NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR

Hazratbal, Kashmir (J&K)-190006

Department of Computer Science and Engineering

Semester: 8th (4th Year),

Subject: Graph Theory

ASSIGNMENT 1

Instructions:

1. *The assignment should be hand written.*
2. *Please don't copy the assignment from classmates.*
3. *The proof of the theorems should be step-wise.*

Max. Marks: 30

1. **Define the following terms/ operations in relation to Graph(s):**   *(10 Marks)*
    i. Vertex cover
    ii. Sub-graph
    iii. Induced Sub-graph
    iv. Maximum Matching
    v. M-saturated Graph
    vi. Union and Intersection operation
    vii. Cartesian Product and Decomposition operation
    viii. Stable-Matching.

2. **Prove the following theorems related to Bi-partite Graphs. Also explain through suitable example where ever it is mentioned in the question:**

    (12 Marks)
    i. ***Konig's theorem*** i.e. if G is a Bi-partite graph then the maximum size of a matching equals to the minimum size of a vertex cover of G.
    ii. ***Hall's theorem*** for a bi-partite graph. Support the proof of the theorem with relevant example.
    iii. If a Bi-partite graph G is K-regular with K>1, Then G has a perfect matching.

3. **Write step-by-step the Shapley Algorithm for Stable Matching and use it for finding Stable-Matching of any instance.**

    (4 Marks)

4. **Prove the correctness of Shapley-Algorithm so as to find the stable-Matching for any instance.**

    (4 Marks)