

Laboratory 9: Cover Sheet

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Section _____

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 9: Implementation Testing

Test Plan 9-1 (Binary Search Tree ADT operations)			
Test case	Commands	Expected result	Checked
Insert (no node)	+3	3	✓
Insert (existing node)	+5 +4 +2 +1	5\ 4\ 3< 2\ 1\	✓
Write Keys	k	1 2 3 4 5	✓
Retrieve	?1	getKey = 1	✓
Retrieve (no match)	?6	Not found	✓
Remove	-2	5\ 4 3< 1	✓
Remove (no match)	-6	Not found	✓
Copy Constructor			✓
operator=			✓
Empty (not empty)	e	Tree is NOT empty	✓
Clear	c	Empty Tree	✓
Empty (empty)	e	Empty Tree	✓
Retrieve (empty)	?1	Not Found	✓
Remove (empty)	-1	Not Found	✓

Laboratory 9: Programming Exercise 1

Test Plan 9-2 (accounts database indexing program)				
Test case	Expected result			Checked
6274	James	Johnson	415.56	✓
2843	Marcus	Wilson	9217.23	✓
4892	Maureen	Albright	51462.56	Rounds to 51492.6
8337	Debra	Douglas	27.26	✓
1892	Bruce	Gold	719.32	✓
9523	John	Carlson	1496.24	✓
3165	Mary	Smith	918.26	✓
3924	Simon	Becker	386.85	✓
6023	John	Edgar	9.65	✓
5290	George	Truman	16110.68	Rounds to 16110.7
8529	Ellen	Fairchild	86.77	✓
1144	Donald	Williams	4114.26	✓
1	No Record with that account ID			✓
-3	No Record with that account ID			✓

Laboratory 9: Programming Exercise 2

Test Plan 9-3 (getCount operation)			
Test case	Commands	Expected result	Checked
Empty		0	✓
Insert 7	+12 +15 +4 +10 +25 +13 +7 g	7	✓
Remove 2	-4 -15 g	5	✓
Clear	c g	0	✓

Test Plan 9-4 (getHeight operation)			
Test case	Commands	Expected result	Checked
Empty		0	✓
Insert 7	+12 +15 +4 +10 +25 +13 +7 h	4	✓
Remove 2	-4 -15 h	3	✓
Clear	c h	0	✓

Laboratory 9: Analysis Exercise 1

What are the heights of the shortest and tallest binary search trees that can be constructed from a set of N distinct keys? Give examples that illustrate your answer.

Height of the tallest BST:

Tallest Height = N

-> If the items are already sorted before being added to the tree, then the BST would just be a linearly linked list. This would make the length the same as the amount of data items

Height of shortest BST:

Shortest Height = $\log(n+1)$

-> The minimal height of a BST can be found when the BST is a complete tree.

Laboratory 9: Analysis Exercise 2

Given the shortest possible binary search tree containing N distinct keys, develop worst-case, order-of-magnitude estimates of the execution time of the following Binary Search Tree ADT operations. Briefly explain your reasoning behind each of your estimates.

retrieve $O(n)$: linear search if the BST is at max height

insert $O(n)$: linear search if the BST is at max height

remove $O(n)$: linear search if the BST is at max height

writeKeys $O(n)$: linear search if the BST is at max height