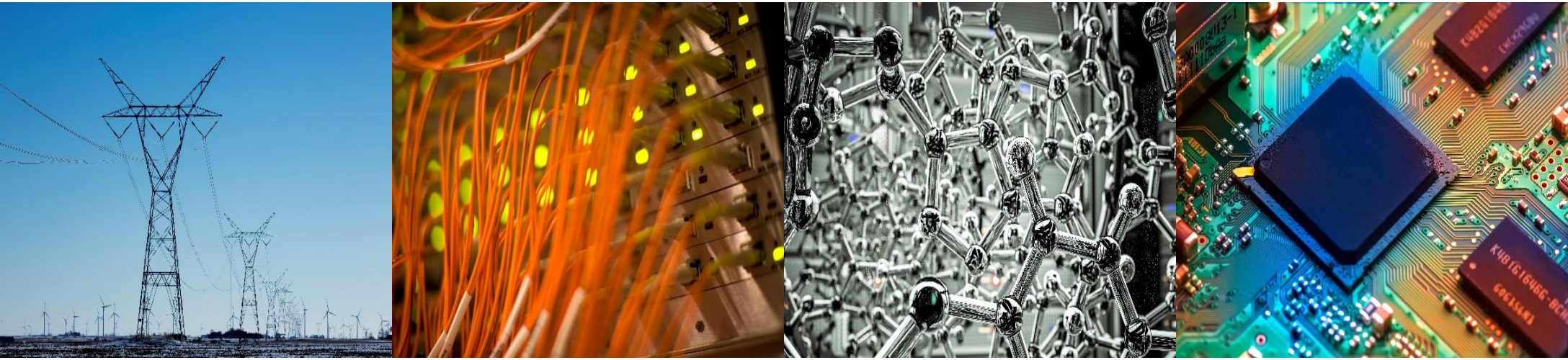
ECE 220 Computer Systems & Programming

Lecture 17 – Linked Lists

October 24, 2024



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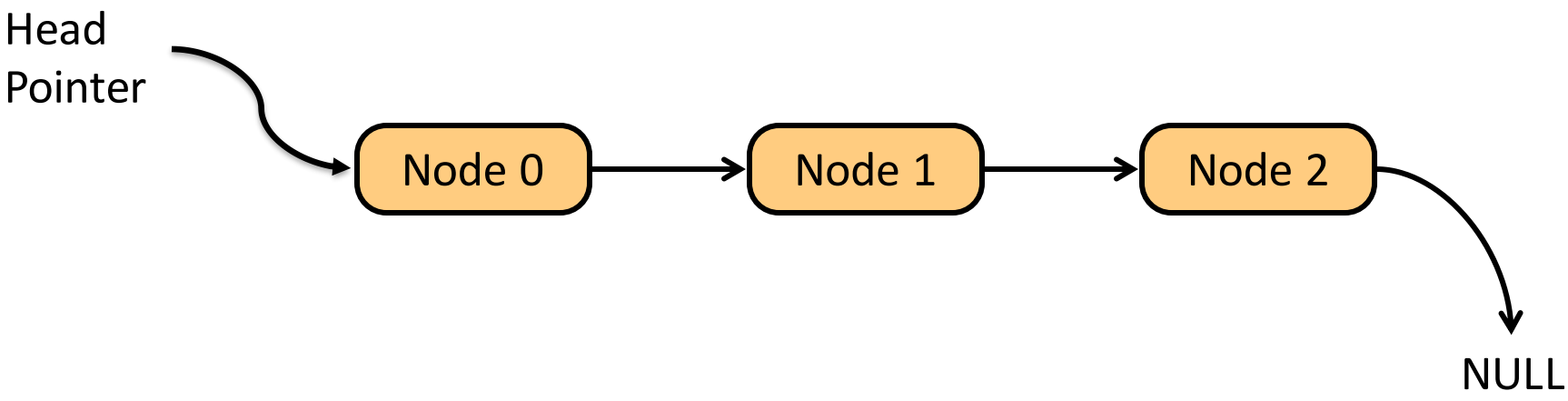
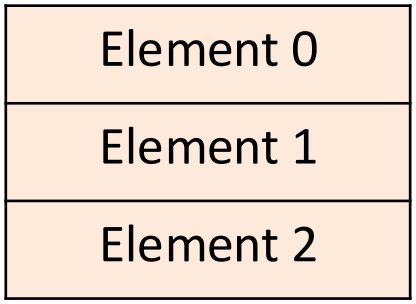
The Linked List Data Structure

