DS2030 DSA for DS
Practise Questions Set 2

1. Given three heaps, each containing n elements. What is the complexity of an efficient algorithm for constructing a single heap containing all the $3n$ elements?
2. What is the maximum difference in the height of two leaf nodes in a min heap?
3. Is the array $4, 5, 7, 10, 19, 8, 11, 9, 20, 12, 21, 16$ a (min)heap? Explain your answer.
4. Assuming that all the keys are distinct, at which positions in a heap (array locations and locations in the tree structure) might the largest key be stored?
5. Given two hash tables containing the same set of n elements, one that uses chaining and one that uses linear probing, What is the complexity of finding the minimum element from both the hash tables?
6. Draw the 11-entry hash table that results from using the hash function $h(i) = (3i + 5) \mod 11$, to hash keys $12, 44, 13, 88, 23, 94, 11, 39, 20, 16, 5$, assuming collisions are handled by chaining.
7. We wish to implement a hash table where collisions are resolved by chaining. However, we want to store the data in free slots of the table itself, rather than creating new lists. All free slots in the table are marked with a boolean flag and are linked together to form a free slot list. Write the algorithms for `put(key, value)` and `remove(key)` methods that performs these operations in expected constant time. Assume that the operations of a singly or doubly linked list are available.
8. What is the expected height of any binary search tree?
9. What is the maximum height of any AVL tree with 7 nodes? Explain your answer.
10. Explain how to use an AVL tree to sort n comparable elements in $O(n \log n)$ time in the worst case.
11. Prove that the an AVL tree containing n keys is $O(\log n)$ height.
12. Consider the sequence of keys $5, 16, 22, 45, 2, 10, 18, 30$. Draw the result of inserting these keys in the given order into an initially empty (2,4) tree.
13. What are the possible ways of splitting a node w in a (2,4) tree that has 4 keys: $k_1, k_2, k_3,$ and k_4? Which of the keys will be part of the new nodes and the parent of w?