# Homework 1: Queues

1. A keyboard buffer on a computer’s operating system is implemented as a circular queue.

(a) Explain why a circular queue is an appropriate data structure choice. [2]

(b) A particular keyboard buffer consists of five cells in a circular queue. The queue **kBuffer** is initialised by setting a variable **size** (containing the number of items in the array) to 0, pointers **front** to 0 and **rear** to -1. A variable **maxSize** holds the maximum size of the queue.

(i) Complete the table to show the results after the following operations. [4]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **kBuffer** | | | | |  |  |  |  |
|  | **[0]** | **[1]** | **[2]** | **[3]** | **[4]** |  | **size** | **front** | **rear** |
| Initial state |  |  |  |  |  |  | 0 | 0 | -1 |
| Enqueue S |  |  |  |  |  |  |  |  |  |
| Enqueue W |  |  |  |  |  |  |  |  |  |
| Dequeue |  |  |  |  |  |  |  |  |  |
| Enqueue E |  |  |  |  |  |  |  |  |  |

(ii) Complete the table to show the results after the following operations. [3]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **kBuffer** | | | | |  |  |  |  |
|  | **[0]** | **[1]** | **[2]** | **[3]** | **[4]** |  | **size** | **front** | **rear** |
| Current state | J | U | X | L | M |  | 3 | 1 | 3 |
| Enqueue T |  |  |  |  |  |  |  |  |  |
| Enqueue R |  |  |  |  |  |  |  |  |  |
| Dequeue |  |  |  |  |  |  |  |  |  |

(c) Code for the keyboard buffer operations needs to be written.

Use the variables defined in part (b): kBuffer, maxSize, size, front, and rear.

1. Write the pseudocode for the isFull() operation, including function header. [2]

(ii) Write the pseudocode for the deQueue operation. [4]

(c) (i) Describe, with the aid of an example, the operation of a priority of a priority queue from the user’s point of view. [2]

(ii) Explain how the principles of data abstraction and encapsulation can be used to hide the details of implementation of a priority queue. [3]

Total 20 marks