



CS 225

Data Structures

Sept. 18 – List Implementation

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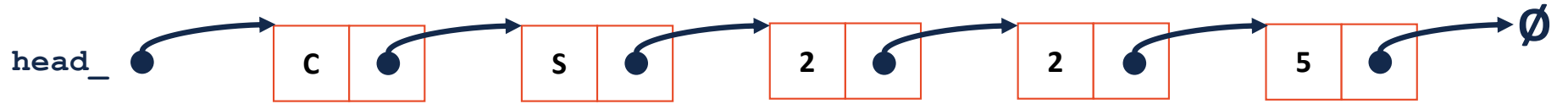
List.h

```
1 #pragma once
2
3 template <typename T>
4 class List {
5     public:
6         /* ... */
7
8
9
10
11
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16
17
18
19     private:
20         class ListNode {
21             public:
22                 T data;
23                 ListNode * next;
24                 ListNode(T & data) :
25                     data(data), next(NULL) { }
26         };
27
28         ListNode *head_;
29
30     ...
31
32 };
```

List.hpp

```
9 #include "List.h"
10
11 ...
12
13
14 template <typename T>
15 void List::insertAtFront(const T& t) {
16
17
18
19
20
21
22 }
```

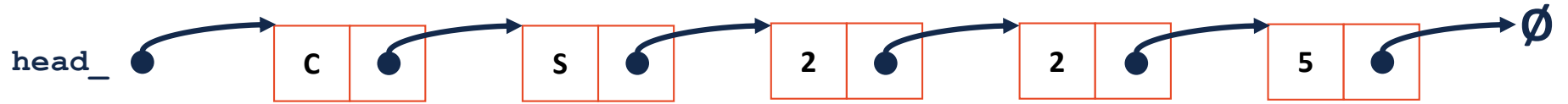
Linked Memory



List.hpp

```
57 template <typename T>
58 typename List<T>::ListNode *&
   List<T>::_index(unsigned index) {
59
60
61 }
62
63
64
65
```

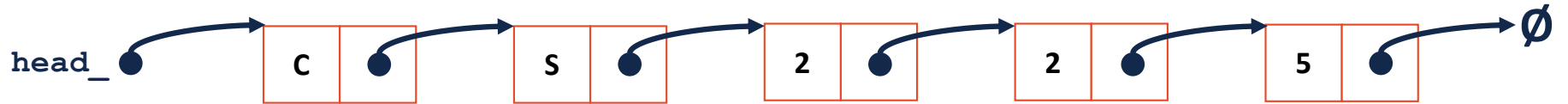
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List.hpp

```
// Iterative Solution:
template <typename T>
typename List<T>::ListNode *& List<T>::_index(unsigned index) {
    if (index == 0) { return head; }
    else {
        ListNode *thru = head;
        for (unsigned i = 0; i < index - 1; i++) {
            thru = thru->next;
        }
        return thru->next;
    }
}
```

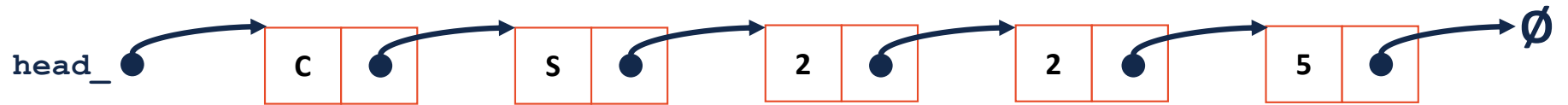
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List.cpp

```
48 template <typename T>
49 T & List<T>::operator[](unsigned index) {
50
51
52
53
54
55
56
57
58 }
```

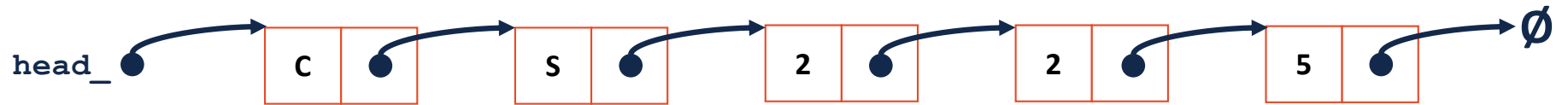

Linked Memory



List.cpp

```
90 template <typename T>
91 void List<T>::insert(const T & t, unsigned index) {
92
93
94
95
96
97
98
99 }
```

