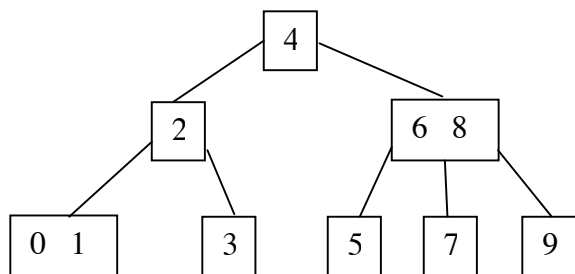


Homework 4 – Due Sunday December 5 at 8:00 pm 92 points possible

You must turn in your homework in ps or pdf format

Be sure to include the names of your partners and how long you worked on the homework together. Remember that you must work with at least 2 other people to form a group of three and you must work for at least 2 hours together (minimum of 1 hour sessions).

1. (6 pts) An empty table has a capacity of 100, and you insert 6 entries with keys 100, 0, 1199, 1299, 1399, and 2. Using linear probing and the basic hash function (key mod size), where will these entries be placed in the table? Where will they be placed with double hashing (with $HF2 = 1 + (\text{key mod } 98)$)?
2. (6 pts) Use a hash table with size of 811 that uses separate chaining to specify where the following entries will be inserted. Use a basic hash function (key mod size). Insert 811, 0, 1623, 2435, 3247, and 2.
3. (9 pts) Use a hash table of size 11 and the basic hash function (key mod size). Insert the following items using quadratic probing, 2, 14, 21, 36, 70, 18, 47, 32, and 11.
4. (9 pts) Rehash the resulting table from problem 3 to a table size of 23.
5. (10 pts) Show the resulting 2-3 trees if we insert the elements 4, 6, 2, 9, 0, 5, 7, 3, 8, and 1 into an initially empty tree. Insert in the order given. Show the tree after each insert.
6. (10 pts) Show the resulting 2-3 trees if we delete the elements 4, 6, 2, 9, 0, 5, 7, 3, 8, and 1 from the resulting tree in question 5 (Shown below to make sure you start with the correct tree). Delete in the order given. Show the tree after each delete.



7. (11 pts) Show the red-black trees that result after successively inserting the keys in the order 5, 16, 22, 45, 2, 10, 18, 30, 50, 12, and 1 into an initially empty red-black tree. Show the tree after each insert. (Be sure to include a legend for your tree so we know which nodes are red and which are black)

8. (10 pts) Did you get to <http://hug.ucr.edu/ieval/login> and evaluate your TA and your instructor? If you haven't, please do so now so that you can answer yes to this question. (Do not answer yes if you *plan* to fill out the evaluations, only answer yes if you have *already* filled out the evaluations.)

9. (21 pts) Given the following numbers, 160, 8, 34, 110, 19, 212, 22, 55, 389, 48, 3, show the array at each pass or phase for each of the specified sorting techniques. Give the Big-Oh notation running time of each sorting algorithm.

- Insertion Sort
- Selection Sort
- Bubble Sort
- Shell sort using an increment sequence of $h_k = N/2$ and $h_{k+1} = h_k / 2$
- Radix Sort
- Merge Sort
- Quick Sort using the first element of each array/subarray as the pivot

Extra Credit

10. (11 pts) Show the red-black trees that result after successively deleting the keys in the order 5,16, 22, 45, 2, 10, 18, 30, 50, 12, and 1 from the resulting red-black tree in question 7 (Shown below to make sure you start with the correct tree). Show the tree after each delete operation. (Be sure to include a legend for your tree so we know which nodes are red and which are black) Squares are black for my tree below.

