

CSI 3334 Data Structures

Homework 4

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Do your own work for this assignment; do not work with others. Consult the book and your professor for help if you need it. Do not use any other resources. Use good grammar, correct spelling, and complete sentences.

1. (10 points) Given input $\{4371, 1323, 6173, 4199, 4344, 9679, 1989\}$ and a hash function $h(x) = x \% 10$ show the resulting:

(a) hash table with a second hash function $h_2(x) = 7 - (x \% 7)$

Insert the inputs in the given order. If any insertion fails, indicate that (but do not resize the table). The hash table size is implied by the hash function.

Index	Linear Probing	Quadratic Probing	Double Hashing	Separate Chaining
0	9679	9679		-- >
1	4371	4371	4371	-- >4371
2	1989			-- >
3	1323	1323	1323	-- >1323-- >6173
4	6173	6173	6173	-- >4344
5	4344	4344	9679	-- >
6				-- >
7			4344	-- >
8		1989		-- >
9	4199	4199	4199	-- >4199-- >9679-- >1989

Failed Insertion (1 failed):

The number 1989 failed to be inserted using Double Hashing, by using h_2 function after the first collision occurs, it hashes to 6 which makes the probing enters a infinite loop because it collides with every single element in the cell.

2. (10 points) Show the result for rehashing each of the four hash tables in problem 1. The new hash table size should be a prime number at least as large as twice the original size, and the primary hash function should change to reflect the new table size.

Solution:

Since the original table size is 10, I decided to use the prime number 23 as the new table size

So the new hashing function becomes $h(x) = x \% 23$

The new hashing table for liner probing method is:

Index	Linear Probing
0	
1	4371
2	
3	
4	
5	
6	
7	
8	
9	6173
10	
11	1989
12	1323
13	4199
14	
15	
16	
17	
18	
19	9679
20	4344
21	
22	

The new hashing table for quadratic probing method is:

Index	Quadratic Probing
0	
1	4371
2	
3	
4	
5	
6	
7	
8	
9	6173
10	
11	1989
12	1323
13	4199
14	
15	
16	
17	
18	
19	9679
20	4344
21	
22	

The new hashing table for double hashing method is:

Index	Double Hashing
0	
1	4371
2	
3	
4	
5	
6	
7	
8	
9	6173
10	
11	1989
12	1323
13	4199
14	
15	
16	
17	
18	
19	9679
20	4344
21	
22	

The new hashing table for separate chaining method is:

Index	Separate Chaining
0	-- >
1	-- >4371
2	-- >
3	-- >
4	-- >
5	-- >
6	-- >
7	-- >
8	-- >
9	-- >6173
10	-- >
11	-- >1989
12	-- >1323
13	-- >4199
14	-- >
15	-- >
16	-- >
17	-- >
18	-- >
19	-- > 9679
20	-- >4344
21	-- >
22	-- >

3. Construct a Leftist Heap using the following input data:
9, 11, 36, 44, 27, 30, 37, 16, 35, 24, 41, 10, 5, 45

Solution:

H stands for *Heap*

Insert 9 to H_1 , insert 11 to H_2 , merging H_2 to H_1 :

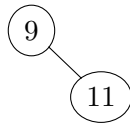
H_1 :



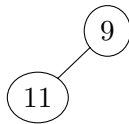
H_2 :



H_1 after merging:



9 becomes the α node, swap:



Insert 36 to H_3 , insert 44 to H_4 , merging H_3, H_4 to H_1 :

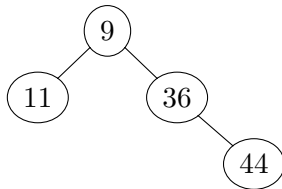
H_3 :



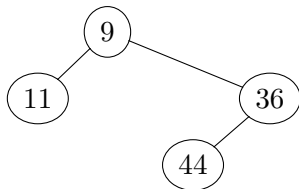
H_4 :



H_1 after merging:



36 becomes the α node, swap:



Insert 27 to H_5 , insert 30 to H_6 , merging H_5, H_6 to H_1 :

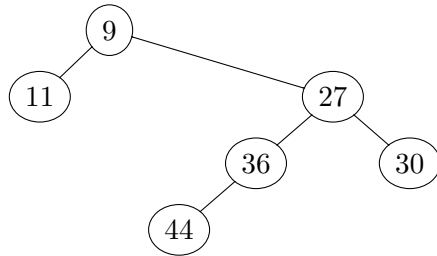
H_5 :



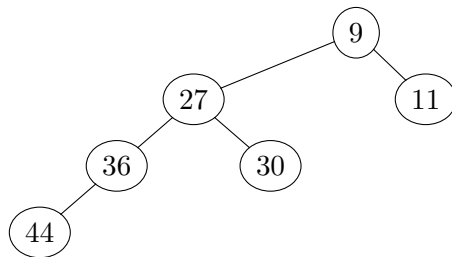
H_6 :



