Department of Computer Science and Engineering,
Anna University, Chennai- 600025
CS23302 – Data Structures and Algorithms
Practical
July – November 2026
Year/Sem/Batch : II/III/ N

Exercise: 10	Priority Queue & Heap	18 – Sep - 2026

Observation (5 Marks)

1. What is the time complexity of the insert() function? Explain why heapifyUp is called after adding a new element to the heap.
2. What is the main difference between heapifyUp and heapifyDown? When is each operation used?
3. If you insert the following elements in order into the min heap: 5, 3, 8, 1, 9, 2, 7. Draw the final heap structure as a tree. Also write the array representation of this heap.
4. For a node at index i in the heap array, what are the formulas for: (a) parent index, (b) left child index, (c) right child index?
5. What is the time complexity of the extractMin() function? Justify your answer.
6. Consider the following elements: 40, 20, 30, 10, 50. Construct a min-heap by inserting the elements one by one. Show the heap after each insertion.

Execution (15 Marks)

1. Implement a Priority Queue using Min Heap for Hospital Patient Management System.

Define a Patient structure that contains:

- PatientID (unique identifier)
- Name (patient name)
- Priority (1 to 5, where 1 is highest priority)
- ArrivalTime (time when patient arrived)

a. Create a MinHeap class that can store Patient objects and compare them based on priority.

b. Implement the following operations:

- Enqueue(Patient p) – Add a patient to the priority queue
- Dequeue() – Extract and return the patient with highest priority
- Display() – Display all patients currently in the queue in priority order

c. Ensure all operations maintain the min heap property.

d. Write a main() function that demonstrates the priority queue with the following operations:

(i) Add 8 patients with different priorities:

- Patient 101: Ram, Priority 3
- Patient 102: Priya, Priority 1
- Patient 103: Raj, Priority 4
- Patient 104: Sita, Priority 1
- Patient 105: Aman, Priority 5
- Patient 106: Neha, Priority 2
- Patient 107: Arjun, Priority 2
- Patient 108: Zara, Priority 3

(ii) Display the heap structure and verify heap property

(iii) Process (dequeue) the 3 patients with highest priority and display their details

(iv) Add 2 emergency patients (Priority 1): Patient 109 (Akshay) and Patient 110 (Bhumi)

(v) Display the updated priority queue

(vi) Verify that the heap property is maintained after each operation

2. Write a C program to implement a min-priority queue using a min-heap. The program should support the following operations:

Insert an element with a priority.

Delete the element with the highest priority.

Display the priority queue.

Demonstrate the operations using at least five elements and explain how the heap property is maintained after insertion and deletion.

3. Write a C program to implement a heap sort using a max-heap. Sort the following elements in ascending order:

45, 20, 35, 10, 50, 25

Display the array after heap construction and after each deletion of the maximum element.