

Qualifying Exam*Kyomin Jung*

1. State definitions of P, NP, and NP-complete problems (16p). State two examples of NP-complete problems. (not just the name of the problem but explain the problem) (10p).
 2. Solve only one of the following problems (15p): 1) State the merge sort algorithm and prove that its running time is $O(n \log n)$. You can either use the Master theorem, or prove it directly. 2) State the vertex cover problem (VC), and state a 2-approximation polynomial time algorithm of VC. Prove that the algorithm is a 2-approximation algorithm.
 3. Define the flow network on a directed graph, and state the flow maximization problem. State the maxflow mincut theorem. Briefly explain the procedure of any polynomial time algorithm to solve this problem (you don't need to write any proof). (20p)
 4. State any two of the following problems (you don't need to write any proof) (24p): 1) Dijkstra's single source shortest path algorithm. 2) Floyd's all pair shortest path algorithm. 3) State the definition of the linear programming problem. 4) Prim's minimum spanning tree algorithm.
 5. Solve any one of the following problems (you don't need to write any proof) (15p): 1) State the Maximum Independent Set problem, and explain that this problem can be expressed as an integer programming. 2) Explain the goal and the procedure of the Google's page rank algorithm.
- Write your answer in English or Korean. Use separate sheet of paper for each problem.