***Introduction:***

**Queue** is also an abstract data type or a linear data structure, just like [stack data structure](https://www.studytonight.com/data-structures/stack-data-structure), in which the first element is inserted from one end called the **REAR**(also called **tail**), and the removal of existing element takes place from the other end called as **FRONT**(also called **head**).

This makes queue as **FIFO**(First in First Out) data structure, which means that element inserted first will be removed first.

Which is exactly how queue system works in real world. If you go to a ticket counter to buy movie tickets, and are first in the queue, then you will be the first one to get the tickets. Right? Same is the case with Queue data structure. Data inserted first, will leave the queue first.

The process to add an element into queue is called **Enqueue** and the process of removal of an element from queue is called **Dequeue**.

***Theory:***

A queue is a useful data structure in programming. It is similar to the ticket queue outside a cinema hall, where the first person entering the queue is the first person who gets the ticket.

Queue follows the **First In First Out(FIFO)** rule - the item that goes in first is the item that comes out first too.

A queue is an object or more specifically an abstract data structure(ADT) that allows the following operations:

* **Enqueue**: Add an element to the end of the queue
* **Dequeue**: Remove an element from the front of the queue
* **IsEmpty**: Check if the queue is empty
* **IsFull**: Check if the queue is full
* **Peek**: Get the value of the front of the queue without removing it

***Objective:***

At the end of this experiment you will be able to perform :

* Queue using array in C.
* Queue using Linked List in C.

***Experiment:***

Queue Using Arrays in C:

#include <limits.h>

#include <stdio.h>

#include <stdlib.h>

struct StackNode {

int data;

struct StackNode\* next;

};

struct StackNode\* newNode(int data)

{

struct StackNode\* stackNode = (struct StackNode\*)malloc(sizeof(struct StackNode));

stackNode->data = data;

stackNode->next = NULL;

return stackNode;

}

int isEmpty(struct StackNode\* root)

{

return !root;

}

void push(struct StackNode\*\* root, int data)

{

struct StackNode\* stackNode = newNode(data);

stackNode->next = \*root;

\*root = stackNode;

printf("%d pushed to stack\n", data);

}

int pop(struct StackNode\*\* root)

{

if (isEmpty(\*root))

return INT\_MIN;

struct StackNode\* temp = \*root;

\*root = (\*root)->next;

int popped = temp->data;

free(temp);

return popped;

}

int peek(struct StackNode\* root)

{

if (isEmpty(root))

return INT\_MIN;

return root->data;

}

int main()

{

struct StackNode\* root = NULL;

push(&root, 10);

push(&root, 20);

push(&root, 30);

printf("%d popped from stack\n", pop(&root));

printf("Top element is %d\n", peek(root));

return 0;

}

Queue Using Linked List in C:

#include <stdio.h>

#include <stdlib.h>

struct node

{

int info;

struct node \*ptr;

}\*front,\*rear,\*temp,\*front1;

int frontelement();

void enq(int data);

void deq();

void empty();

void display();

void create();

void queuesize();

int count = 0;

void main()

{

int no, ch, e;

printf("\n 1 - Enque");

printf("\n 2 - Deque");

printf("\n 3 - Front element");

printf("\n 4 - Empty");

printf("\n 5 - Exit");

printf("\n 6 - Display");

printf("\n 7 - Queue size");

create();

while (1)

{

printf("\n Enter choice : ");

scanf("%d", &ch);

switch (ch)

{

case 1:

printf("Enter data : ");

scanf("%d", &no);

enq(no);

break;

case 2:

deq();

break;

case 3:

e = frontelement();

if (e != 0)

printf("Front element : %d", e);

else

printf("\n No front element in Queue as queue is empty");

break;

case 4:

empty();

break;

case 5:

exit(0);

case 6:

display();

break;

case 7:

queuesize();

break;

default:

printf("Wrong choice, Please enter correct choice ");

break;

}

}

}

void create()

{

front = rear = NULL;

}

void queuesize()

{

printf("\n Queue size : %d", count);

}

void enq(int data)

{

if (rear == NULL)

{

rear = (struct node \*)malloc(1\*sizeof(struct node));

rear->ptr = NULL;

rear->info = data;

front = rear;

}

else

{

temp=(struct node \*)malloc(1\*sizeof(struct node));

rear->ptr = temp;

temp->info = data;

temp->ptr = NULL;

rear = temp;

}

count++;

}

void display()

{

front1 = front;

if ((front1 == NULL) && (rear == NULL))

{

printf("Queue is empty");

return;

}

while (front1 != rear)

{

printf("%d ", front1->info);

front1 = front1->ptr;

}

if (front1 == rear)

printf("%d", front1->info);

}

void deq()

{

front1 = front;

if (front1 == NULL)

{

printf("\n Error: Trying to display elements from empty queue");

return;

}

else

if (front1->ptr != NULL)

{

front1 = front1->ptr;

printf("\n Dequed value : %d", front->info);

free(front);

front = front1;

}

else

{

printf("\n Dequed value : %d", front->info);

free(front);

front = NULL;

rear = NULL;

}

count--;

}

int frontelement()

{

if ((front != NULL) && (rear != NULL))

return(front->info);

else

return 0;

}

void empty()

{

if ((front == NULL) && (rear == NULL))

printf("\n Queue empty");

else

printf("Queue not empty");

}

}

***Algorithm:***

### Algorithm for ENQUEUE operation:

1. Check if the queue is full or not.
2. If the queue is full, then print overflow error and exit the program.
3. If the queue is not full, then increment the tail and add the element.

### Algorithm for DEQUEUE operation:

1. Check if the queue is empty or not.
2. If the queue is empty, then print underflow error and exit the program.
3. If the queue is not empty, then print the element at the head and increment the head.