



BITS F232: FOUNDATIONS OF DATA STRUCTURES & ALGORITHMS (1ST SEMESTER 2023-24) QUEUE ADT

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SOLVING A MAZE USING A STACK

```
1 1 1 1 1      1 1 1 1 1
1 1 0 0 1      1 1 0 0 1
1 0 0 0 1      1 0 1 0 1
m 0 1 e 0      m 0 1 e 0
```

Enter a rectangular maze using the following characters:

m - entry

e - exit

1 - wall

0 - passage

Enter one line at a time; end with Ctrl-z:

1111111

1111111

1110011

1100011

1m01e01

1111111

1111111

1111111

1110011

1100011

1m01e01

1111111

1111111

1111111

1110011

1100011

1m.1e01

1111111

Lab 6: Next week's Lab

1111111

1111111

1110011

11.0011

1m.1e01

1111111

1111111

1111111

1110011

11.011

1m.1e01

1111111

1111111

1111111

1110011

11...11

1m.1e01

1111111

1111111

1110011

1100011

1m.1e01

1111111

Success

1111111

1111111

1110011

1101011

1m.1e01

1111111

1111111

1111111

1110011

11.1011

1m.1e01

1111111

1111111

1110011

1101011

1m.1e01

1111111

Failure

QUEUES



Img. Source: <https://www.javascripttutorial.net/>

Some Applications of Queues:

1. Network routers
2. Scheduling a single shared resource (CPU)
3. Concurrent web servers

Is it NOT a linear data structure?

What operations would you like to see in a queue ADT?

EXAMPLE SERIES OF OPERATIONS ON A QUEUE

ARRAY-BASED IMPLEMENTATION OF A QUEUE

Approach 1: Similar to stack based implementation where $Q[0]$ be the front of the queue and have the queue grow from there.

How good is this approach?

Approach 2: Using an Array with three variables to avoid moving objects once they are placed in the queue.

Use three variables: f , r , and n . Let us see the dequeue and enqueue operations... (What is the complexity?)

If we repeatedly enqueue and dequeue a single element, what problem it might cause?

CONTINUED...

Approach 3: Use a circular array with 'f' and 'r' indices wrapping around the end of the queue.

Which operator in C++ can do this?

OPERATIONS USING CIRCULAR ARRAY & INTERFACE

```
Algorithm size()  
    return n
```

```
Algorithm empty()  
    return (n == 0)
```

```
Algorithm dequeue ()  
    if empty() then  
        throw QueueEmpty  
    else  
        ???  
        ???
```

```
Algorithm enqueue (P) {  
  
    if size() == N - 1 then  
        throw QueueFull  
  
    else {  
  
        ???  
        ???  
        ???  
    }  
}
```

```
template <typename E>  
  
class Queue {  
public:  
    int size() const;  
    bool empty() const;  
    const E& front() const  
        throw(QueueEmpty);  
    void enqueue (const E& e);  
    void dequeue()  
        throw(QueueEmpty);  
};
```