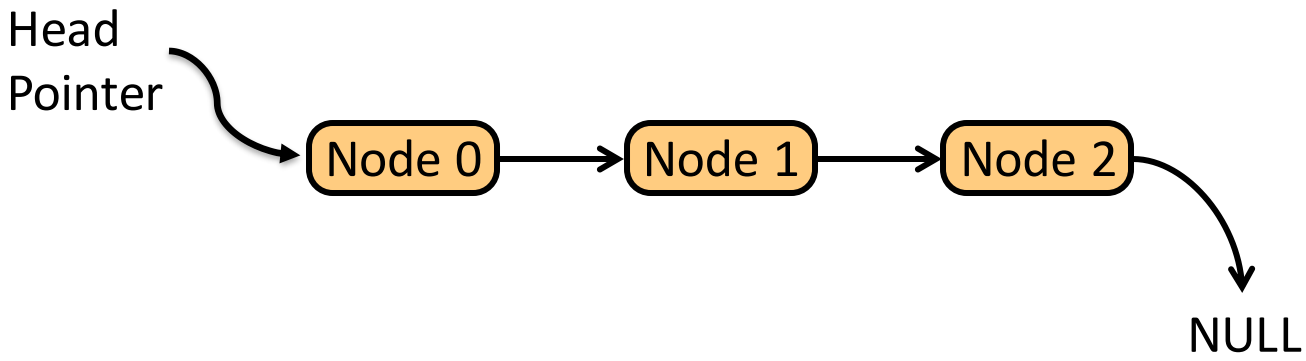
A linked list is an ordered collection of nodes, each of which contains some data, connected using pointers.

- Each node points to the next node in the list.
- The first node in the list is called the _____
- The last node in the list is called the _____



Array vs. Linked List

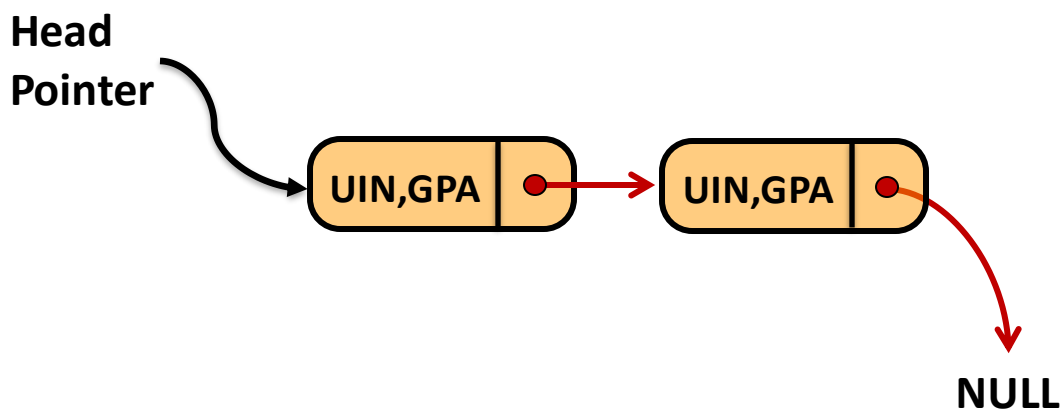




	Array	Linked List
Memory Allocation		
Memory Structure		
Memory Overhead		
Order of Access		
Insertion/Deletion		

Example: A List of Student Records

```
typedef struct studentStruct Node;
struct studentStruct{
   int UIN;
   float GPA;
   Node *next;
};
```

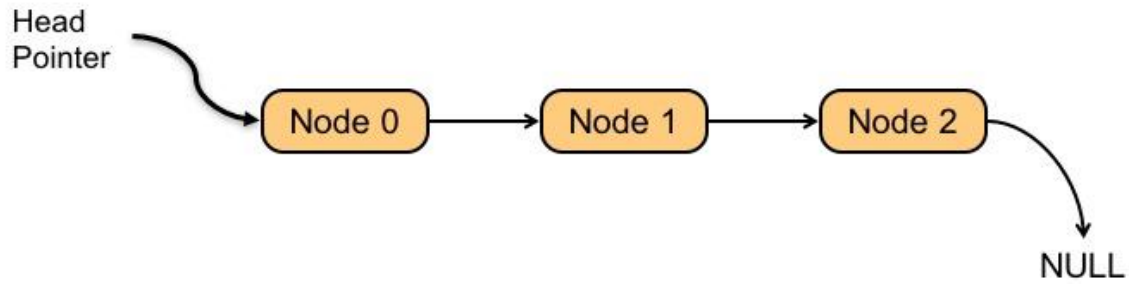


We have a list of 200 student records (nodes) **sorted by UIN**

1. Traverse the list to find a student record by UIN
2. Add a new student record to the sorted list at the correct location
3. Delete a student record from the list

