Assignment 5

Spectal Graph Theory

April 16, 2018

Reading Assignment

Reading assignment will consist of some advance topics in SGT. Link for the same are:

- Introduction to SGT
- Coloring and highest eigenvalue
- Cheeger's Inequality/ second EigenValue
- Leighton-Rao algorithm

You can also take a look at this couse, for video lectures. Interested students can complete all the slides on SGT from linear algebra course. References on some of the algorithms discussed in last lecture are:

- finding Bridges in O(m + n)
- Finding Articulation point
- 3D dp solution to count fixed length path for all pair of nodes

Sufficent codition for Hamiltonian cycle

Programming Assignment

Problem 1

In the lecture we discussed algorithm to find $\forall(i,j)\ st\ i,j \in V$, number of paths from $i \to j$ having length exactly k. This this problem you are required to find all paths having length $\leq k$. Formally "devise an $O(n^2k)$ algorithm to count the number of paths from $i \to j$ having length $\leq k\ \forall(i,j) \in V$, where $G = (V, E)$ containing multiedges and self loops".

Problem 2

We discussed an algorithm to find bridges in a given graph (though most of you were sleeping z^{z^z}).

A road network is under construction in iitk (to increase the reach to GHT :P), new roads are added one at a time. So you have to tell the number of roads which are most important for connectivity (basically bridges). Note that in this problem you have to tell number of bridges, everytime a new road is added. Formally you have to solve the problem discussed in lecture in online mode (graph is dynamic).

One possible solution could be to run the algorithm to find bridges, everytime a new road is added. But this will result in $O(q(n+m))$ q: queries (number of new roads added), So the motive of this problem is to reduce the complexity.

This is the link to solution, but visit it after you have given sufficient time.

Deadline

Since this assignment is long and endsems are near, last date for submission is 7^{th} may.

Note: This pdf contains hyperlinks, (awesome LaTeX :)), so click on text to find link.