

CSCI E-124 Midterm Sample Questions

Please solve ALL the problems.

T/F questions are worth 3 points each. Multiple choice questions are worth 5 points each.

- (0) **T F** Suppose you are given a graph with the edges in sorted order. Using Kruskal's algorithm, you can find the minimum spanning tree in $O(|E| \log^* |V|)$ time.
- (1) **T F** Suppose you are given a graph with the edges in sorted order. Using Kruskal's algorithm but without path compression, you can find the minimum spanning tree in $O(|E| \log^* |V|)$ time.
- (2) **T F** If $T(n) = 49T(n/7) + n^2$, then $T(n) = O(n^2 \log n)$.
- (3) **T F** Consider a shortest path from a vertex s to a vertex t in a graph. If the weight of every edge in the graph is increased by one, the path remains a shortest path.
- (4) On inputs for which both are valid, in the worst case:
- a) breadth first search is asymptotically faster than depth first search.
 - b) mergesort is asymptotically faster than sorting with a heap.
 - c) using Dijkstra's algorithm or all-pairs shortest paths is asymptotically faster than the Floyd-Warshall (dynamic programming) all-pairs shortest path algorithm
 - d) all of the above are true
 - e) none of the above are true
- (5) Which of the following cannot be done in linear time?
- a) Determining if a graph is bipartite.
 - b) Solving the single-source shortest path problem on an acyclic directed graph.
 - c) Performing m union-find operations on n elements.
 - d) Determining the strongly connected components of a graph.
 - e) a and b
 - f) b and c
 - g) c and d
- (6) The farthest point from a given point X in a graph is the point whose distance from X is maximal. How would you tackle the problem of finding the farthest point from X ?
- a) DFS
 - b) BFS
 - c) Topological sort
 - d) Dijkstra's algorithm
 - e) Counting argument