Sri SAI RAM ENGINEERING COLLEGE
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YEAR	SEM
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CS8391

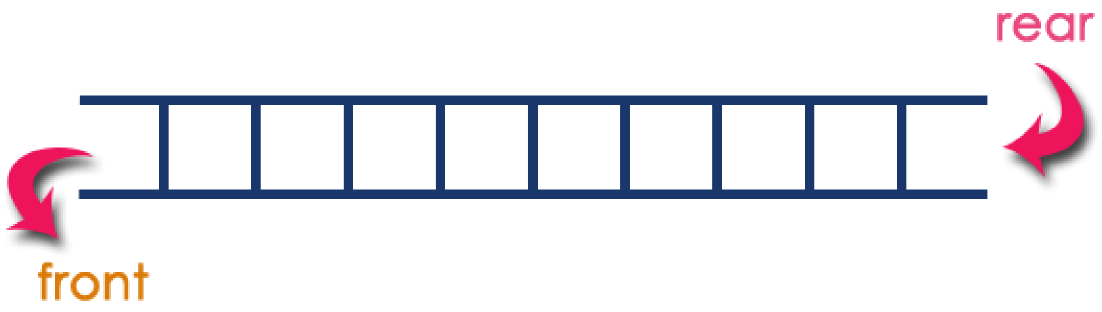
DATA STRUCTURES

UNIT No. 2

2.3.2 Queue ADT

Version: 1.XX

Queue is a linear data structure in which the insertion and deletion operations are performed at two different ends. In a queue data structure, adding and removing elements are performed at two different positions. The insertion is performed at one end and deletion is performed at another end. In a queue data structure, the insertion operation is performed at a position which is known as 'rear' and the deletion operation is performed at a position which is known as 'front'. In queue data structure, the insertion and deletion operations are performed based on FIFO (First In First Out).



The following operations are performed on a queue data structure:

1. **enQueue(value) - (To insert an element into the queue)**
2. **deQueue() - (To delete an element from the queue)**
3. **display() - (To display the elements of the queue)**

Queue data structure can be implemented in two ways. They are as follows...

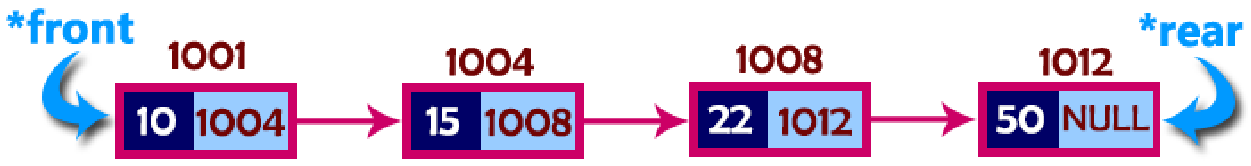
1. **Using Array**
2. **Using Linked List**

Queue Using Linked List:

The major problem with the queue implemented using an array is, It will work for an only fixed number of data values. That means, the amount of data must be specified at the beginning itself. Queue using an array is not suitable when we don't know the size of data which we are going to use. A queue data structure can be implemented using a linked list data structure. The queue which is implemented using a linked list can work for an unlimited number of values. That means, queue using linked list can work for the variable size of data (No need to fix the size at the beginning of the implementation). The Queue implemented using linked list can organize as many data values as we want.

Example

In linked list implementation of a queue, the last inserted node is always pointed by '**rear**' and the first node is always pointed by '**front**'.



Operations

To implement queue using linked list, we need to set the following things before implementing actual operations.

- Step 1 - Include all the **header files** which are used in the program. And declare all the **user defined functions**.
- Step 2 - Define a '**Node**' structure with two members **data** and **next**.
- Step 3 - Define two **Node** pointers '**front**' and '**rear**' and set both to **NULL**.
- Step 4 - Implement the **main** method by displaying Menu of list of operations and make suitable function calls in the **main** method to perform user selected operation.

enQueue(value) - Inserting an element into the Queue

- Step 1 - Create a **newNode** with given value and set '**newNode → next**' to **NULL**.
- Step 2 - Check whether queue is **Empty** (**rear** == **NULL**)
- Step 3 - If it is **Empty** then, set **front** = **newNode** and **rear** = **newNode**.
- Step 4 - If it is **Not Empty** then, set **rear → next** = **newNode** and **rear** = **newNode**.

deQueue() - Deleting an Element from Queue

- Step 1 - Check whether **queue** is **Empty** (**front == NULL**).
- Step 2 - If it is **Empty**, then display **"Queue is Empty!!! Deletion is not possible!!!"** and terminate from the function
- Step 3 - If it is **Not Empty** then, define a Node pointer '**temp**' and set it to '**front**'.
- Step 4 - Then set '**front** = **front → next**' and delete '**temp**' (**free(temp)**).

display() - Displaying the elements of Queue

- Step 1 - Check whether queue is **Empty** (**front** == **NULL**).
- Step 2 - If it is **Empty** then, display **'Queue is Empty!!!'** and terminate the function.
- Step 3 - If it is **Not Empty** then, define a Node pointer **'temp'** and initialize with **front**.
- Step 4 - Display '**temp → data** --->' and move it to the next node. Repeat the same until '**temp**' reaches to '**rear**' (**temp → next** != **NULL**).
- Step 5 - Finally! Display '**temp → data** ---> **NULL**'.

Implementation of Queue Data structure using Linked List - C Programming

```
#include<stdio.h>
#include<conio.h>

struct Node
{
  int data;
  struct Node *next;
}*front = NULL,*rear = NULL;

void insert(int);
void delete();
void display();

void main()
{
  int choice, value;
  clrscr();
  printf("\n:: Queue Implementation using Linked List ::\n");
  while(1){
    printf("\n****** MENU ******\n");
```

```
        printf("1. Insert\n2. Delete\n3. Display\n4. Exit\n");
        printf("Enter your choice: ");
        scanf("%d",&choice);
        switch(choice){
            case 1: printf("Enter the value to be insert: ");
                    scanf("%d", &value);
                    insert(value);
                    break;
            case 2: delete(); break;
            case 3: display(); break;
            case 4: exit(0);
            default: printf("\nWrong selection!!! Please try again!!!\n");
        }
    }
}
void insert(int value)
{
    struct Node *newNode;
    newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = value;
    newNode -> next = NULL;
    if(front == NULL)
        front = rear = newNode;
    else{
        rear -> next = newNode;
        rear = newNode;
    }
    printf("\nInsertion is Success!!!\n");
}
void delete()
{
    if(front == NULL)
```

```
      printf("\nQueue is Empty!!!\n");
   else{
      struct Node *temp = front;
      front = front -> next;
      printf("\nDeleted element: %d\n", temp->data);
      free(temp);
   }
}
void display()
{
   if(front == NULL)
      printf("\nQueue is Empty!!!\n");
   else{
      struct Node *temp = front;
      while(temp->next != NULL){
             printf("%d--->",temp->data);
             temp = temp -> next;
      }
      printf("%d--->NULL\n",temp->data);
   }
}
```