Department of Computer Science
Forman Christian College University

COMP360: Introduction to AI
Fall 2021

FORMAN CHRISTIAN COLLEGE
(A CHARTERED UNIVERSITY)

Task 1 (5)	Task 2 (5)	Task 3 (5)	Task 4 (5)	Total (20)

Lab 1: FIFO and LIFO Implementation

Lab Instruction:

- Get your attendance marked before leaving the classroom.
- This is an individual Lab assignment. Each student must submit their own work.
- Plagiarism will not be tolerated in any case.

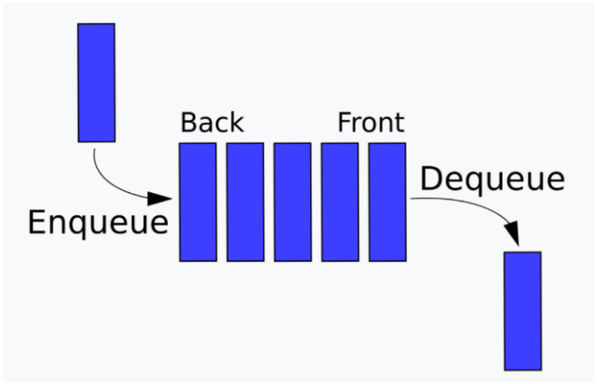
FIFO Queue:

Introduction:

A FIFO Queue is a linear First-In-First-Out data structure. In this data structure, first element is added to the queue and the same is the first to be removed.

A queue supports the following standard operations:

1. enqueue: Inserts an element at the rear (right side) of the queue.
2. dequeue: Removes the element from the front (left side) of the queue and returns it.
3. peek: Returns the element at the front of the queue without removing it.
4. isEmpty: Checks whether the queue is empty.
5. size: Returns the total number of elements present in the queue.



Task 1: Implementation of the FIFO Queue:

Observe the following ***FIFO_Queue*** Class it contains the variables necessary for the implementation of the FIFO Queue. You need to complete the empty functions in a way that when you run those functions they should give the correct output.

```
# Custom queue implementation in Python
class FIFO_Queue:
    # Initialize queue
    def __init__(self, size=1000):
        # list to store queue elements
        self.q = [None] * size
        # maximum capacity of the queue
        self.capacity = size
        # front points to the front element in the queue
        self.front = 0
        # rear points to the last element in the queue
        self.rear = -1
        # current size of the queue
        self.count = 0

# Function to dequeue the front element
    def dequeue(self):
        # check for queue underflow
        if self.isEmpty():
            print('Queue Underflow!! Terminating process.')
            exit(-1)
        x = self.q[self.front]
        print('Removing element…', x)
        self.front = (self.front + 1) % self.capacity
        self.count = self.count - 1
        return x
```

```
# Function to add an element to the queue
    def enqueue(self, value):
        # check for queue overflow
        if self.isFull():
            print('Overflow!! Terminating process.')
            exit(-1)
        print('Inserting element…', value)
        self.rear = (self.rear + 1) % self.capacity
        self.q[self.rear] = value
        self.count = self.count + 1


# Function to return the front element of the
queue
    def peek(self):




    # Function to return the size of the queue
    def size(self):
```

# Function to check if the queue is empty or not def isEmpty(self):	# Function to check if the queue is full or not def isFull(self):

Task 2: Run the following function main() and record the observations and note down the exact results under the output.

if __name__ == '__main__':
 	
# create a queue of capacity 5 	
q = Queue(5)
 	
q.enqueue(1)
q.enqueue(2)
q.enqueue(3)
 	
print('The queue size is', q.size())
print('The front element is', q.peek())
q.dequeue()
print('The front element is', q.peek())
 	
q.dequeue()
q.dequeue()
 	
if q.isEmpty():
print('The queue is empty')
else:
print('The queue is not empty')
	OUTPUT:

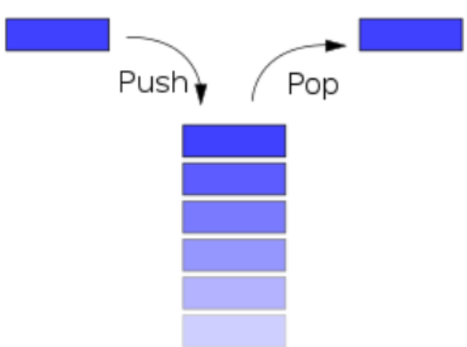
LIFO Stack:

Introduction:

A stack is a linear data structure that follows the LIFO (Last–In, First–Out) order, i.e., items can be inserted or removed only at one end of it.

The stack supports the following standard operations:

- push: Pushes an item at the top of the stack.
- pop: Remove and return the item from the top of the stack.
- peek: Returns the item at the top of the stack without removing it.
- size: Returns the total number of items in the stack.
- isEmpty: Checks whether the stack is empty.
- isFull: Checks whether the stack is full.



Task 3: Implementation of the LIFO Stack

Observe the following ***LIFO_Stack*** class. You need to complete the empty functions in a way that when you run those functions they should give the correct output.

```
# Custom stack implementation in Python
class LIFO_Stack:
    # Constructor to initialize the stack
    def __init__(self, size):
        self.arr = [None] * size
        self.capacity = size
        self.top = -1

    # Function to add an element `val` to the stack
    def push(self, val):
        if self.isFull():
            print('Stack Overflow!! Calling exit()…')
            exit(-1)

        print(f'Inserting {val} into the stack…')
        self.top = self.top + 1
        self.arr[self.top] = val

    # Function to pop a top element from the stack
    def pop(self):
        # check for stack underflow
        if self.isEmpty():
            print('Stack Underflow!! Calling exit()…')
            exit(-1)

        print(f'Removing {self.peek()} from the stack')

        # decrease stack size by 1 and (optionally)
return the popped element
        top = self.arr[self.top]
        self.top = self.top - 1
```

```
    # Function to return the top element of the stack
    def peek(self):




    # Function to return the size of the stack
    def size(self):




    # Function to check if the stack is empty or not
    def isEmpty(self):




    # Function to check if the stack is full or not
    def isFull(self):
```

Task 4: Run the following function main(), observe the output, and note it down under the output.

```
if __name__ == '__main__':

    stack = Stack(3)

    stack.push(1)       # Inserting 1 in the stack
    stack.push(2)       # Inserting 2 in the stack

    stack.pop()         # removing the top element (2)
    stack.pop()         # removing the top element (1)

    stack.push(3)       # Inserting 3 in the stack

    print('Top element is', stack.peek())
    print('The stack size is', stack.size())

    stack.pop()         # removing the top element (3)

    # check if the stack is empty
    if stack.isEmpty():
        print('The stack is empty')
    else:
        print('The stack is not empty')
```

Output:

Note: This is an individual Lab and Groups are not allowed. No need to search on internet treat it like a lab exam. There could be errors in the above code you need to fix them in order to perform successful execution.