

Laboratory 11: Cover Sheet

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Place a check mark in the *Assigned* column next to the exercises your instructor has assigned to you. Attach this cover sheet to the front of the packet of materials you submit following the laboratory.

Activities	Assigned: Check or list exercise numbers	Completed
Implementation Testing	✓	✓
Programming Exercise 1	✓	
Programming Exercise 2		
Programming Exercise 3	✓	✓
Analysis Exercise 1	✓	✓
Analysis Exercise 2	✓	✓
	Total	

Laboratory 11: Implementation Testing

Check with your instructor whether you are to complete this exercise prior to your lab period or during lab.

Test Plan 11-1 (Heap ADT operations)			
Test case	Commands	Expected result	Checked
Insert	+3 +7 +10 +13 +11 +9 +6 +2	13 11 9 3 10 7 6 2	✓
Full (full)	f	Heap is Full	✓
Remove	-	11 10 9 3 2 7 6	✓
	-	10 6 9 3 2 7	✓
	-	9 6 7 3 2	✓
	-	7 6 2 3	✓
	-	6 3 2	✓
Empty (not)	e	Not Empty	✓
Full (not)	f	Not Full	✓
Clear	c	Empty Heap	✓
Empty (empty)	e	Heap is empty	✓

Laboratory 11: Programming Exercise 1

Test Plan 11-2 (Priority Queue simulation results)		
Time (minutes)	Longest wait for any low priority (0) task	Longest wait for any high priority (1) task
10		
30		
60		

Question 1: Is your priority queue task scheduler unfair—that is, given two tasks T_1 and T_2 of the same priority, where task T_1 is enqueued at time N and task T_2 is enqueued at time $N + i$ ($i > 0$), is task T_2 ever dequeued before task T_1 ?

Question 2: If so, how can you eliminate this problem and make your task scheduler fair?

Laboratory 11: Programming Exercise 3

Test Plan 11-4 (The writeLevels operation)			
Test case	Commands	Expected result	Checked
Insert	+3 +7 +10 +13 +11 +9 +6 +2	13 11 9 3 10 7 6 2	✓
WriteLevel	W	13 11 9 3 10 7 6 2	✓
Remove	- -	10 6 9 3 2 7	✓
WriteLevel	W	10 6 9 3 2 7	✓

Laboratory 11: Analysis Exercise 1

You can use a heap—or a priority queue (Programming Exercise 1)—to implement both a first-in, first-out (FIFO) queue and a stack. The trick is to use the order in which data items arrive as the basis for determining the data items' priority values.

Part A

How would you assign priority values to data items to produce a FIFO queue?

Increment the priority value every time a data item is inserted, starting from 0.

Part B

How would you assign priority values to data items to produce a stack?

Assign the initial priority value as the maxSize of the stack and decrement the priority value for every new item added.

Laboratory 11: Analysis Exercise 2

Part A

Given a heap containing ten data items with distinct priorities, where in the heap can the data item with the next-to-highest priority be located? Give examples to illustrate your answer.

The item with the next-to-highest priority would be a child of the highest priority element.

Part B

Given the same heap as in Part A, where in the heap can the data item with the lowest priority be located? Give examples to illustrate your answer.

The lowest priority item would be the last leaf, which can be found by horizontally traversing the heap by its size