CS302 - Problem Set 9

1. **[11 points]** Prove the BFS shortest path algorithm I described in class is correct. That is, prove that if the shortest distance from s to v is n, then $L[v] = n$ (and if s and v are not connected by a path, then $L[v] = \infty$.)

   (See final page for hints.)

2. **[6 points]** What is the runtime of the BFS shortest path algorithm I described in class if the graph is given as an adjacency matrix? (Let n be the total number of vertices in the graph, m the total number of edges, n_s the number of vertices connected to s by a path, and m_s the number of edges connected to s by a path.)

Hint for proof: I have two loop invariants: one regarding the order in which elements are added to the queue (needed for maintenance), and one regarding the correct assigning of shortest lenghts (needed for termination)