Traverse a sorted list to find a student record by UIN

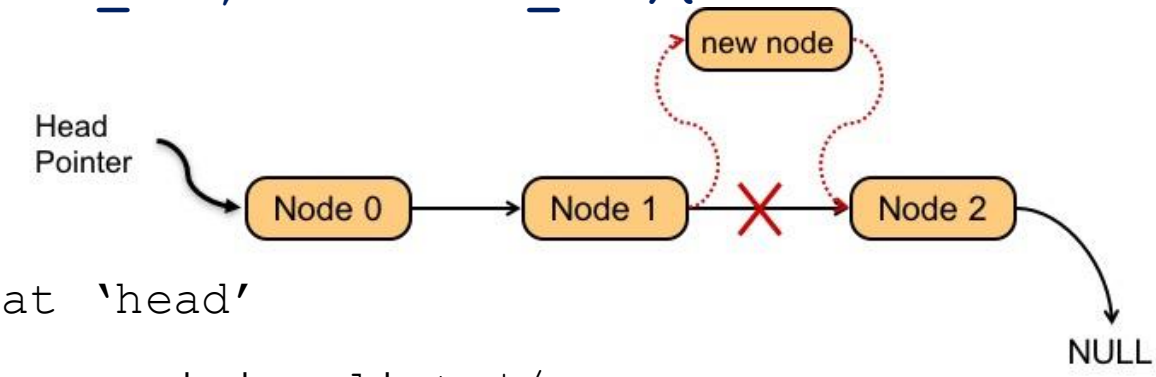
```
/* If matching UIN is found, print "record found" and return a pointer
to this node, otherwise print "record not found" and return NULL */
Node *find_node(Node *head, int S_UIN){
```




```
/* Algorithm */
/* base case 1:
list is empty/reach the tail OR
current node's UIN is past the range (record not found) */



/* base case 2:
current node's UIN matches S_UIN */



/* recursive case: traverse the remaining list */



}
```

Add a new student record to a sorted list

```
/* add a new node to a sorted list at the correct location */
void add_node(Node **list, int new_UIN, float new_GPA){
```

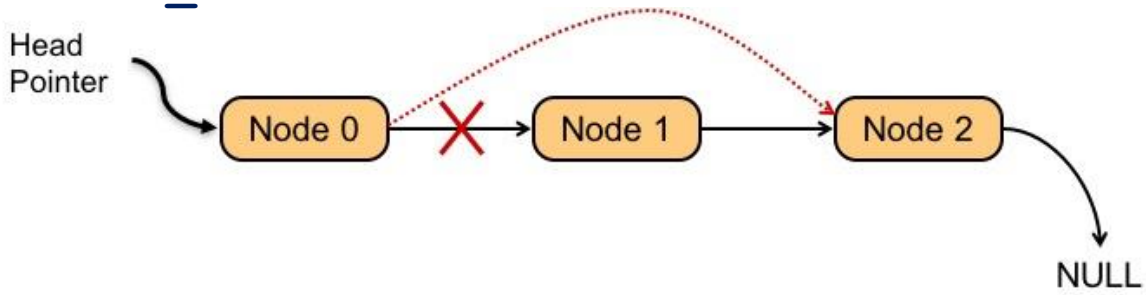



```
 /* Algorithm
    base case: insert new node at 'head'

    recursive case: traverse the remaining list */
```

```
}
```

Delete an existing student record from a sorted list

```
/* remove a node from a sorted list */
void remove_node(Node **list, int old_UIN){
```




```
/* Algorithm
   base case 1:
   empty list OR node with matching UIN not in list (record not found)

   base case 2:
   found node with matching UIN, redirect pointers and remove node

   recursive case: traverse the remaining list */
```

```
}
```