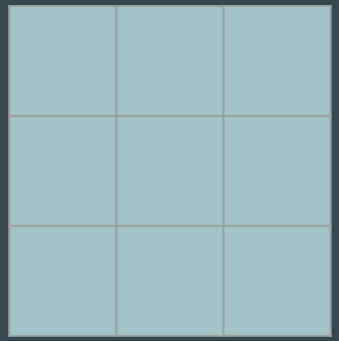
COMP1511 Week 9

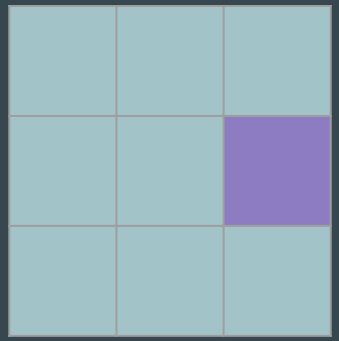
malloc(), free(), 1D and 2D linked lists

free()

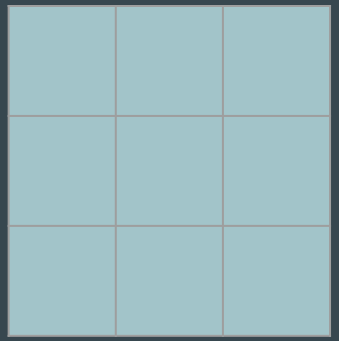
- malloc() allocates memory in the heap
- free() un-allocates it

The heap





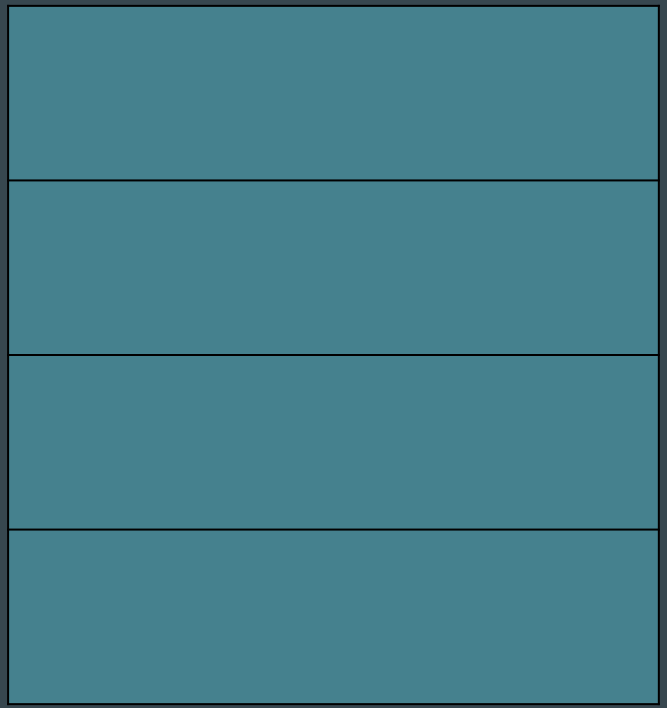
A = malloc(sizeof(struct node))



free(A)

