

Qualifying Exam*Kyomin Jung*

1. State a definition of P, NP, and NP-complete problems (15p). State the definition of approximation ratio of an approximation algorithm for a minimization problem (10p).

 2. Solve only one of the following problems: 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 randomized quick sort algorithm and prove that its expected running time is $O(n \log n)$. You cannot apply the Master theorem for this case. (25p)

 3. State any two of the following algorithms (you don't need to write any proof): 1) Floyd's all pair shortest path algorithm. 2) Dijkstra's single source shortest path algorithm. 3) Prim's minimum spanning tree algorithm. 4) An integer multiplication algorithm that runs in $O(n^{1.99})$, where n is the input bit size. (25p)

 4. Solve any two of the following problems: 1) State the Maximum Independent Set problem, and explain that this problem can be expressed as a zero-one integer programming. 2) State the RSA cryptography key generation method, encryption method and decryption method. 3) State the formula for Google's page rank algorithm and explain that the page rank corresponds to a stationary distribution of a random walk on the Web graph. 4) State a definition of a flow network, and state the Edmonds-Karp algorithm for flow maximization (no need to write any proof). (25p)
- Write your answer in English or Korean. Use separate sheet of paper for each problem.