Day: M T W T F S Date: __/__/__

Q.1 Write the definition of the following functions for stack, while re-utilizing the implemented functions of linked list.

⇒ Using functions of linked list.

- DECLARE (S)

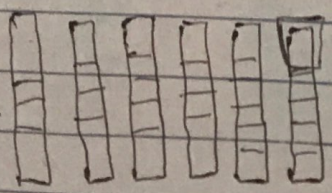
- Empty (S)

- Top (S)
  ⇒ Retrieve (First (S), S)
- Push (e, S)
  ⇒ insert (e, First (S), S)
- Pop (S)
  Retrieve (First (S), S), Delete (First (S), S

STACK:

(special type of list)

stack is a linear data structure which follows a particular order in which the operations are perform The order may be LIFO (Last come first out) or Fito (First come Last out)



Declare (S):

Declare : → S:

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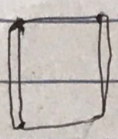
The function value of Declare(S) is an empty stack.

Empty : → S:

The function Empty(S) causes the stack to be emptied and returns the position which is End(S)



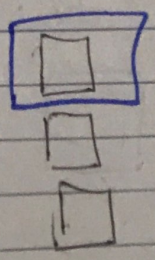
Along with Empty then is another function is Emply(S) which is a boolean function which returns true is the stack is emply, else returns false.

Top (s):

Top : S → E:

This function is defined to return the first element in the list but if the list is empty, then its value is undefined.

Top (S)



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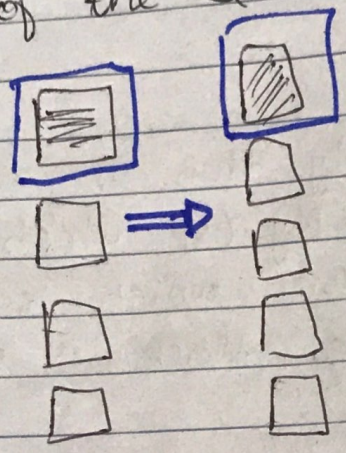
Push (e, s):

Push : E X S → L :
Push (e, s)

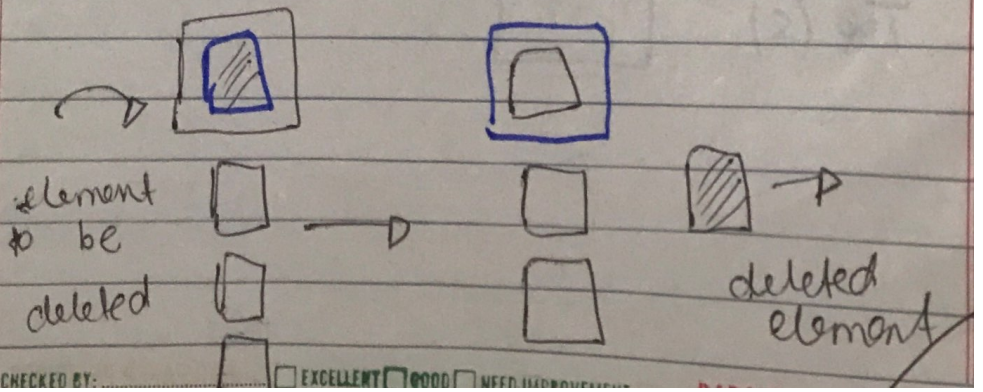
This function takes two arguments e and s element and stack which insert element (e) at the top of the stack.



Pop (s):

Pop : S → E
Pop (s) :

This function removes the top element from the stack i.e return the top element and delete it from the stack.



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Implementation of stack in cpp using linked lists:

```
#include <iostream>
using namespace std;
type of struct Node
{   int data;
    Node * next;
} Node;
class stack
{
  Private:
   Node * top;
   int max-size;
   int size = 0;
Public:
   voide Delare (int size)
{     Max-size = size;
      top = Null;
    cout << " stack created .\n ";
}
  if (size >= Max-size)
  { cout << " Stack is full " << endl; }
else
    Node * temp;
   temp = New Node();
   temp-> data = data;
   temp -> next = top;
    top = temp;
    Size ++;
 cout << " Element pushed into the stack.\n ";
  }}
```

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```
void pop()
{
  if (size == 0)
  { cout << "stack is empty" << endl; }
else
{  Node * temp;
   temp = top;
   top = temp -> next;
   temp -> next = NULL;
   delete temp;
   size--;
cout << "Element removed from stack \n";
}
}
void Top()
{
  if (size == 0)
{ cout << "stack is empty \n"; }
else
{
 cout << Top element is = " top -> data << end
}
void size()
{
cout << "The size of the stack is " << size << endl
}
void Empty()
{   Node *temp;
  temp = top;
  top = NULL;
  size = 0
  cout << "stack emplied \n"; }
```