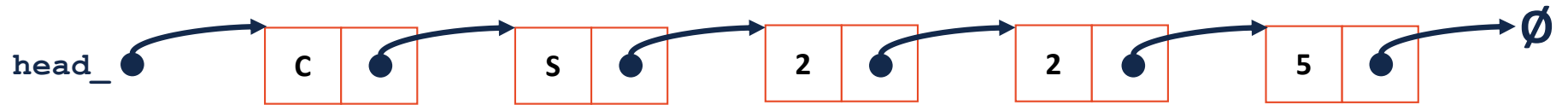
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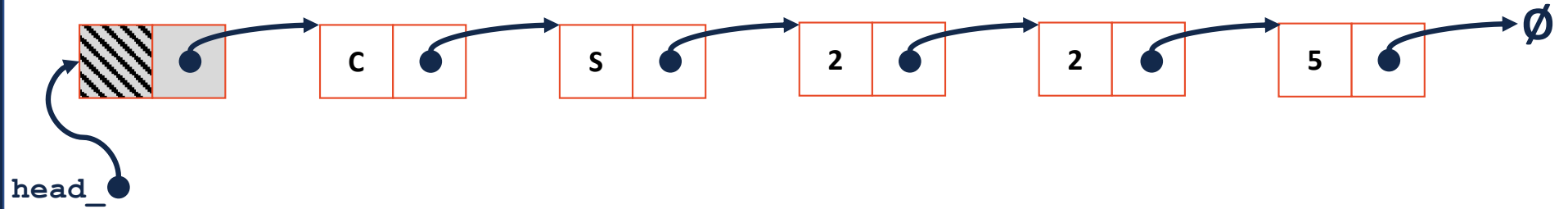
List.cpp

```
103 template <typename T>
104 void List<T>::remove(unsigned index) {
105
106
107
108
109
110
111
112 }
```

