Southern Technical University
Technical Institute / Qurna
Dep. of Computer Systems Techniques

Second class
Subject : Data Structures
Lecturer : Israa Mahmood Hayder
Lecture no.15

الطابور الدائري (Queue)

الاسبوع - الخامس عشر -

B// Rationale (مبررات الوحدة) :-

Our next problem is to implement a circular array as an ordinary linear, This is like doing arithmetic on a circular clock face; the hours are numbered from 1 to 12, and if we add four hours to ten o'clock, we obtain two o'clock.

C// Central Ideas (الفكرة المركزية):-

- Circular Queue
- Circular Queue operations

D// Objectives (أهداف الوحدة):-

After studying this unit, the student will be able to understand how the Circular Queue operates.

1-Circular queue(Circular Arrays)

In concept, we can overcome the inefficient use of space simply by thinking of the array as a circle rather than a straight line. See Figure 6.1. In this way, as entries are added and removed from the queue, the head will continually chase the tail around the array, so that the snake can keep crawling indefinitely but stay in a confined circuit. At different times, the queue will occupy different parts of the array, but we never need worry about running out of space unless the array is fully occupied, in which case we truly have overflow.

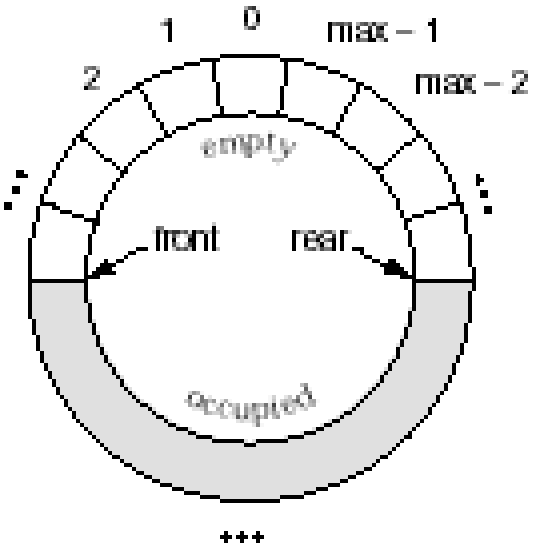

Figure 6.1-Circular queue

2- Implementation of Circular Arrays

Our next problem is to implement a circular array as an ordinary linear (that is, straight-line) array. To do so, we think of the positions around the circle as numbered from 0 to max - 1, where max is the total number of entries in the circular array, and to implement the circular array, we use the same-numbered entries of a linear array. Then moving the indices is just the same as doing modular arithmetic: When we increase an index past max - 1, we start over again at 0. This is like doing arithmetic on a circular clock face; the hours are numbered from 1 to 12, and if we add four hours to ten o'clock, we obtain two o'clock.
A very rough analogy of this linear representation is that of a priest serving communion to people kneeling at the front of a church. The communicants do not move until the priest comes by and serves them. When the priest reaches the end of the row, he returns to the beginning and starts again, since by this time a new row of people have come forward.

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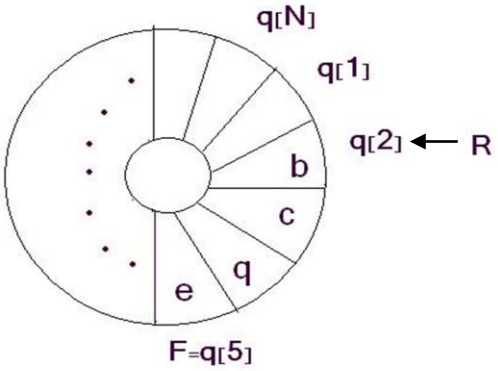
Circular Queue Is a queue that arrange the elements q[1],q[2],….q[n] in a circular fashion with q[1] following q[n] which prevent an excessive use of memory.



