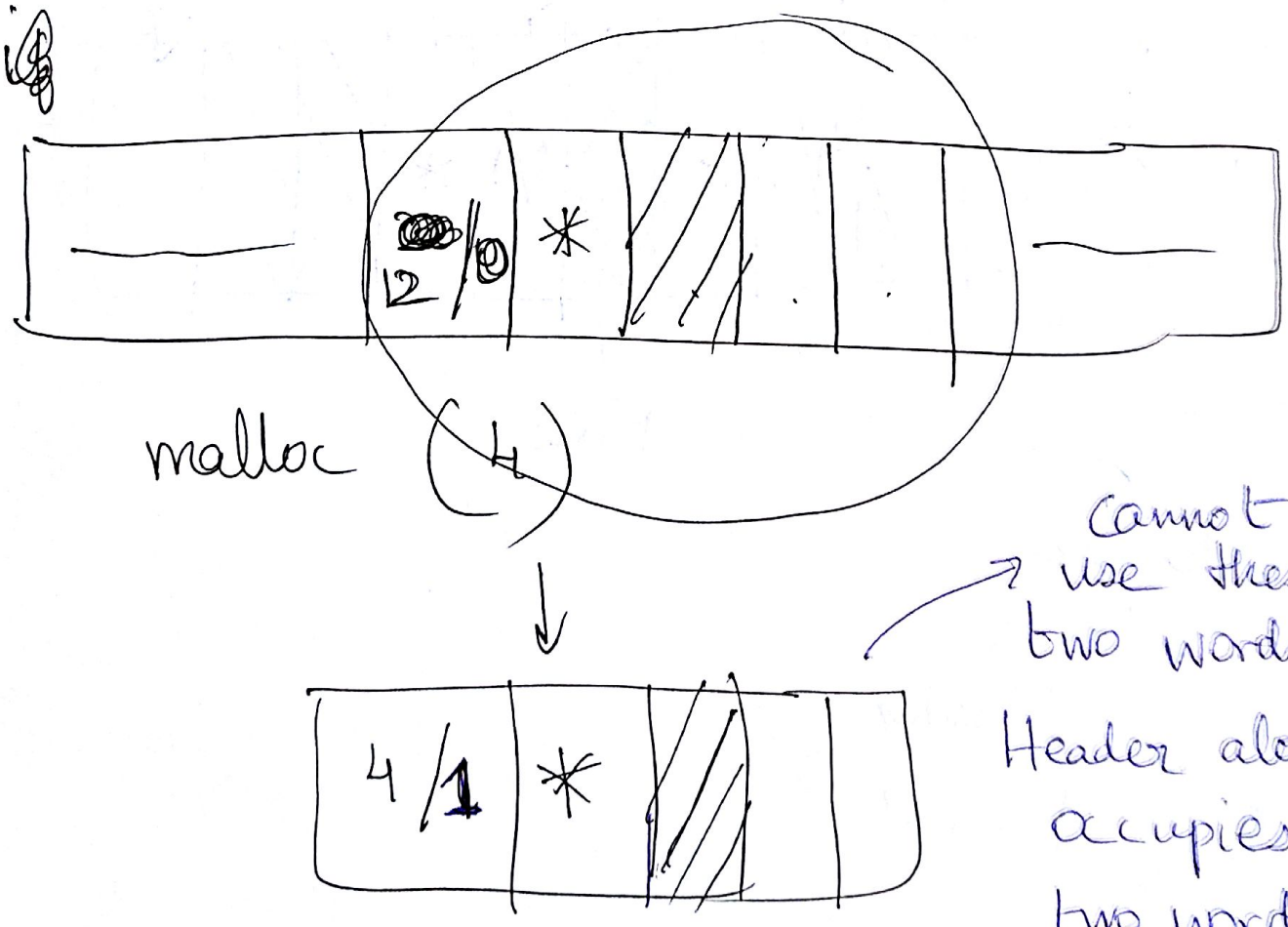
You check your best_fit //

↳ null ?

or not

// Best_fit we have one !

check if we need to split it or not //



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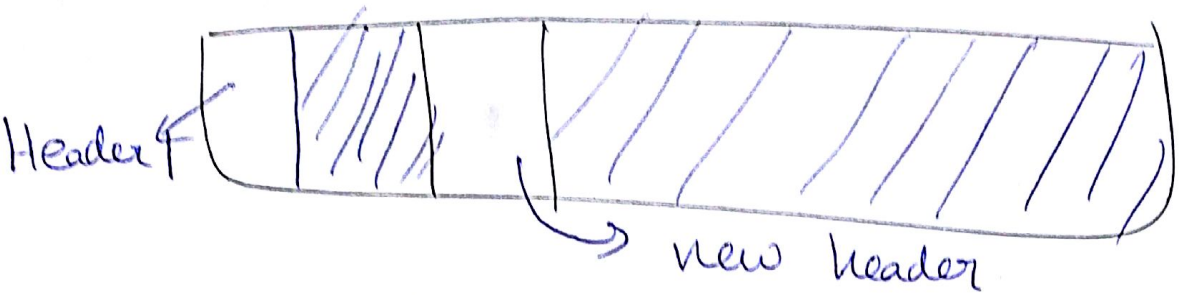
If we do end up splitting,



↓

→ create a new header

→ update the next pointers

→ Don't forget to set the allocated bit

return the ptr to the payload

// End of Mem_Alloc

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