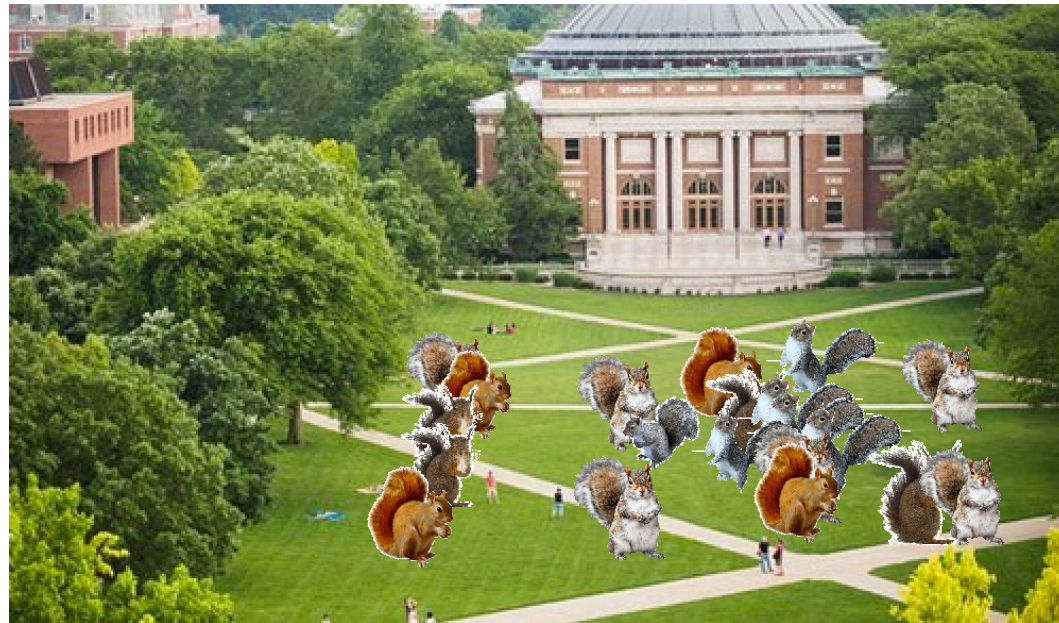
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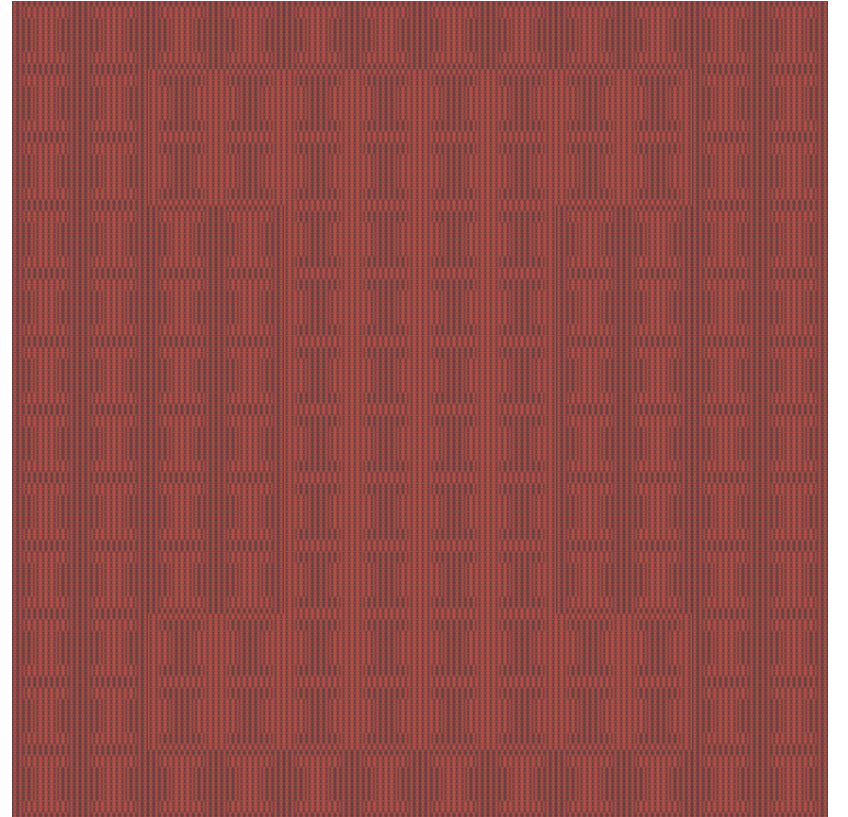
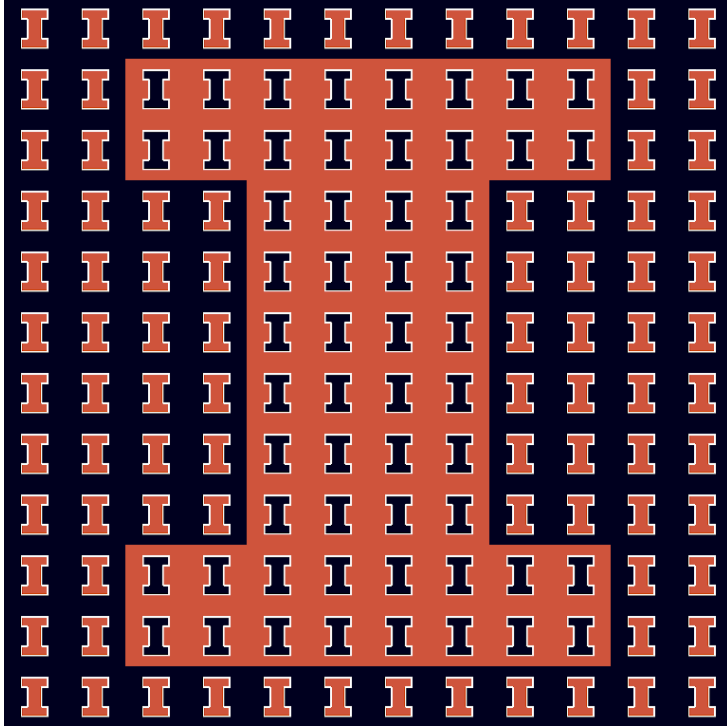


Sentinel Node



MP2











List Implementations

1. Linked List

2.

