





9. (4) Suppose you have the letter/frequency pairs of {A:6 B:2 C:10 D:3 E:5 F:1}. Construct an optimal Huffman code tree for these letters.
10. (4) You have a set of items, with their weights and values, as follows: A(wt 5, value 3), B(6, 2), C(4, 4), D(2, 8), E(2, 6). You have a knapsack with a maximum capacity of 10. Using the fractional knapsack algorithm, what do you put in the knapsack, how much of each item, and what's the total value you obtain?
11. (4) Sketch pseudocode for depth-first search.
12. (2) Suppose we have the disjoint data structure, as shown here. Show the different sets that are represented by this data structure (show how many there are, what is in each set).

A	B	C	D	E	F	G
C	F	C	E	G	F	G

Name:

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13. (2) Write the “find set” function for a disjoint set data structure; make sure you do path compression.

14. (4) Sketch pseudocode for Prim’s algorithm.

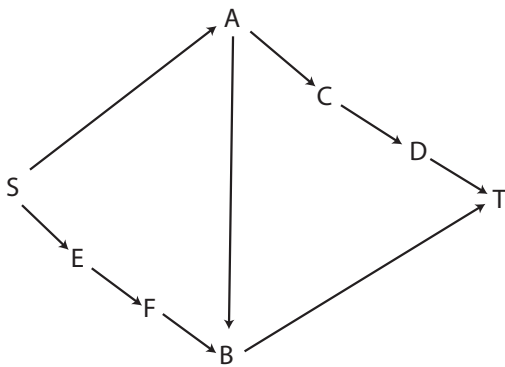
15. (2) Sketch the “relax” function used in Bellman-Ford.

16. (4) Sketch pseudocode for Dijkstra’s algorithm.

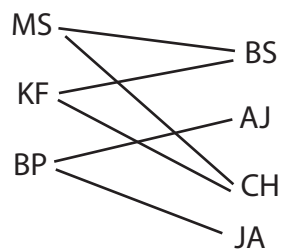
17. (2) What is the Big-O complexity of Dijkstra’s algorithm (assuming you use the a good implementation, which relies on a binary or Fibonacci heap)?

18. (4) There are two main approaches to maximum flow: the Ford-Fulkerson method, and the Edmonds-Karp algorithm. Sketch a graph where Ford-Fulkerson can have a very high run time.

19. (6) Run Edmonds-Karp on this graph; show the flow found on each step (and in particular, show how the residual flow is used). All edges have capacity 1.



20. (4) Maximum flow can be used to solve the stable marriage problem (also known as maximum bipartite matching). Illustrate how you would alter the possible matchings shown below into a maximum flow problem.



21. (4) Sketch the (probable) relationship between P, NP, and Co-NP. I'm expecting to see the Venn diagram.

22. (6) Give a definition for P and NP. Make sure you say something about decision problems.

23. (4) Briefly define the 3CNF-SAT problem.

24. (4) Briefly define the subset-sum problem.

25. (8) Illustrate how you can convert a 3CNF-SAT problem into a subset-sum problem. You might want to show a simple 3CNF-SAT problem, and the equivalent subset-sum problem.

