Analysis of Algorithms

Final Exam : 17 June 2014

1. Find an optimal parenthesization of a matrix-chain multiplication whose sequence of dimensions is $(5, 10, 4, 6, 50, 8)$.

2. Describe the Huffman code algorithm. What is the time complexity of the algorithm?

3. A directed graph $G = (V, E)$ is *semiconnected* if, for all pairs of vertices $u, v \in V$, we have $u \rightsquigarrow v$ or $v \rightsquigarrow u$, where $u \rightsquigarrow v$ means that v is reachable from u. Give an efficient algorithm to determine whether or not G is semiconnected. What is the time complexity of your algorithm?

4. Describe the Floyd-Warshall algorithm for the all-pairs shortest-paths problem. What is the time complexity of the algorithm?

5. Find a maximum flow in the following flow network (capacity of each edge is 1) by running the Ford-Fulkerson method. For each iteration, pick the augmenting path that is lexicographically smallest (i.e., if there are choices, choose the vertex with the smallest number). Show the residual network after each flow augmentation.

6. Construct the string-matching automaton for the pattern $P = aabaabb$, and illustrate its operation on the text string $T = aaabaabaabbaababaa$.