CSE 101
Quiz 2, Spring, 2013

Answer all questions. Give informal (at least) proofs for all answers. Grading will be on completeness and logical correctness, and if applicable, efficiency, as well as correctness. Out of 80 points.

**Which version of Dijkstra do we use?** 20 points each We saw two implementations of Dijkstra’s algorithm in class, one using arrays and the other using a heap. For each of the following kinds of graph, explain which implementation you would use and give a time analysis for that version on the graph in question. When the graphs described are undirected, that means in the directed graph, there are edges in both directions.

1. The $\log n$ dimensional hypercube, where we think of nodes as all bit strings of length $k = \log n$, and two nodes are adjacent if they differ in exactly one bit.

2. A randomly chosen graph on $n$ nodes, where each edge is present with probability $1/2$

**Using algorithms to solve new problems– 40 points** Explain how we can modify or use one of the known graph search algorithms to solve the following problem in the given time: (10 points correct algorithm, 10 points correctness proof, 10 points efficiency, 10 points time analysis)

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**Shortest distance in a graph with node weights** You are given a directed graph $G$ with non-negative weights $w[u]$ for each node $u \in V$. You are also given nodes $u$ and $v$, and wish to find the smallest total weights of nodes along any path that starts at $u$ and ends at node $v$. Show how to do this in $O((n + m) \log n)$ time.