CSE 373 Homework 5
Student number _____
Name _____

1) Negative Graphs (20 points)

(a) [5 Points] If there is more than one minimum cost path from v to w, will Dijkstra's algorithm always find the path with the fewest edges? If not, explain in a few sentences how to modify Dijkstra's algorithm so that if there is more than one minimum path from v to w, a path with the fewest edges is chosen. Assume no negative weight edges or negative weight cycles.

(b) [5 Points] Give an example where Dijkstra's algorithm gives the wrong answer in the presence of a negative cost edge but no negative-cost cycles. Explain briefly why Dijkstra's algorithm fails on your example. The example need not be complex; it is possible to demonstrate the point using as few as 3 vertices.

(c) [10 Points] Suppose you are given a graph that has negative-cost edges but no negative-cost cycles. Consider the following strategy to find shortest paths in this graph: uniformly add a constant k to the cost of every edge, so that all costs become non-negative, then run Dijkstra's algorithm and return that result with the edge costs reverted back to their original values (i.e., with k subtracted).

 • Give an example where this technique fails (Dijkstra's would not find what is actually the shortest path) and explain why it fails.

 • Give a general explanation as to why this technique does not work. Think about your example and why the original least cost path is no longer the least cost path after adding k.

2) Sorting (10 points)

1) Using RadixSort with a radix of 6 (letters a,b,c,d,e,f) to alphabetically sort the following strings, draw contents of each bucket at the end of each iteration.
`Strings = (abc, da, ffff, defcd, abebd, ca, b, fef, dfe)`

2) Using MergeSort, sort the following list of numbers. Show your work by drawing the merge-tree (as seen in the lecture slides) to show each merge and join of intermediate steps. Assume that when there are odd number of elements, that the left 'half' will include the extra element.
`Numbers = [5,7,9,1,3,4,8,6,2]`