PhD/ M.Sc. Engg. CSE

30 August 2019

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 6283: Advanced Algorithms

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **3 (three)** questions. Answer all of them.

Figures in the right margin indicate marks.

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1. a) Define Turing Machine. How did Turing prove that, the 'Halting Problem' is undecidable? 9

   b) Prove that circuit satisfiability problem is NP-hard. 8

   c) Given the recursion 8

   $$T(n) = aT(n/b) + f(n), \quad a \geq 1, \; b > 1$$

   Prove that if $f(n) = \Omega(n^{(\log_b^a + \varepsilon)})$ for some constant $\varepsilon > 0$ and if $af(n/b) < cf(n)$ then, $T(n) = \Theta(f(n))$

2. a) Show the results of inserting the keys in a B-Tree with minimum degree 3: 9

   S, F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E

   b) Given the flow network defined by the adjacency list below: 8

   source -> $v_1 = 16$
   source -> $v_2 = 13$
   v_1 -> v_3 = 12
   v_2 -> v_1 = 4
   v_2 -> v_4 = 14
   v_3 -> v_2 = 9
   v_3 -> sink = 20
   v_4 -> v_3 = 7
   v_4 -> sink = 4

   Find the maximum flow for the network.

   c) Prove the correctness of Dijkstra's algorithm for finding single source shortest paths. 8

3. a) In an e-commerce site customers browse the products randomly by clicking on the links and thumbnails. The browsing habits indicate their buying habits and hence can be mined for product recommendations. Elaborate the idea of using association rule mining, sequence mining, and graph mining in click streams for product recommendations. 15

   b) Construct/Define the dynamic programming algorithm/equation for DTW and Viterbi algorithms. 10