```
oid display()
{
  if (size == 0)
{
  cout << " Stack i
}
else
{
  Node * temp;
  temp = top;
  while (temp !
{
   cout << tem
   temp = te
}
}
};
   int
{
  int
  stac
  while
{
  cout
  cout
  co
  do
  e
```

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```
void display ()
{
   if (size == 0)
{
   cout << " Stack is empty \n";
}
else
{
   Node * temp;
   temp = top;
   while (temp != Null)
{
   cout << temp -> data << " , ";
    temp = temp -> Next;
}
}
};
    int main ()
{
  int choice item , s;
    Stack S;
  while (1)
{
  cout << " Stack operations " << endl;
  cout << " 1. Declare Stack " << endl;
  cout << " 2. push element " << endl;
  cout << " 3. Pop element " << endl;
  cout << " 4. Display Stack " << endl;
  cout << " 5. Empty the stack " << endl;
  cout << " 6. Size of stack " << endl;
  cout << " 7. Top item " << endl;
```

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```
cout << " 8. Quit \n 9. Enter your ch
cin >> choice;
switch (choice)
{  case 1;
   cout << "Enter size of stack";
    cin >> s;
    s. Declare (s);
    break;
 Case 2;
cout << " Enter value to be pushed ";
cin >> item;
 s. push (item);
  break;
 Case 3:
   s. pop ();
   break;
 Case 4:
  s. Display ();
   break;
 case 5:
   s. Empty ();
   break;
 Case 6:
  s. Size ();
  break;
Case 7 : s. top (); break;
Case 8: return 0; break;
default;
 cout << " Wrong Choice " << endl;
}}
   return 0;
}
```

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UNIVERSITY OF ENGINEERING & TECHNOLOGY PESHAWAR

DEPARTMENT OF COMPUTER SYSTEM ENGINEERING.

NAme: Salman Shakeel

Section: B

Reg no: 20PwCse1925

Assignment : 02

INSTRUCTOR

SIR NASRU

DATA STRUCTURE & ALGORITHM:

Day: M T W T F S

Date: __/__

Q Write the difinition of the follo
functions for Queue while re-utili
the implemented functions of linked

Solution:-

Re-utilizing the fundions of linked lis

- Declare (Q)
- Empty (Q)
- Head (Q)
  - Retreive (First (Q), Q)
- Enqueue (e, Q)
  - Insert (e, End (Q, Q)
- Dequeue (Q)
  - Retreive (First (Q), Q)
  - Delete (First (Q), Q)

Queue:

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 (FIFO) 'First in First out rule, the

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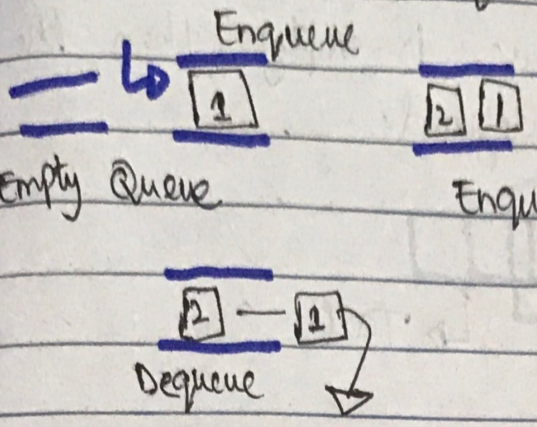
item that goes in first is the item that comes out first too.



In the above example since 1 was kept in the queue before 2, it was the first to be removed from the queue as well. As it follows the fifo rule.

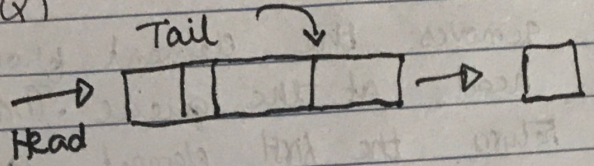
- **Declare (Q):**

  Declare: → Q:

  This function declares a new empty queue.

- **Empty (Q):**

  This function causes the queue to be emptied and it returns position End (Q).



- **Head (Q):**

  Head : Q → E:

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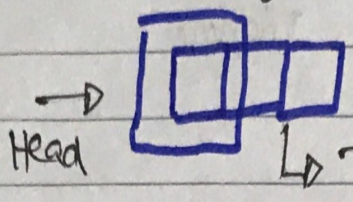
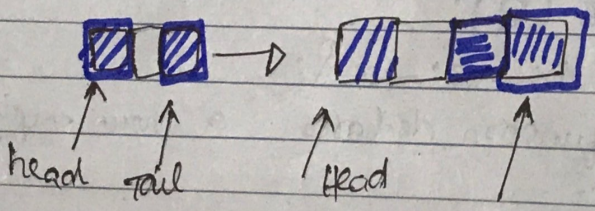
The function value Head(Q) is th function first element in the list. If the Queue is empty, then the value is undefined.



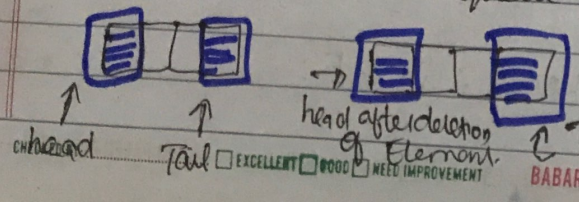
- **Enqueue (e, Q):**

Enqueue : E x Q → Q :
Enqueue (e, Q)
Add an element e in the tail of the queue.



- **Dequeue (Q):**

Dequeue : Q → E :
Dequeue (Q)
It removes the element from the head at the queue. That is it return the first element and delete it from the queue.



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Queue implementation in C++ code. Using linked list operations:

