Name: _____

1. (1 pt.)

   - **Read all material carefully.**
   - You may refer to your books, papers, and notes during this test.
   - No computer or network access of any kind is allowed (or needed).
   - Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
   - Use the conventions used in class and the textbook for notation, algorithmic options, etc.

   Write your name in the space provided above.

2. (9 pts.) Depict the action of *in-place heapsort* on the following array, sorting it in ascending order. Depict (1) the state of the array and (2) the implicit binary heap it encodes (in the usual graphical form), after each *deleteMax* operation.

   90 94 79 36 85 68 87 75 6 97

[additional space for answering the earlier question]

3. (3 pts.) Depict a complete binary search tree with the 11 keys $1, 2, \ldots, 11$.

4. (8 pts.) Using the tree of Question 3 as the initial state of a splay tree, depict the state of the tree after a search for each of the following four keys: $3, 1, 4, 1$. Depict also the intermediate states before and after any zig, zig-zig, and zig-zag operations.

[additional space for answering the earlier question]

[additional space for answering the earlier question]

5. (3 pts.) Using notation from Reynolds's paper as discussed in class, and parameters $k = 5$ and $j = 8$, compute c_n for $n = 1, 2, 3, 4, 5$.

6. (6 pts.) Using the c_n values from Question 5, and the tabular representation used in class, depict the action of a five-way polyphase merge with six tapes that starts with c_n runs on tape n for $n = 1, 2, \ldots, 5$.