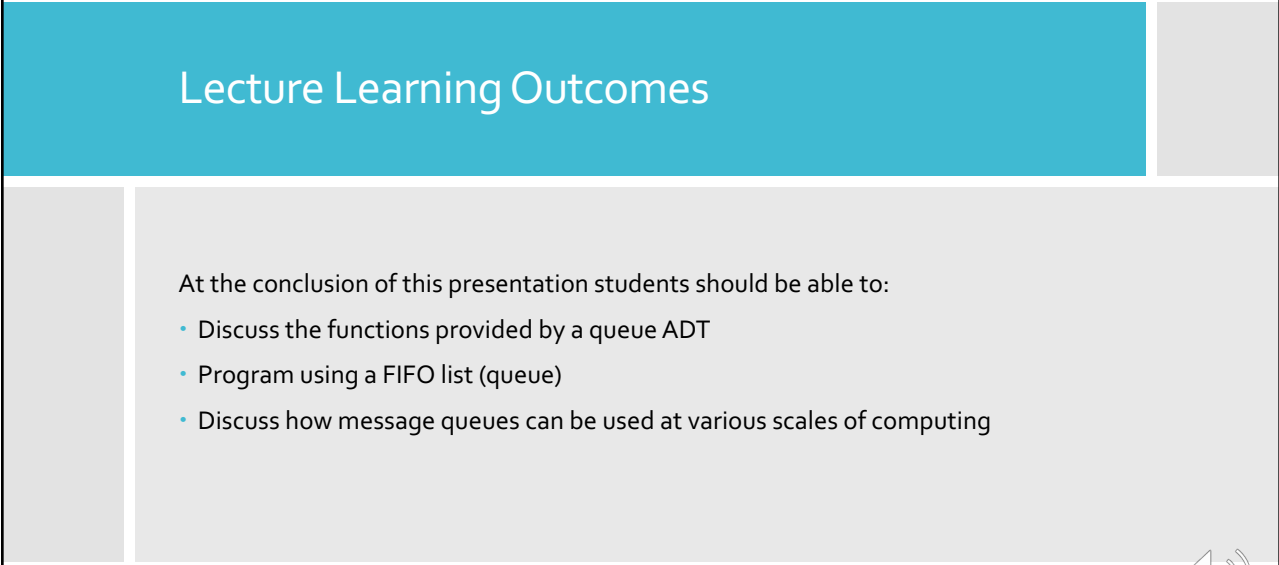



Queuing

CS2263 – Systems Software Development




1



Lecture Learning Outcomes

At the conclusion of this presentation students should be able to:

- Discuss the functions provided by a queue ADT
- Program using a FIFO list (queue)
- Discuss how message queues can be used at various scales of computing



2

FIFO List

- What is it?
 - First-In-First-Out
 - Can you picture it?
- Both a stack and a queue are **abstract data types**
 - The underlying data type does not have to be known.
 - Needs to support the operations
 - But you know this: CS1083



3

Queue Implementations

- What could the underlying implementations be?
 - In Java you used
 - In C you can do something similar using pointers
 - We will, but later in the course
 - Other data structure choices?
 - Arrays
 - Disk-based files?



4

Queues – Array Implementation

- Can think of it as a circular list
- Use an array and track the first and last element in the list

```
int queue[MAX];  
int front=0, size=0;
```



5

Queue – Functionality I

- Enqueue: Add an element to the end of the list

```
1  if(size < MAX){ // is there room?  
2      // pos: shadow variable, only needed inside the code block  
3      int pos = (front+size)%MAX;  
4      queue[pos] = val;  
5      size++;  
6  }
```



6

FIFO Queue – Functionality II

- Dequeue: Remove an element from the head of the list

```
1  if(size > 0){ // if queue isn't empty
2      val = queue[front];
3      front = (front+1)%MAX;
4      size--;
5  }
```



7

Queues – Thinking Bigger

- Limits of array-based queues
- DIY using heap/dynamic memory
- C libraries (packages with .c/.h)
- Between applications – same machine
 - IPC using shared memory, most likely implemented in C
- Separate process dedicated to queueing
 - Same machine
 - Between machines (cloud computing)
 - RabbitMQ is an example
- See L8Resources for examples/ideas



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Queues – Utility at Scale

- Queueing applications
 - Pathfinding in directed graphs
 - Interrupts within an operating system
 - Real-time environmental sensor data collected in a common area
 - Multiple tools requiring the same real-time data
 - Input from the Twitter firehose, stored in queues on a machine(s) according to theme with multiple, identical processes, running on separate virtual machines, instantiated automatically based on the queue size.

