

Department of Mathematics
Indian Institute of Technology Delhi
MAJOR TEST

Time : 2 Hour

MTL 342 Analysis and Design of Algorithms

Full Marks - 36

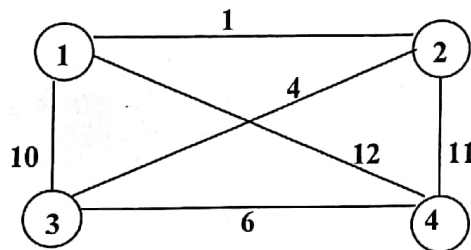
Date: November 19, 2019

Duration: 1:00 – 3:00 pm

Venue: LHC310

Q1 (a) Consider the following graph with each edge having its weight. Obtain the Minimum Spanning Tree for the graph using Branch and Bound method with D-search strategy.

Describe the search process.



(b) Explain why Dynamic Programming can be applied to find the largest common subsequence (LCS) between two given strings of characters. Use your scheme to find the LCS of the string $X = ABACDA$ and $Y = BADCA$.

[4 + 5 = 9]

Q2. (a) Explain the method of Huffman Coding for a given alphabet Σ of cardinality n .

Obtain Huffman codes for the Alphabet $\Sigma = \{ a, b, c, d, e, f, g \}$. Is it better than normal Binary coding? Justify your answer.

6, 7, 10, 12, 15, 20, 30

(b) What do you mean by a Matroid? Explain by stating its properties.

(c) Consider the problem of Optimal Storage on a tape for n files of lengths l_1, l_2, \dots, l_n

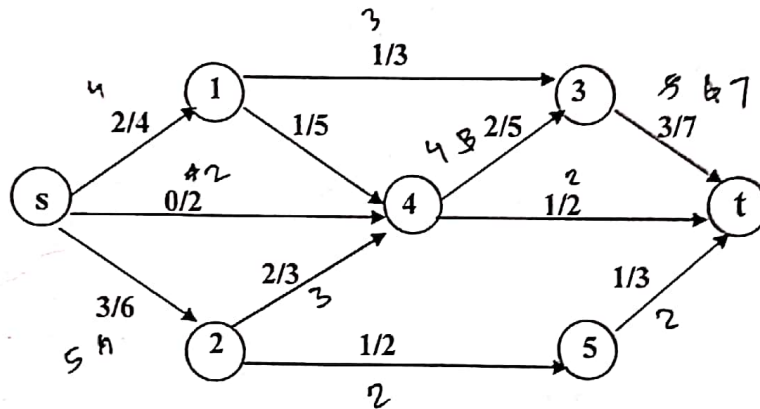
Can you explain the solution of the problem through Matroids?

[4 + 2 + 3 = 9]

- Q3. (a) Write nondeterministic algorithm to show Vertex Cover is in NP. Justify your answer.
- (b) Is Vertex Cover in NP-Hard? Justify your answer.
- (c) Consider the Boolean expression $a.(b + c).(\sim b + c + d)$, where a, b, c, d are Boolean variables. Can it be reduced to a Vertex Cover problem? Explain.

[3 + 1 + 5 = 9]

- Q4. (a) Explain the terms Flow, Cut, Residual capacity and Augmenting path referring to the following diagram – where each figure has its usual interpretation.



- (b) Prove that if a Network N does not have an Augmentation path with respect to a flow f then it is the maximum flow of the network.

[4 + 5 = 9]