List.h

```
1 #pragma once
2
3 template <typename T>
4 class List {
5     public:
6         /* ... */
7
8     private:
9
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40
41
42 };
```

Array Implementation

C	S	2	2	5
[0]	[1]	[2]	[3]	[4]

Array Implementation

insertAtFront:

C	S	2	2	5
[0]	[1]	[2]	[3]	[4]

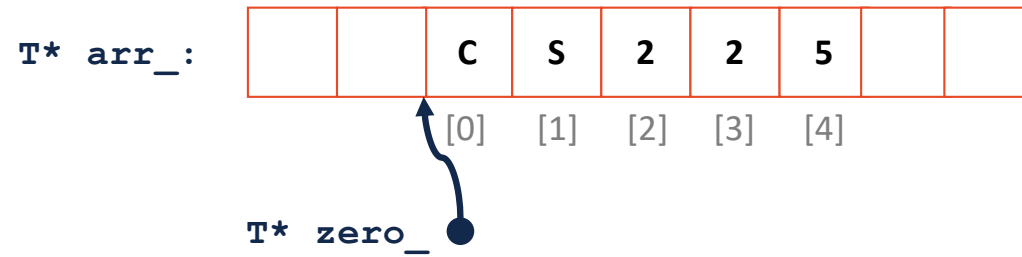
Resize Strategy – Details



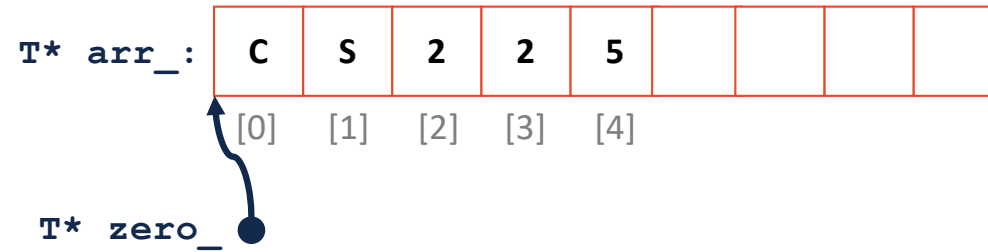
Resize Strategy – Details



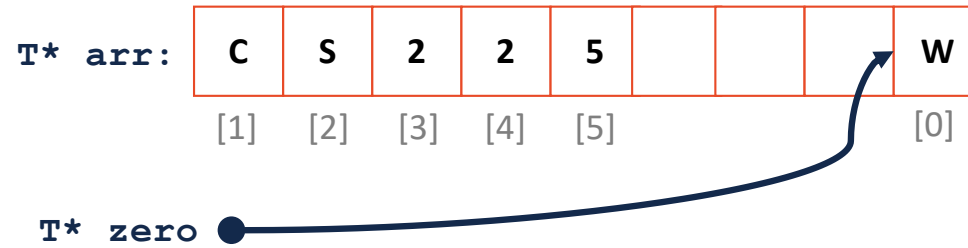
Array Implementation



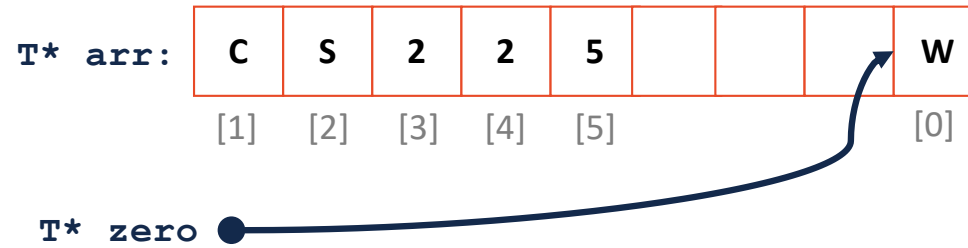
Array Implementation



Array Implementation



Array Implementation



Array Implementation

	Singly Linked List	Array
Insert/Remove at front		
Insert at given element		
Remove at given element		
Insert at arbitrary location		
Remove at arbitrary location		