

111-1 PDSA Final

Dec. 19, 2022

學號：_____

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1. (5%) Heapsort consists of two steps, heap construction followed by successive deletions. How long do these first and second steps take to fully complete?
 - a. logarithmic and logarithmic
 - b. logarithmic and linear
 - c. linear and logarithmic
 - d. linear and linear
 - e. linearithmic and linear
 - f. linear and linearithmic
 - g. linearithmic and linearithmic
2. (6%) A binary search tree (BST) is generated by inserting in order the following integers: 50, 15, 12, 25, 40, 58, 81, 31, 18, 37, 60, 24. What are the numbers of the nodes in the left sub-tree and right sub-tree of the root, respectively?
3. (6%) When you construct a BST with the preorder traversal of a binary search tree 10, 4, 3, 5, 11, 12, 21, 36, please write down all the leaf nodes?
4. (8%) Please compare the **worst-case** and **average-case** (after N inserts) complexities of the *insert* and *search* operations for the following ST (symbol table) implementations:
 - A. sequential search (unordered list)
 - B. binary search (ordered array)
 - C. BST (binary search tree)
 - D. red-black BST
5. (5%) What is the worst-case running time of the sweep-line algorithm to find all R intersections among N orthogonal line segments?
 - a. constant + R
 - b. $\log N + R$
 - c. $N + R$
 - d. $N \log N + R$
 - e. $N \log N + R \log N$

6. (5%) What is the order of growth of Dijkstra's algorithm if we use an ordered array for the priority queue (PQ)? Assume there are no self-edges or parallel edges.
- V
 - E
 - V^2
 - $E \log V$
 - EV
7. (5%) Suppose that a digraph G is represented using the adjacency-lists representation. What is the order of growth of the running time to find all vertices that point to a given vertex v ?
- $\text{indegree}(v)$
 - $\text{outdegree}(v)$
 - V
 - $V + E$
8. (15%) Write a function to construct the **binary tree** from its inorder and postorder traversals. Return the root of the binary tree as the output.
9. (15%) Please prove: *topological sort* algorithm computes SPT (shortest-paths tree) in any edge-weighted DAG (directed acyclic graph) in time proportional to $E + V$.
10. (15%) Write a function that reads in N 2-dimensional points in an array. An edge is defined as: v is connected to w , if and only if the distance between v and w is smaller than d . Print the smallest d , which results in that all the N points are connected.
11. (15%) Given an undirected graph, write a pseudocode function that colors the graph's vertices such that no two adjacent vertices share the same color by minimizing the total number of colors used.