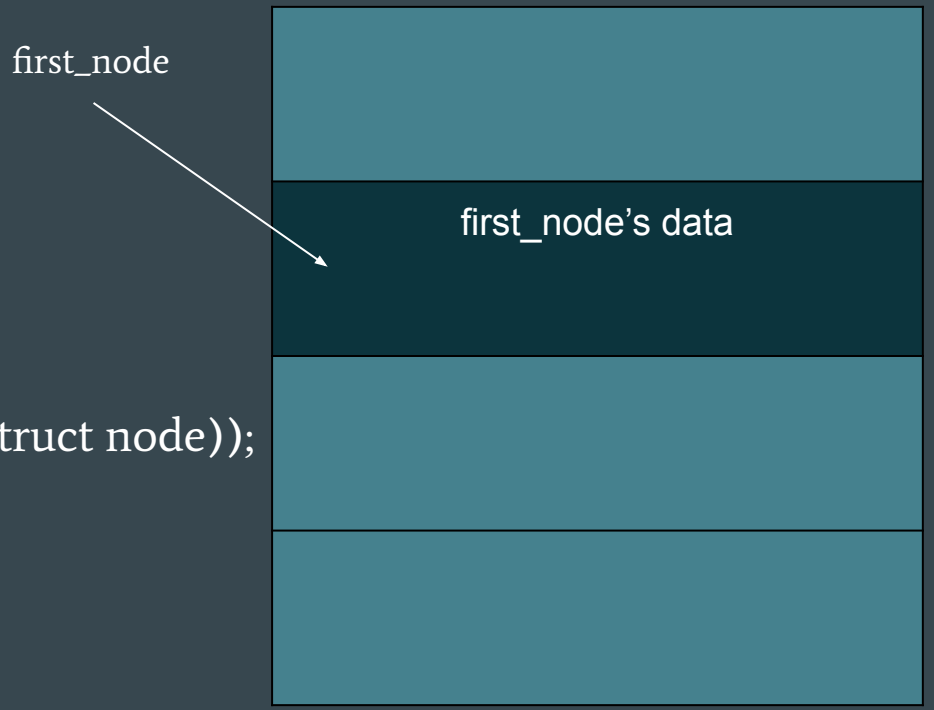
Use After Free

```
struct node {
        int data;
};

...

struct node *first_node = malloc(sizeof(struct node));
```



Use After Free

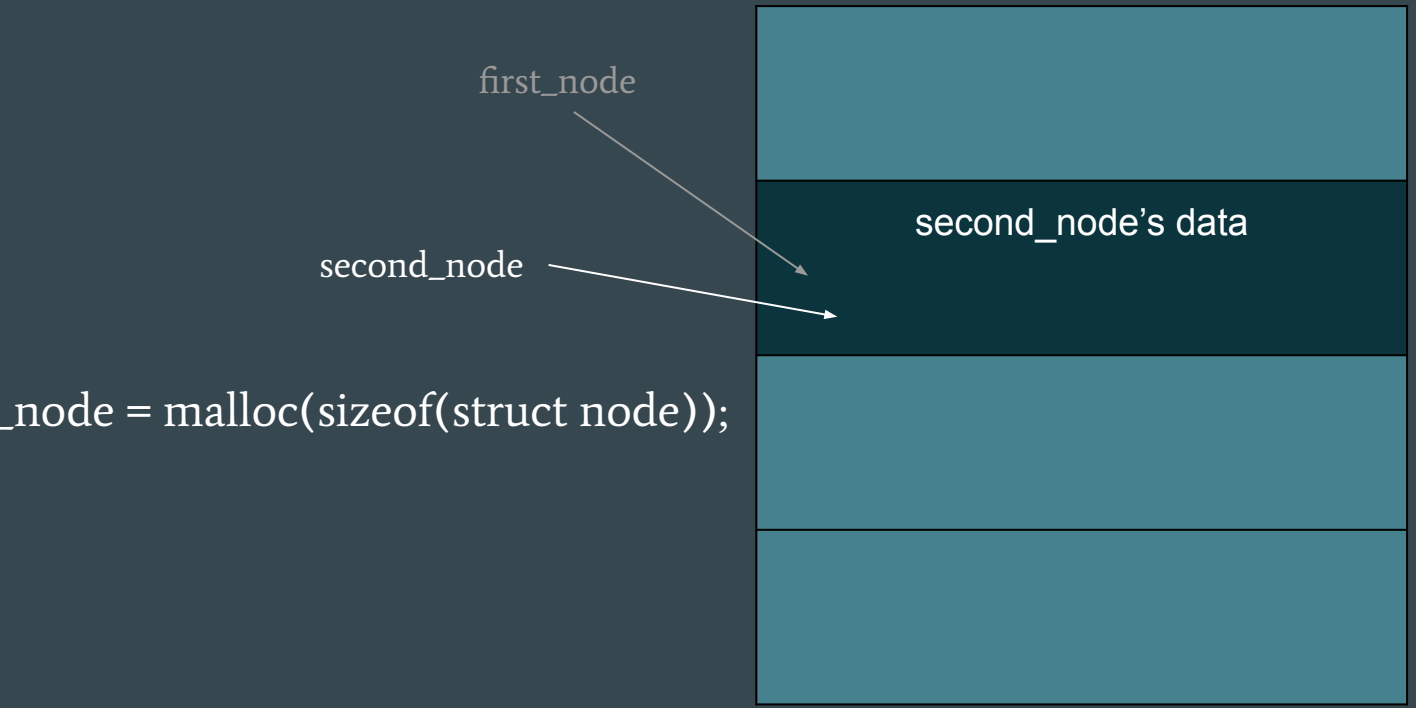
```
struct node {
        int data;
};

...

struct node *first_node = malloc(sizeof(struct node));
```