3-Operations On Circular Queues :-

1- Insertion

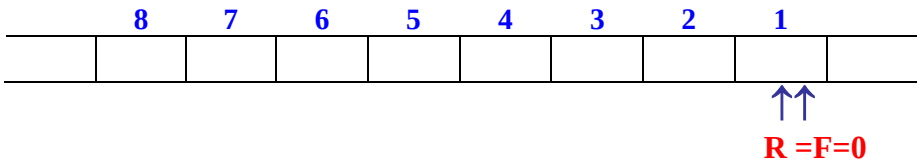
```
If  R = N  then     R ← 1
Else
    R ← R+1
End if
If  F=R  then write "Error Queue is Over Flow "
Else
   q( R ) ← item
end if
if  F=0  then  F ←1     ( F  إذا كان العنصر المضاف هو أول عنصر نحدث)
end if
```

2- Deletion :

```
If  F=0  then write "Error Queue is Under Flow "
Else
```

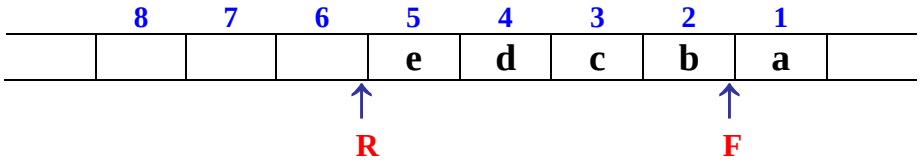
```
item ← q(F)
 if  F=R  then  R ←F←0          (إذا كان أخر عنصر في الطابور)
 else
    if  F=N  then  F←1          ( نحدث المؤشر بعد الحذف)
     else
        F ← F+1
     end if
  end if
end if
```

Example :- Consider the following Circular queue :-

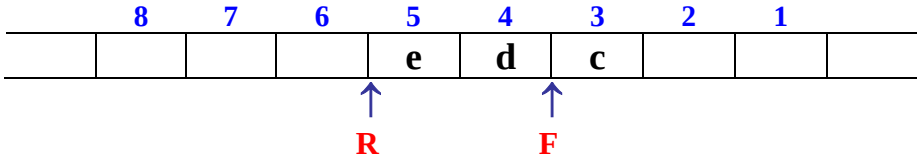


Execute the following operations graphically :-

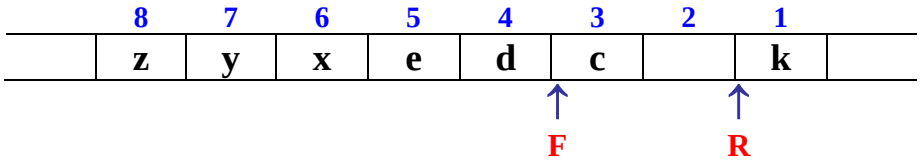
1- insert items (a,b,c,d,e)



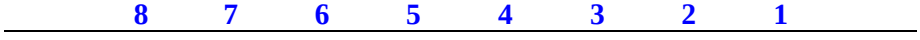
2- delete 2 items

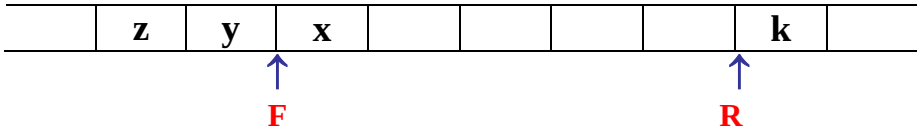


3- insert items (x,y,z,k)

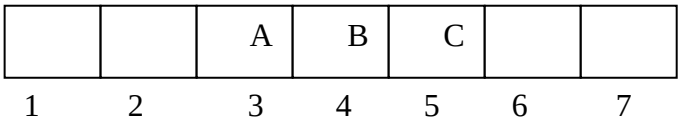


4- delete 3 items





Quiz1: Write the algorithm to insert an item to the Circular Queue
Quiz2: 1-Write the algorithm to Clear the Circular Queue.
Quiz3: IF you have the following Circular Queue :



Answer the following graphically:

1- Put the F and R pointers
2- Insert the element D,E and F
3- Delete 2 items

References:

1- Data Structures Demystified, by Jim Keogh and Ken Davidson, ISBN:0072253592, McGraw-Hill/Osborne © 2004.

3- هياكل البيانات / الطبعة الثانية، تاليف د.عصام الصفار،اصدارات السفير للنشر/ بغداد، ٢٠٠١

4- الحقيبة التعليمية لمادة الهياكل ، عداد نفارت يوسف ميناس