Prof. Anna Baynes

CSC 130 Final

Name: _____

There are 8 problems. Good luck and have a great summer.

WRITE BIG AND CLEAR. IF I CANNOT READ IT, YOU WILL NOT GET THE POINTS.

1. Mergesort (20 points):

   Merge a short sorted array to the larger sorted array, given the larger one has space at its end. The returned larger array should have all the values sorted.

   Input: array1: [4,6,9] array2: [1,5,8,10, , ,]
   In the above input, array1 size is 3 and array2 size is 7.
   Output: array: {1,4,5,6,8,9,10]

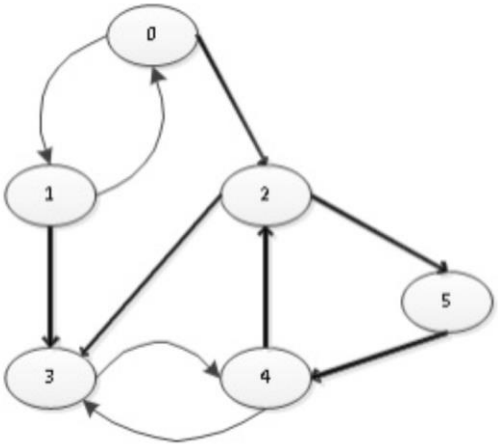
   Use as-close-to-Java code as possible. You won't be deducted for syntax errors (missing brackets or semicolons, etc). You will only lose points if you use English (ie "put this element in the second array").

   Is it possible to do this without creating any new arrays? If not why? If so how?

2. Quicksort (5 points):
   True or False: In QuickSort, if you always choose the item in the center of the array as the pivot then QuickSort runs in worst-case O(n log n) time.

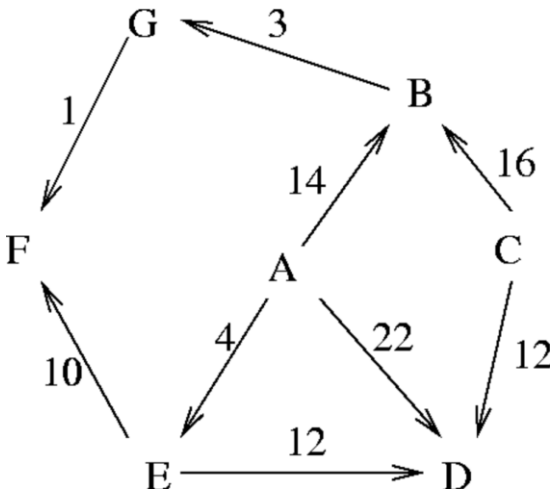
3. BFS (10 points);

   Using the BFS algorithm we studied in class, show how the values in this graph will be outputted during the traversal. In your work, show the pending set BFS uses and how that set is updated through the algorithm's execution.



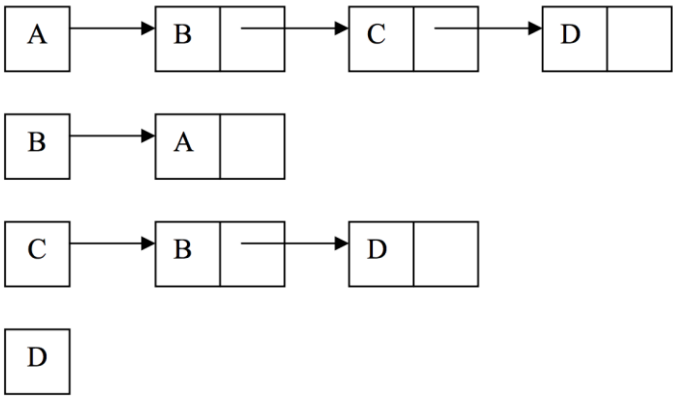
4. Prim's Algorithm (10 points)
   Explain if it does or does not matter what node in the graph you start Prim's algorithm on. Write clearly and concisely. Use a maximum of 30 words (but shorter is better).

5. Dijkstra's Algorithm (20 points)
   In what order are the nodes in the following graph visited when Dijsktra is run when the starting node is A?



6. Adjacency Matrix and Adjacency List (10 points)

   Given the following adjacency list of a directed graph, no weights, showing out-degrees.



   a. Draw the conceptual (ie nodes and edges) representation of the graph.

   b. Draw the adjacency matrix representation of the graph.

7. Sorting Comparison Question (15 points)

   For this question, solve the same problem using two different algorithms with two different runtimes. The problem is: You are given an unsorted array of integers. Find and print any duplicate numbers.

   Example input: {5, 6, 0, 6}
   Example output: {6}

   Give your answer in English using concise language, keep your words limited (30 words maximum). You are given a runtime, and your answer should be an algorithm which is the **tightest bound** for that algorithm.

   a. Print the duplicates in time $O(n^2)$. For your algorithm, is $O(n^2)$ best case, average case or worst case?

   b. Print the duplicates in O(n log n). For your algorithm, is O(n log n) best case, average case or worst case?

8. Give a precise graph example (ie draw the graph) where DFS is better to use than BFS in terms of space efficiency. Explain why: Be clear, concise, and we're not looking for novels. (10 points)

9. Extra Credit:
   Prove if Dijkstra's algorithm can or cannot handle negative weighted edges.