Use After Free

free(first_node);

Use After Free

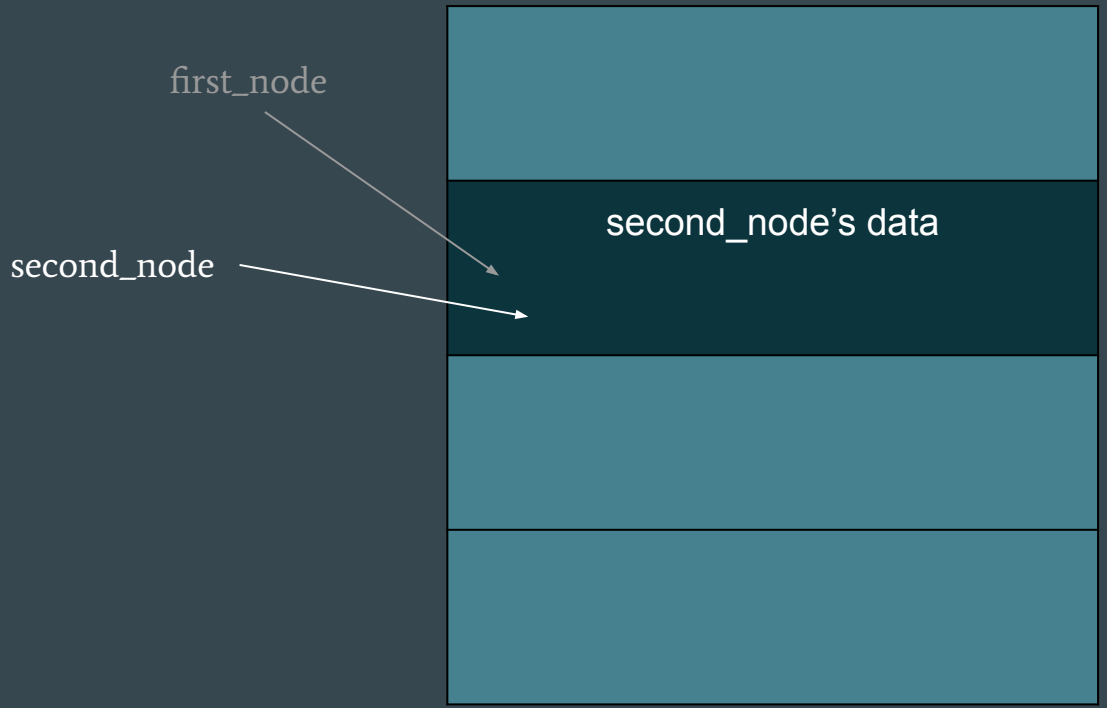



```
struct node *second_node = malloc(sizeof(struct node));
```

Use After Free

printf(“%d\n”, first_node->data);

???



Memory Leaks

- What if you forget to free() something?
- Can use dcc --leak-check to find leaks!

General Linked Lists Points to Consider

What should happen if the list

- Is empty?
- Contains one node?
- Contains multiple nodes?

General Linked Lists Points to Consider

If you're inserting/deleting/searching for a node, it can also be useful to consider what happens if the node is

- At the start of the list?
- In the middle?
- At then end?
- Not in the list at all?

