Midterm CS361 Spring 2017

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I. True or False (2 points each, best 15, answer all)

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F 1. Quicksort is an excellent example for greedy algorithms and has a best time of O(n log n).
F 2. By using Merge Sort, we can sort n^2 elements in $O(\sqrt{n} log n)$ time.
T 3. If $f(n) = O(n^6)$, then $f(n) = O(n^6 \log n)$.
F 4. The Master Theorem has three cases and it covers all possible recurrence situations.
T 5. If $f(n) = \mathbf{O}(n^6)$ and $f(n) = \mathbf{\Omega}(n^6)$ then $f(n) = \Theta(n^6)$.
T ~~F~~ 6. An undirected, connected, and weighted graph may have more than one Minimum Spanning Tree (MST).
F 7. Adjacency Matrix cannot be used to represent a DAG.
F ~~T~~ 8. Depth first search and breadth first search generally result in the same "Search tree."
F ~~T~~ 9. Like Merge sort, topological sort can sort n elements in O(n log n) time.
F ~~T~~ 10. Problems that can be solved by Dynamic Programming can, generally speaking, also be solved with a Greedy algorithm.
T 11. Kruskal and Prim algorithm in finding a MST are examples of Greedy algorithms.
F ~~T~~ 12. If a connected graph G=(V,E) that satisfying the condition |V|= |E| -1, then it is always a tree.
T 13. For a connected undirected graph G=(V,E), its Breadth-First Tree has |V| -1 edges.
F ~~F~~ 14. According to Parenthesis Theorem of DFS, two vertices do not have to be in the same tree.
T 15. Topologic sort can only be performed on DAGs, and the results on the same graph can be different.
F ~~T~~ 16. The 0-1 Knapsack Problem has a dynamic programming solution as well as a greedy algorithm solution. no!

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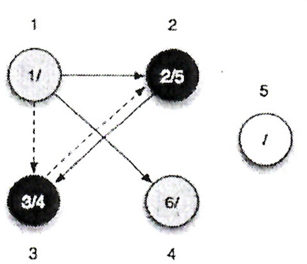
II. Filling in the blank + Multiple choice, circle the best answer on the cases and filling in the complexity blank for each problem (3 points each, best five, answer all)

1. $T(n) = 27T(n/3) + n =$ $\Theta(n^3)$. In addition, we achieve this by using Master Theorem's case? a. 1 b. 2 c. 3	2. $T(n) = 3T(n/3) + n^2 =$ $\Theta(n^2)$. In addition, we achieve this by using Master Theorem's case? a. 1 b. 2 c. 3	3. $T(n) = 3T(n/3) + 10n =$ $\Theta(n)$ n lg n. In addition, we achieve this by using Master Theorem's case? a. 1 b. 2 c. 3 -2
4. $T(n) = 4T(n/2) + n^2 =$ $\Theta(n^2)$ $n^2 \lg n$. In addition, we achieve this by using Master Theorem's case? a. 1 b. 2 c. 3 -2	5. $T(n) = 2T(n/4) + \lg n =$ $\Theta(n^{1/2})$ $\sqrt{n}$. In addition, we achieve this by using Master Theorem's case? a. 1 b. 2 c. 3 -3	6. $T(n) = 8T(n/3) + \lg n =$ $\Theta(n^{1.5})$ $n^{\log_3 8}$. In addition, we achieve this by using Master Theorem's case? a. 1 b. 2 c. 3

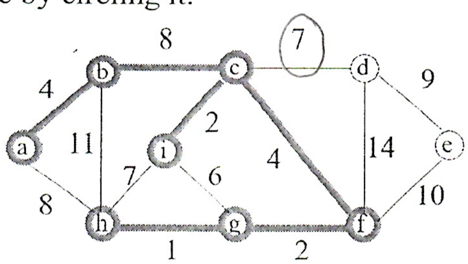
III. Finishing the examples (3 points each).

a. For the DFS example below, finish every vertices' starting and ending timestamps if they are still not done as rows d and f in the array.

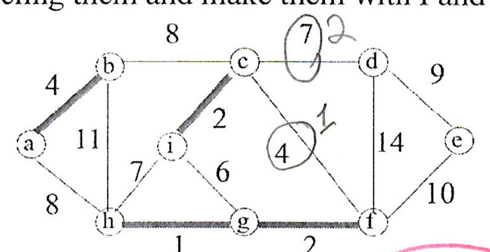


	1	2	3	4	5
d	1	2	3	6	9
f	8	5	4	7	10

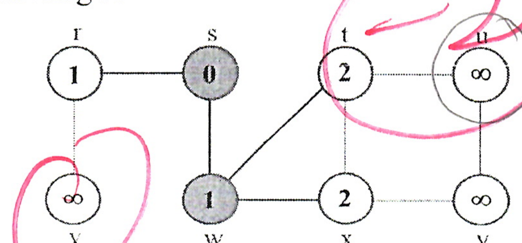
b. With Prim's algorithm for MST, which edge will be included in the MST? Clearly mark the edge by circling it.



c. Which 2 edges will be included with Kruskal's algorithm for MST? Clearly mark the edges by circling them and make them with I and II.



d. For the BFS example below, which vertex will be discovered next? Clearly mark the vertex by circling it.



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