Stacks & Queues

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CSCI 2270 Data Structures

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Stacks

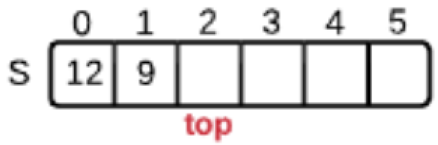
- Stores a collection of elements and restricts which element may be accessed at any time.
- Operate on a last in, first out principle (LIFO)
- **Think about a *stack* of plates**
  - You have 3 plates stacked on top of each other
  - To place a new plate onto the stack, it must go on top
  - To remove a plate from the stack, it must come from the top

Stacks

- Placing a new element onto the stack is called a **push**
- Removing an element from the stack is called a **pop**
- **Think about reading a sentence**
  - Push each word you read onto the stack
  - After reading the whole sentence, pop each word from the stack
  - Compare this to the original sentence

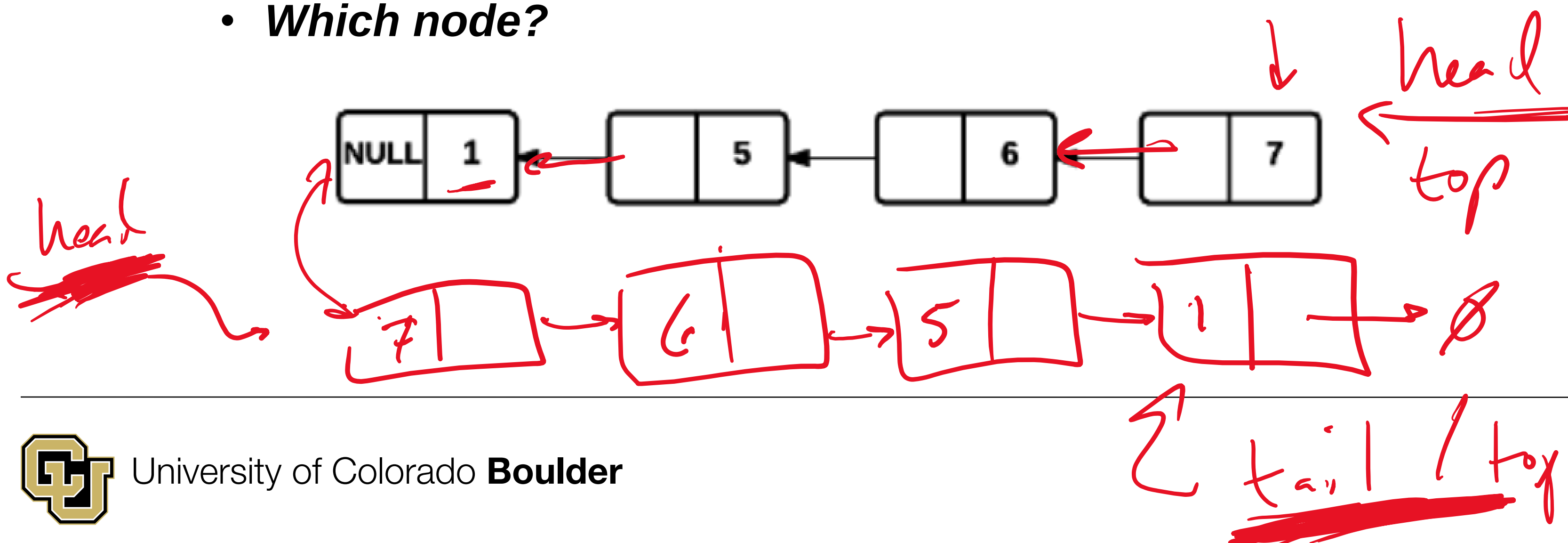
Stacks: Implementation

- **Array**
  - An array can be turned into a stack by implementing restrictions on where you can add/remove elements
  - The “top” of a stack implemented from an array is set to be the *numElements* index
    - ***Why?***



Stacks: Implementation

- **Linked Lists**
  - Linked lists may also be used to implement stacks
  - Each node represents a data element of the stack
  - Each node stores a pointer to the *prev* node in the list
    - ***The bottom of the list has a prev pointer to NULL***
  - The *top* of the stack is a pointer to a node
    - ***Which node?***



