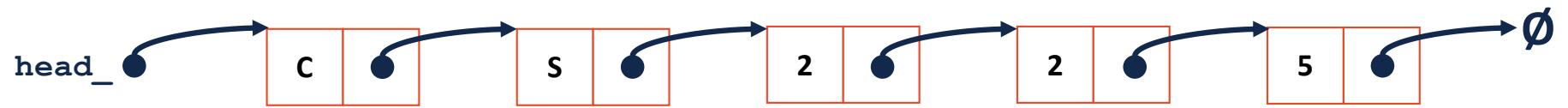# CS 225

Data Structures

February 9 – Lists 2
G Carl Evans

List.h

```cpp
1  #pragma once
2
3  template <typename T>
4  class List {
5    public:
       /* ... */
...
19
20   private:
21     class ListNode {
22       public:
23         T data;
24         ListNode * next;
25         ListNode(const T & data) :
              data(data), next(NULL) { }
26     };
27
28     ListNode *head_;
...

   };
```

Linked Memory

head_ → C → S → 2 → 2 → 5 → Ø

List.cpp

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

Array Implementation

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

List.h

```
1   #pragma once
2
3   template <typename T>
4   class List {
5     public:
...       /* ... */
28    private:
29
30
31
32
33  };
```

Array Implementation

insertAtFront:

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

Resize Strategy: +2 elements every time

Resize Strategy: +2 elements every time

Resize Strategy: x2 elements every time

Resize Strategy: x2 elements every time

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		

Queue ADT

- [Order]:

- [Implementation]:

- [Runtime]:

Stack ADT

- [Order]:

- [Implementation]:

- [Runtime]:

Queue.h

```
 1  #pragma once
 2
 3  template <typename T>
 4  class Queue {
 5    public:
 6      void enqueue(T e);
 7      T dequeue();
 8      bool isEmpty();
 9
10    private:
11      T *items_;
12      unsigned capacity_;
13      unsigned size_;
14  };
15
16
17
18
19
20
21
22
```

What type of implementation is this Queue?

How is the data stored on this Queue?

Queue.h

```
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3   template <typename T>
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15
16
17
18
19
20
21
22
```

What type of implementation is this Queue?

How is the data stored on this Queue?

Queue<int> q;
q.enqueue(3);
q.enqueue(8);
q.enqueue(4);
q.dequeue();
q.enqueue(7);
q.dequeue();
q.dequeue();
q.enqueue(2);
q.enqueue(1);
q.enqueue(3);
q.enqueue(5);
q.dequeue();
q.enqueue(9);

Queue.h

```cpp
1   #pragma once
2
3   template <typename T>
4   class Queue {
5     public:
6       void enqueue(T e);
7       T dequeue();
8       bool isEmpty();
9
10    private:
11      T *items_;
12      unsigned capacity_;
13      unsigned size_;
14  };
15
16
17
18
19
20
21
22
```

				m	o	n	

Queue<char> q;

...

q.enqueue(m);
q.enqueue(o);
q.enqueue(n);

...

q.enqueue(d);
q.enqueue(a);
q.enqueue(y);
q.enqueue(i);
q.enqueue(s);
q.dequeue();
q.enqueue(h);
q.enqueue(a);