H_1 after merging:



9 becomes the α node, swap:



Insert 37 to H_7 , insert 16 to H_8 , insert 35 to H_9 , merging H_7 , H_8 , H_9 to H_1 :

H_7 :



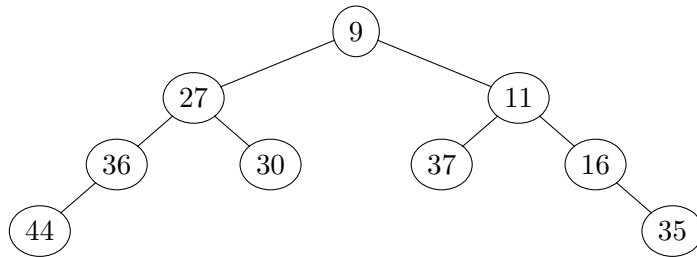
H_8 :



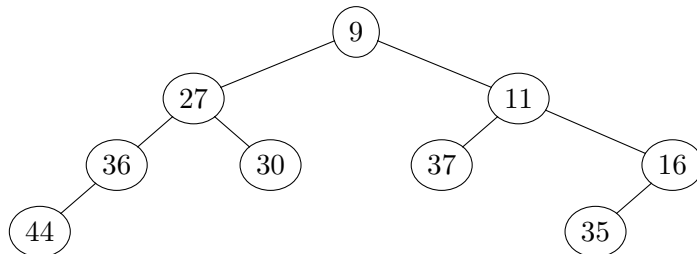
H_9 :



H_1 after merging:



16 becomes the α node, swap:

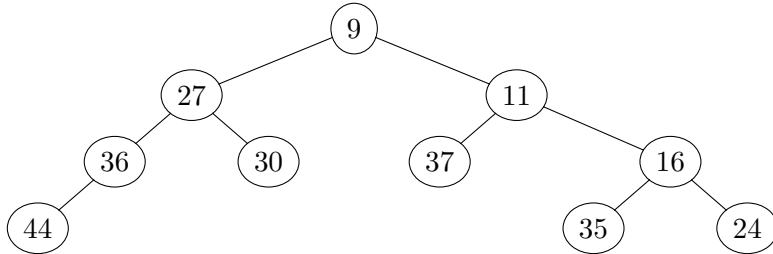


Insert 24 to H_{10} , merging H_{10} to H_1 :

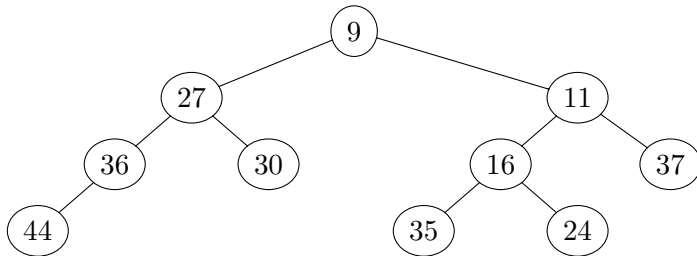
H_{10} :



H_1 after merging:



11 becomes the α node, swap:

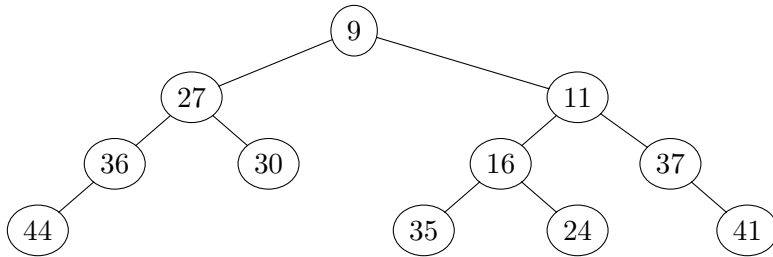


Insert 41 to H_{11} , merging H_{11} to H_1 :

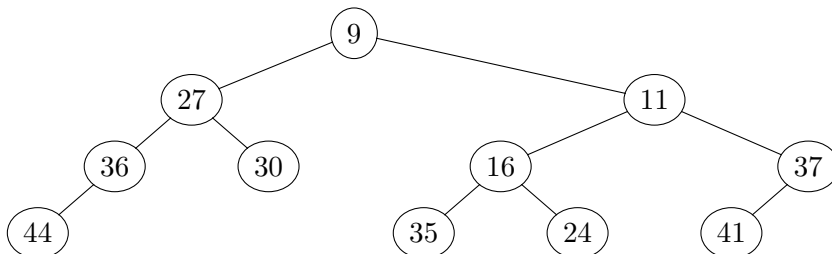
H_{11} :



H_1 after merging:



37 becomes the α node, swap:



Insert 10 to H_{12} , insert 5 to H_{13} , insert 45 to H_{14} , merging H_{12} , H_{13} , H_{14} to H_1 :

H_{12} :



H_{13} :



H_{14} :



H_1 after merging:

