

## Reading List for the In-Class Part of Exam 3 (Dec. 6th, 9 AM)

### Module 5

- 1) Prove that being a directed acyclic graph (DAG) is a necessary and sufficient condition to be able to come up with a topological sort for a directed graph.
- 2) In the case of Dijkstra algorithm: when a vertex  $v$  is picked for relaxation, prove that we have optimized that vertex (i.e., we have found the shortest path from the source  $s$  to the vertex  $v$ ).
- 3) In the case of Dijkstra algorithm to find shortest paths from a source vertex: prove that the weights of the vertices that are optimized are in the non-decreasing order.

### Module 6

- 4) What is an NP-complete problem? How do we typically prove a problem is an NP-complete problem?
- 5) Show that the Hamiltonian Circuit (HC) problem is polynomial-time reducible to the Traveling Salesman problem (TSP). What is the time-complexity of the reduction?
- 6) Prove that the approximation ratio of the Twice-around-the-tree heuristic for the Traveling Salesman problem (TSP) is 2.0.