1. (10%) Compute the failure function of the Knuth-Morris-Pratt algorithm for the pattern ababaab.

2. (10%) Write a C or C++ program to invert an input string by using a stack. For example, a string CGTA is outputted if input ATGC.

3. (10%) Write a C or C++ function to concatenate 2 doubly linked lists.

4. (10%) A list is (25, 4, 75, 2, 59, 10, 59, 13, 47). This list is interpreted as a binary tree. Please depict the binary tree and the initial max heap for heap sort algorithm.

5. (10%) Explain how to find a cycle is created in Kruskal's minimum-cost spanning tree algorithm.

6. (10%) Explain what is NP-complete problem.

7. (20%) Solve the following recurrence relations.

   (1) $T(n) = \begin{cases} 7T(\frac{n}{2}) + 18n^2, & n > 2 \\ 1, & n \le 2 \end{cases}$

   (2) $T(n) = \begin{cases} 2T(\sqrt{n}) + \log n, & n > 4 \\ 1, & n \le 4 \end{cases}$

8. (10%) Using dynamic programming method to construct one table to find LCS (Longest Common String) of (1 0 0 1 0 1 0 1) & (0 1 0 1 1 0 1 1 0).

9. (10%) Prove "Yes" or "No" for (1) $2^{n+1} = O(2^n)$, (2) $2^{2n} = O(2^n)$.

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