

**Assignment 2 releasing
soon**

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**End of this week or early
next week**

- Linked lists
- Dynamic memory
- Structs

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Remember to get support

- Revision Sessions
- Help Sessions
- See forum for details

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Memory Recap

`malloc()`

- `malloc` -> Memory Allocation (allocate memory on the heap)
- Returns a pointer to the location on the heap
- We can decide how large the allocation

Calling `malloc`

- `ptr = (cast-type*) malloc(byte-size)`

Example:

```
#include <stdio.h>

int main(void) {
    malloc(1000);
    malloc(sizeof(int));
    malloc(sizeof(char) * 50);

    return 0;
}
```

Heap memory cheat sheet

- Allocate memory:

`malloc()`

- Deallocate: `free()`

- Grow/shrink memory

`realloc()`

- All require `stdlib.h`

`sizeof()`

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Dynamic arrays on the heap

A common way of using malloc is to create dynamic arrays:

```
int main(void) {  
    int num_elements;  
    scanf("%d", &num_elements);  
  
    int *data =  
    malloc(num_elements *  
    sizeof(int));  
    data[0] = 5;  
  
    return 0;  
}
```

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Linked Lists

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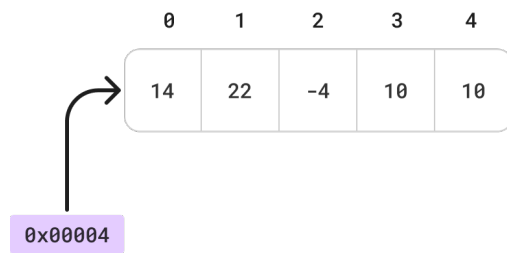
So far

**arrays to store
collections of data**

0	1	2	3	4
14	22	-4	10	10

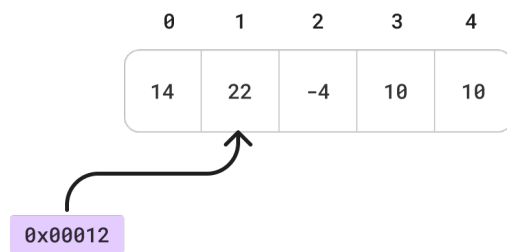
Arrays are **contiguous**, so
we use the address of the
first index to access each
element

array variable points to start



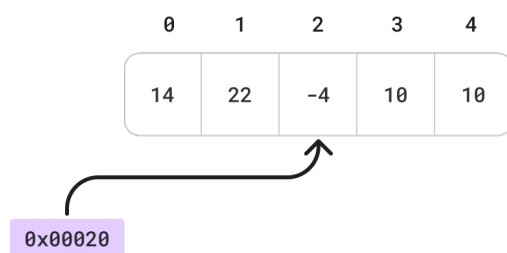
Move along the

`sizeof(int)`



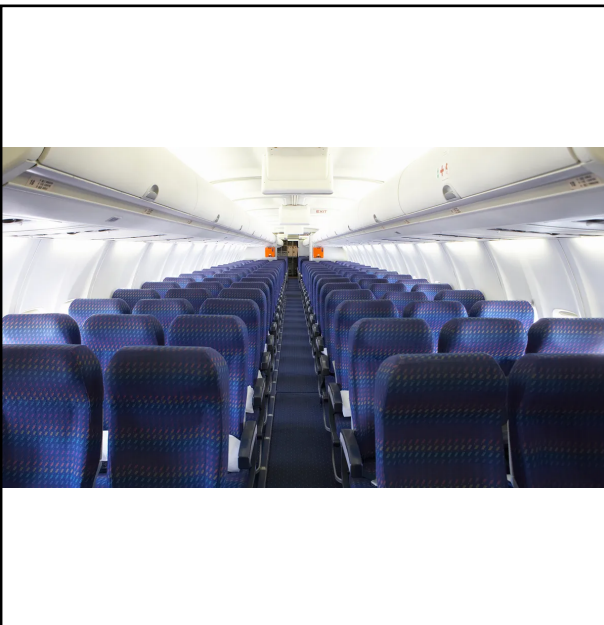
Move along the

`sizeof(int)`



Limitations of arrays

- If we know exactly how many elements we need to store, and we have the data, great!
- else, we need to have sufficient memory set aside in advance, or grow it, but...
- Allocating memory is **expensive**



**What if we had a way to
store additional data very
easily?**

Where growing memory
was cheap

Enter the linked list

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Linked lists

- Similar to dynamic arrays
 - they store collections of data
 - are dynamic (can grow/shrink)

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Linked lists

- Different to arrays
 - *Efficiently* dynamic (you can add memory bit by bit)
 - are not contiguous
 - are not random access

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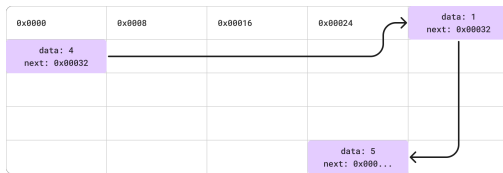
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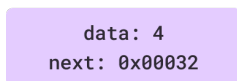
Array

[illegible]

Linked List

[illegible]

We use a struct on the heap



```
struct node {
    int data;
    struct node *next;
};
```

[illegible]

Break, Kahoot, Demo

Demo goals

- Create a linked list with the elements `11, 8, 7`
- A reference to the linked list on the heap in `main`
- A way to print each element

Feedback

<https://forms.office.com/r/K3PjvWebtD>

