

Qualifying Exam

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1. State definitions of P, NP, and NP-complete problems (15p). State two examples of NP-complete problems excluding the vertex cover problem, and the maximum independent set problem. (not just the name of the problem but state the definition of the problem) (10p).
 2. Solve only one of the following problems (20p): 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. Show 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. Solve any one of the following problems (you don't need to write any proof) (18p): 1) Explain Floyd's all pair shortest path algorithm. 2) State the definition of the linear programming problem 3) Explain Prim's minimum spanning tree algorithm.
 5. Solve any one of the following problems (you don't need to write any proof) (17p): 1) State the RSA cryptography key generation method, encryption method and decryption method. 2) Explain the goal and the procedure of the Google's page rank algorithm. 3) 1) State the Maximum Independent Set problem, and explain that this problem can be expressed as an integer programming.
- Write your answer in English or Korean. Use separate sheet of paper for each problem.