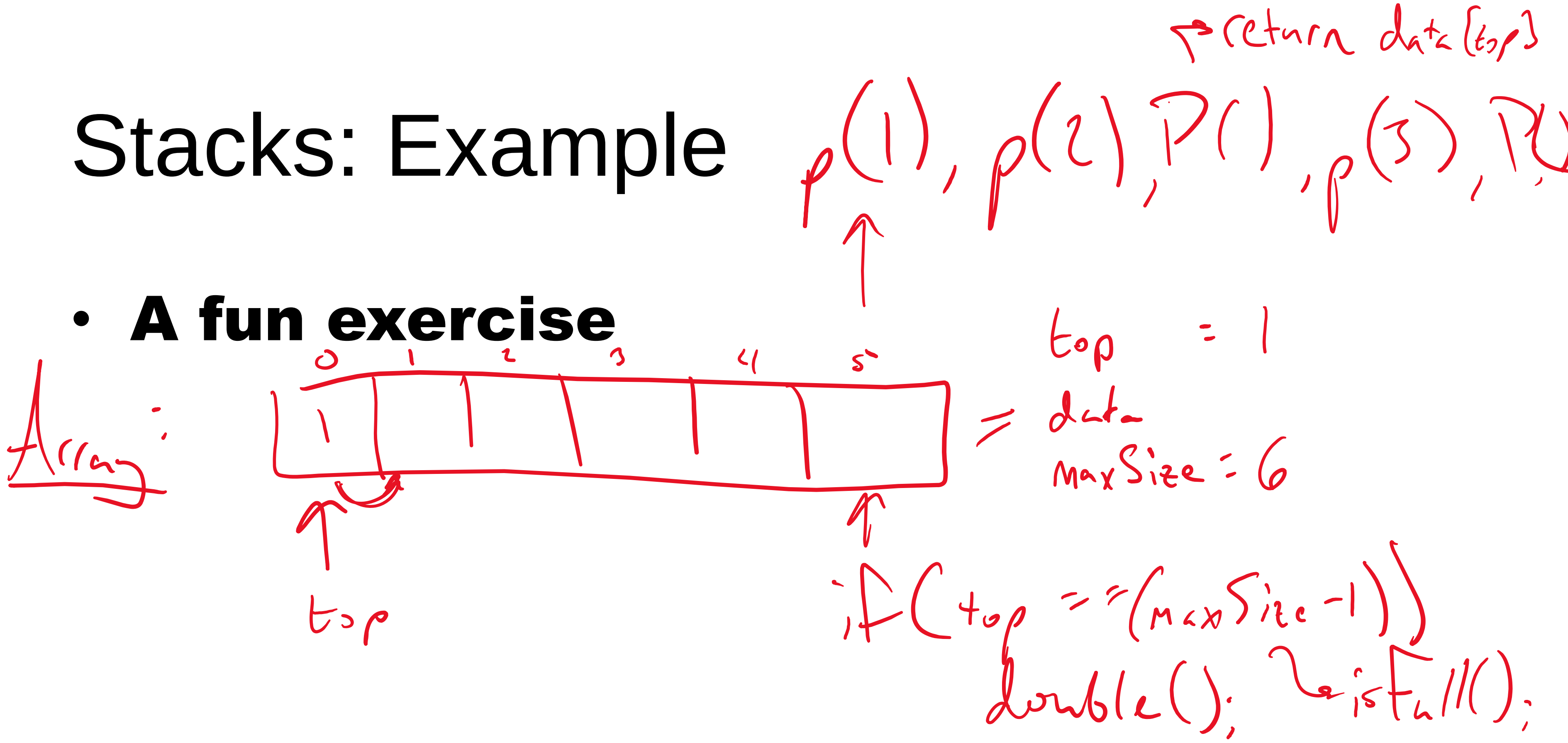
Stack: ADT

	Array	LinkedList
top :	int	*Node
top		head
data	[, , , ,]	DNE
maxSize	$\underbrace{\qquad\qquad}$	DNE

```
Stack:
        private:
                top
                data
                maxSize
        public:
                Init()
                isFull()
                isEmpty()
            →   push(value)
            →   pop()
```

Stacks: Example

- **A fun exercise**

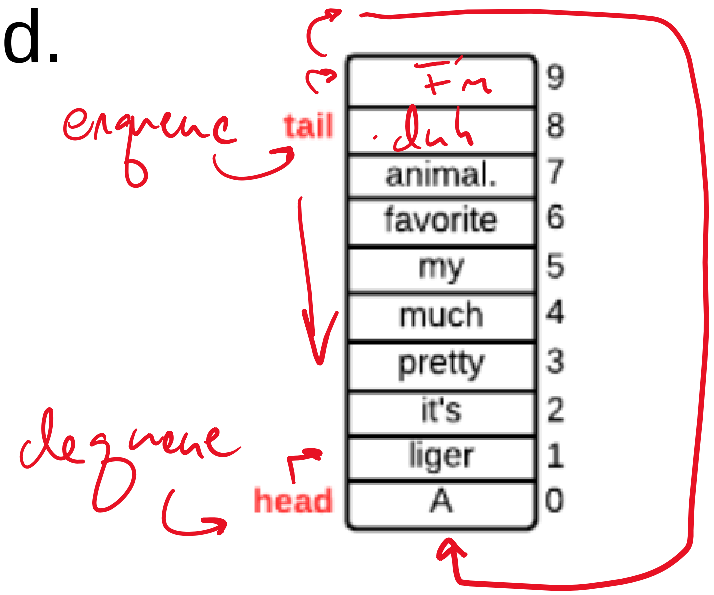


Queues

- **A queue is similar to the other data structures we've covered**
  - Stores collection of elements
  - Restricts which element may be accessed
- **Unlike stacks, queues are FIFO: First In First Out**
- **Think of the waiting queue at the DMV**
  - Get a ticket
  - First ticket gets served first

Queues

- Words are added at the ***tail***
- Words are removed from the ***head***
- The position of the *tail* and *head* move as elements are added.



Queues: Array or Linked List?

- **How do each need to operate?**

Queues: ADT

```
Queue:
        private:
                head
                tail
                data
                queueSize
                maxQueue
                isEmpty()
                isFull()
        public:
                Init()
                enqueue(value)
                dequeue()
```

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