

WRIGHT STATE UNIVERSITY
Department of Computer Science and Engineering
CS7200: Algorithm Design and Analysis

Fall 2013

Midterm (30 pts = 7+4+6+4+9)

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- 1) [Stable Marriage Problem]: State whether the following claims are true or false. If true, justify it *as clearly as possible*. If false, provide a counterexample/argument.
 - (a) If w is the top choice of m and m is the top choice of w , then m and w must be paired with each other in any stable matching.
 - (b) If w is the last choice of m and m is the last choice of w , then m and w must be paired with each other in any stable matching.
- 2) Dijkstra's shortest paths algorithm requires all the edge weights to be non-negative. Show by constructing an example that the algorithm can fail to compute the shortest path between the source and a target when the graph contains a negative edge.
- 3) The mileage chart below shows distances between seven cities. Use Kruskal's Algorithm to find the Minimum Spanning Tree and its weight.

	Boston	Dallas	Houston	Louisville	Nashville	Pittsburgh	St. Louis
Boston	***	1748	1804	941	1088	561	1141
Dallas	1748	***	243	819	660	1204	630
Houston	1804	243	***	928	769	1313	779
Louisville	941	819	928	***	168	388	263
Nashville	1088	660	769	168	***	394	695
Pittsburgh	561	1204	1313	388	394	***	760
St. Louis	1141	630	779	263	695	760	***

- 4) Consider the recurrence:

$$T(n) \leq \begin{cases} T(3n/4) + T(n/5) + cn & \text{if } n \geq 60 \\ d & \text{if } n < 60. \end{cases}$$

Give an expression/formula for the length of the shortest path from the root to a leaf in the recursion tree.

- 5) Determine order-theoretic solutions to the following recurrences:

(a) $T(n) = 5 T(n/7) + n$

(b) $T(n) = 2 T(n-1) + 1$