BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations (July 2021 Semester)

Sub: **CSE 462** (Algorithm Engineering Sessional Quiz)

Full Marks: 40 Time: 50 Minutes (Sections A + B)

The figures in the margin indicate the full marks.

SECTION - A

Answer all **THREE** questions in this section

1. Briefly describe the topics and results that you have covered in your lecture. (4)

2. Write two short questions based on the portion that you taught in the class. The question should reflect your overall understanding of the topics covered in your lecture. (*Your questions must be different than the questions of Section - B*) (2)

3. Answer the questions that you have written as part of the answer to Question no. 2. (6)

SECTION - B

There are **TWELVE** questions in this section. Answer any **SEVEN**.

1. When do we call an algorithm a parameterized algorithm? Write the role of kernelization for parameterized algorithms? (2+2)

2. Suppose you are trying to connect some points on a 2D plane by wires of shortest total length. Give an example where a steiner tree (with additional points) gives better solution than a minimum spanning tree of the points. (4)

3. Give a short proof sketch for the proposition - *Vertex Cover can be solved optimally in polynomial time when the maximum degree of a graph is at most 2.* (4)

4. What are the reductions required to clean up a graph G to form a Feedback Vertex Set? (4)

5. Formulate a parameterization for Linear Programming Vertex Cover or LPVC. (4)

6. What is solution compression? How can this technique be used for Vertex Cover? (4)

7. Can we solve Feedback Vertex Set problem using iterative compression technique? Why or why not? (4)

8. "In terms of running time, we cannot do better than $4^k n^{\mathcal{O}(1)}$ for Disjoint Feedback Vertex Set" - is this statement correct? Why or why not? (4)

Contd ... P/2

CSE 462

9. Color-coding can help reduce the input space of k-path problem by resolving a dependency thus improving the time and space complexity. - Explain (4)

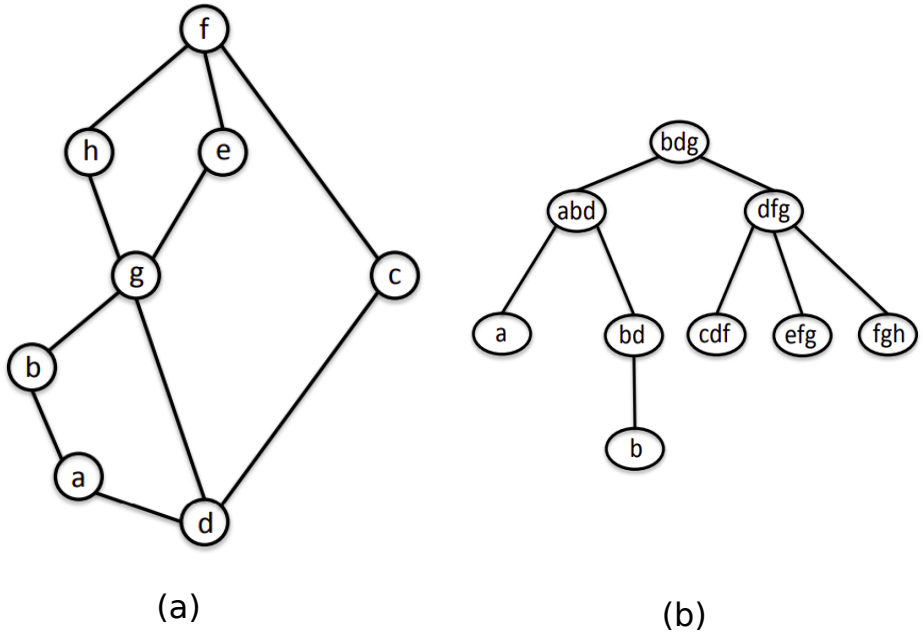

Figure 1: A series-parallel graph and it's tree-decomposition

10. The figure above contain a series-parallel graph G and a tree decomposition of that graph G.
    (a) What is the treewidth of the tree decomposition shown in the figure. (1+3)
    (b) Convert the decomposition of 1 into Nice tree decomposition.

11. What are the properties of a Nice Path decomposition? Why is Nice path decomposition important in case of path decomposition of a graph? (3+1)

12. Express 3Colorability problem using monadic second order logic (MSO_2). (4)