**CPP104: Sorting Arrays Activity Documentation**

### Discussion on Queues

#### Definition

A queue is a fundamental data structure in computer science that follows the First In, First Out (FIFO) principle. This means that the first element added to the queue will be the first one to be removed. Queues are analogous to lines at a service point, where the first person in line is the first to be served.

class Queue:

def \_\_init\_\_(self):

self.queue = []

def is\_empty(self):

# Check if the queue is empty

return len(self.queue) == 0

def enqueue(self, item):

# Add an item to the end of the queue

self.queue.append(item)

def dequeue(self):

# Remove and return the item from the front of the queue

if self.is\_empty():

raise IndexError("Dequeue from an empty queue")

return self.queue.pop(0)

def front(self):

# Return the item at the front of the queue without removing it

if self.is\_empty():

raise IndexError("Front from an empty queue")

return self.queue[0]

def size(self):

# Return the number of items in the queue

return len(self.queue)

def \_\_str\_\_(self):

# Return a string representation of the queue

return str(self.queue)

# Example usage of the Queue class

queue = Queue()

queue.enqueue(1)

queue.enqueue(2)

queue.enqueue(3)

print(queue) # Output: [1, 2, 3]

print(queue.dequeue()) # Output: 1

print(queue.front()) # Output: 2

print(queue.size()) # Output: 2

Queues are used in various scenarios where order needs to be preserved, such as:

1. **Print Spooling**: Printers use queues to manage print jobs. The first job sent to the printer is the first one printed.
2. **Task Scheduling**: Operating systems use queues to manage processes that are ready to execute.
3. **Breadth-First Search (BFS)**: Graph traversal algorithms use queues to explore nodes layer by layer.
4. **Customer Service**: Managing customers in a call center where the first caller is the first to be attended to.

**Question 1: Queue Operations**

Which of the following operations adds an item to the end of a queue?

a) push b) pop c) enqueue d) dequeue

**Question 2: Queue Characteristics**

A queue operates on which principle?

a) Last In, First Out (LIFO) b) First In, First Out (FIFO) c) Random Access d) Last In, Last Out (LILO)

**Question 3: Removing Items from a Queue**

Which of the following operations removes an item from the front of a queue?

a) push b) pop c) enqueue d) dequeue

**Question 4: Queue Methods**

If a queue is initialized with the elements [5, 10, 15], what will be the result of calling dequeue once?

a) [5, 10, 15] b) [5, 10] c) [10, 15] d) [15]

**Question 5: Queue Front Operation**

In a queue with the elements [7, 14, 21], what does the front method return?

a) 7 b) 14 c) 21 d) None