CS3383, Winter 2019 Assignment # 5

Rasoul Shahsavarifar

Faculty of Computer Science, UNB

Due time: Friday, Feb/15/2019, 1:30 p.m

Student's full name: ..... Student ID:.....

Note:

- No submission after the due time will be accepted.
- The full credit will be given only for correct solutions that are described clearly.

Question 1 (7 marks) (Based on exercise 5.21 of DPU textbook) A *feedback edge* set of an undirected graph $G = (V; E)$ is a subset of the edges $E' \subseteq E$ that intersects every cycle of the graph. Removing E' will make the graph acyclic. Design and write a greedy algorithm that will, given a graph G with positive edge weights, find a feedback edge set E' of minimum total weight. Analyse your algorithm's running time.

Question 2 (5 marks) (Based on exercise 5.32 of DPU textbook) A server has n customers waiting to be served. The service time required by each customer is known in advance: t_i minutes for customer i. Customers are served one-at-a-time, so the time that a customer waits is the sum of their service time and the service time of all the customers served before them. Give an order that will lead to the minimum total waiting time (summed over all customers), and prove that why this order is optimal.

Question 3 (4 marks) (Exercise 5.17 of DPU textbook) Under a Huffman encoding of n symbols with frequencies $f1, f2, \ldots, f_n$, what is the longest a codeword could possibly be? Give an example set of frequencies that would produce this case.

Question 4 (4 marks) (Based on exercise 5.32 of DPU textbook) Suppose that $n = 2^k$, where n and k are integers. Prove that there exists an instance of the set cover problem (Section 5.4 DPU textbook) with following properties.

a) There are n elements in the base set.

b) The optimal cover uses just two sets

c) The greedy algorithm picks at least $\log n$ sets.