Data Structures and Algorithms

Lab 8: Queue

I. Objective

After completing this tutorial, you can:

- Implement a queue with a linked list containing ADT.

II. Introduction

In previous tutorial, we have learned how to construct a linked list of general data type **<E>**. In this tutorial, we consider queue, which is one of the most popular ADT. The order in which elements come off a queue gives rise to its alternative name, **FIFO** (first in, first out). In queue, we have two important methods:

- *enQueue*, which adds new element to the queue;
- *deQueue*, which removes the first element of queue.

Fig. 1 illustrates the two methods, *enQueue* and *deQueue*. We must notice that queue maintains tracks two positions, *front* and *rear*.

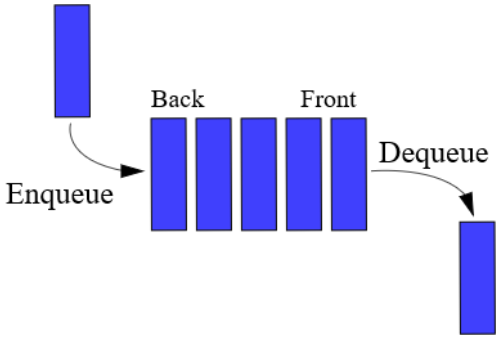
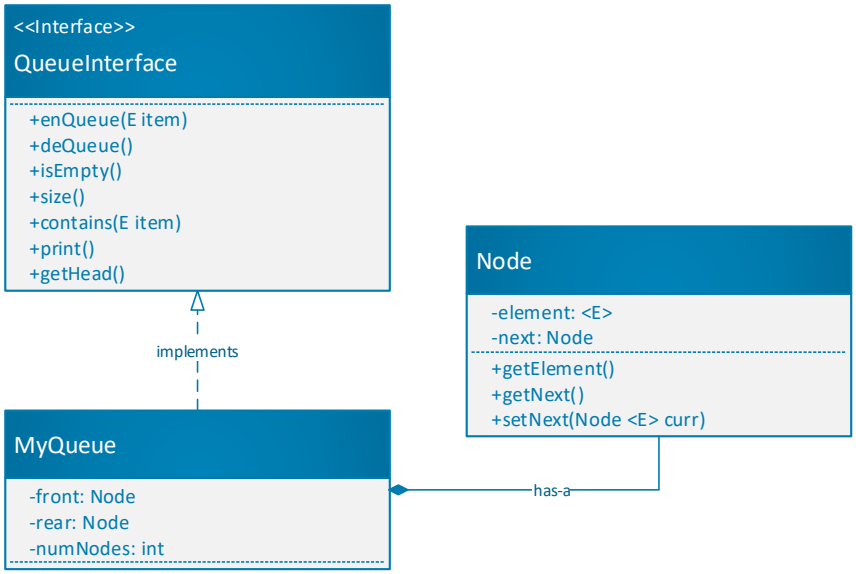


Figure 1 euQueue and deQueue methods in stack

III. UML model



The following figure presents an UML model of queue:

- *QueueInterface* represents public functions of queue, *e.g.*, push new item, pop an item.
- *Node* class represents an item (node) in stack.
- *MyQueue* class implements *QueueInterface* and includes items has *Node* types.

IV. Exercises

1. Based on the previous lab tutorial, you need to implement the queue ADT which contains general data type **`<E>`**. Then, implement **`Fraction`** class and test your program.

2. A palindrome is a word, phrase, or number that is spelled the same forward and backward. For example, *"dad"* is a palindrome; *"A man, a plan, a canal: Panama"* is a palindrome if you take out the spaces and ignore the punctuation; and *1001* is a numeric palindrome.

   We can use a stack to determine whether a given string is a palindrome. Implement a program to determine whether an input is palindrome.

3. (*) Show how to implement a queue using two stacks.

4. (*) **The Ophidian Bank** – At the Ophidian Bank, a single teller serves a long queue of people. New customers join the end of the queue, and the teller will serve a customer only if s/he has all the appropriate paperwork. Write a representation of this queue; 25% of the time (random), a customer's paperwork isn't quite right, and it's back to the end of the queue. Show what a few minutes of the bank's lobby would look like.