```
#include<iostream>
using namespace std;
typedef Node.
{
    int data;
    Node *next = Null;
} Node;
class Queue
{
  Private :
    Node * Head;
    Node* Tail;
 int Capacity, Size = 0;
Public :
    void Declare (int c)
{
   Head = tail = Null;
    Capacity = c;
    Cout << "Queue created" << endl;
}
void Enqueue (int n)
{
   if (size >= capacity)
   Cout << "Queue is full" << endl;
 else
{
    Node *temp;
   temp = new Node;
   temp => data = n;
```

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```
    if (Head == Null)
    { Head -> next = temp;  Tail = temp; }
    cout << "Element Enqueued \n";
      size++;
  }
}

Void Dequeue ()
{
  if (Front = Null)
  cout << " Queue is Empty .\n";
else
{
  Node * temp = Head;
    Head = Head -> Next;
  if (Head == Null)
  {
    Tail = Null; }
  delete temp;
  size--;
Cout << " Element Dequed \n";
}
}

void Head ()
  {
    if (Head == Null)
  cout << " Queue is empty .\n";
else
  cout << " Head " << Head -> data << endl;
}
    void size ()
    if (Head == Null)
```

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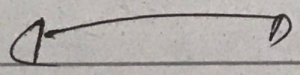
```
    cout << " Queue is Empty .\n";
else
{ Node * temp = Head;
   Node * N;
  while (temp != Null)
  {
     N = temp;
     temp = temp -> Next;
       delete N;
}
  Head = tail = Null;
  cout << " Queue Emptied .\n";
    size = 0;
}
}

   void   Display ()
  {
     if (Head == Null)
  { cout << " Queue is empty \n "; }
else
{ Node * temp = Head;
   int Array [size];
     int i = 0;
   while (temp != Null)
{
```

```
        Array [i] = temp -> data;
        i++;
        temp = temp -> Next;
    }
    for (int j = size-1 ; j > 0; j--)
    {
      cout << Array [j] << "->";
    }
      cout << Array [0] << endl;
    }
  };
    int main()
{
    int choice, item ,s;
    Queue q;
   while (1)
{
cout << "1. Create Queue" << endl;
cout << "2. Enqueue" << endl;
cout << "3. Dequeue" << endl;
cout << "4. Empty the Queue" << endl;
cout << "5. Size of Queue" << endl;
cout << "6. Head" << endl;
cout << "7. Tail": << endl;
```

```
cout << "8. Display Queue" << endl;
cout << "9. Quit" << endl;
cout << "Enter choice" << endl;
cin >> choice;
switch (choice)
{
 case 1;
cout << "Enter Size of Queue" << endl;
cin >> s;
 q. Declare (s);
 break;
case 2;
cout << "Enter the value of Enqueued.\n";
cin >> item;
q. Enqueue (item);
   break;
 case 3:
 q. dequeue ();
  break;
case 4:
 q. Empty ();
  break;
case 5;
  q. size ();
 break;
```

```
case 7:
  q.tail();
    break;
case 8:
  q.display();
    break;
case 9:
    return 0;
    break;
default:
    cout<<"wrong choice.?\n";
}
}
return 0;
}
```



End.