General Linked Lists Points to Consider

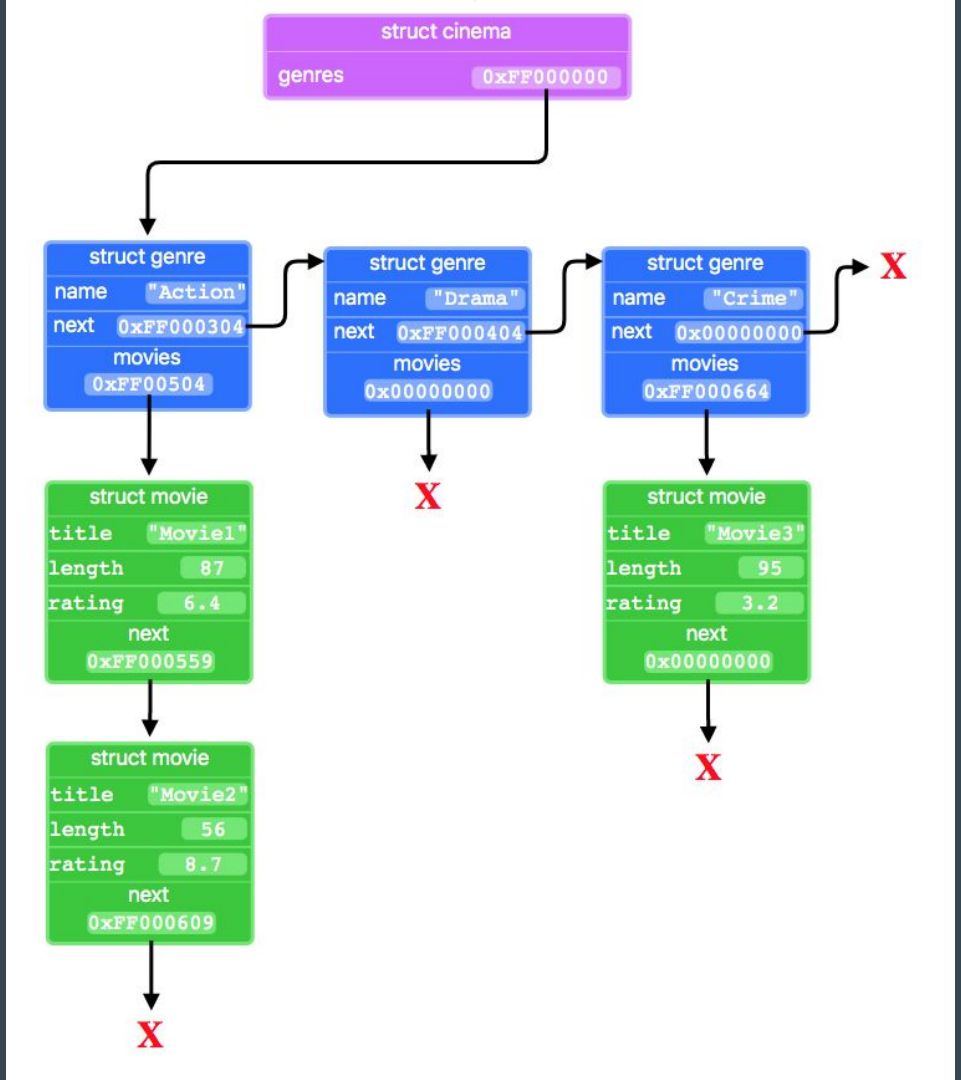
If you want to loop through every node in a linked list:

```
struct node *curr = head;
while (curr != NULL) {
    // do stuff
    curr = curr->next;
}

// after finishing the loop, curr == NULL
```

General Linked Lists Points to Consider

If you want to find the last node of a linked list:

```
struct node *curr = head;
while (curr->next != NULL) {
    // do stuff
    curr = curr->next;
}

// after finishing the loop, curr == the last node of the list
```


struct cinema
genres
0xFF000000
struct genre
name
"Action"
next
0xFF000304
movies
0xFF00504
struct genre
name
"Drama"
next
0xFF000404
movies
0x00000000
struct genre
name
"Crime"
next
0x00000000
movies
0xFF000664
X
X
struct movie
title
"Movie1"
length
87
rating
6.4
next
0xFF000559
struct movie
title
"Movie3"
length
95
rating
3.2
next
0x00000000
X
struct movie
title
"Movie2"
length
56
rating
8.7
next
0xFF000609
X