Graph and Network: Course Description

- This course consists of two parts.
- The first part follows Chapters 7, 8, 9, 10, 11, 12 and 13 of

  L. Lovász, J. Pelikán, K. Vesztergombi, Discrete Mathematics: Elementary and Beyond, Tsinghua University Press, 2006.

  We will go through all these very basic material quickly (perhaps, in one month) and will assign some additional reading. We wish you relish the beauty of Concrete Mathematics and have a feel of some ad hoc aspect and algorithmic aspect of mathematics.
- The second part basically follows

  B.P. Kitchens, Symbolic Dynamics: One-sided, Two-sided and Countable State Markov Shifts, Springer, 1998.

  I dare to spend most of the class time on this part because, as Andreas Dress asserts and I fully support, "Networks are **snapshots** of dynamical systems and dynamical systems are networks **in action**". The topic coverage for this part will depend on the progress in the course. But we expect to finish at least the first four chapters of the above-mentioned book. We choose to focus on this special direction of graph (network) theory, rather then spending time among several directions, so that we can go a bit deeper to demonstrate the beautiful connection among various branches of mathematics. We wish you find the usefulness of the language of graph theory even in some Abstract Mathematics.
- Here you find the stories of how one of the greatest graph theorists develops and has fun in his mathematics:

  W.T. Tutte, Graph Theory As I Have Known It, Clarendon Press, 1998.
- Here are some randomly chosen material from the internet, from which you can have some idea of the second part of this course:

  E.M. Coven, Z.H. Nitecki, On the genesis of symbolic dynamics as we know it, `http://front.math.ucdavis.edu/0611.5322`

  B. Marcus, R. Roth, P. Siegel, Introduction to Coding for Constrained Systems, `http://www.math.ubc.ca/~marcus/Handbook/index.html`

  Symbolic Dynamics and Linear Algebra: `http://www.mth.uea.ac.uk/~h720/teaching/symbolicdynamics/`
- To pass this course you need to have a good study habit. Please read the following which I copied from `http://www.math.wisc.edu/~brualdi/475syllfall07.pdf`:

This course does require considerable work. You should be devoting at least 6 hours a week outside of class to it; reading the book, thinking about the ideas, concepts, and techniques, talking with some of your classmates about them, doing all the assigned exercises, doing many of the unassigned exercises, etc. It is expected that students will read the book - not everything you should learn and know will be discussed in class. Of course, I will write stuff on the chalkboard but I will not write the book on the board! The class and the book will reinforce each other, and neither is a replacement for the other. Questions and comments from students are very much encouraged. It's best to do the reading assignments before the class in which they are discussed. In the class, we (you and I) will discuss the material - class participation is encouraged and expected.

Something more from `www.math.harvard.edu/~propp/192/09-13.doc`:

As in most math courses, you'll be learning facts and mastering techniques, but you'll also have opportunities to explore problems for which you haven't been given all the tools yet, for which you'll need to use a mix of rigorous and non-rigorous reasoning. You'll also have opportunities to communicate ideas orally and in writing. ... Lots of ways to participate: answering a question (correctly or not) in a way that propels the discussion forward; asking a good question; giving a synthesis or a recapitulation. (Or, occasionally: "I think Joe was trying to say something."). The only dumb questions are the ones that don't get asked. In asking a question, you show that you know what's confusing you. Don't ridicule other students' questions. Feel free to interrupt with questions. But you should also respect my decision if I feel the need to rein in the discussion (say, so that we can cover everything you'll need to know in order to do the homework). ... If you have suggestions about the way the course is run, let me know. Don't wait until it's too late for me to change what I'm doing. Keep track of your good ideas! If you find clever alternative solutions to homework problems, or simpler proofs of the theorems we discuss, make a note of them, so that two years from now, when you ask me to write a letter of recommendation for grad school, and I ask "Who are you?", you'll be able to say "I'm the person who ..."

- The grade for this course will be determined by several quizzes, reading reports, oral presentations, and final exam. If you are in my class, I will expect to learn something from you. You are judged not only by what you learn from what I teach in class but also by what you learn from the suggested readings, and additionally, by the NEW ideas which you can contribute and impress me.

- Your interest and curiosity in the chosen topics described above is important to make this course a happy experience for you. **Before you decide or decide not to register to this course, please think the matter through.** For your reference, I should tell you that I hope very

much the following assertions from `www.math.harvard.edu/~propp/192/09-13.doc` will apply to my course as well:

To enjoy this course, you'll need to have some tolerance for spontaneity. I can't give you a week-by-week syllabus, because at this point I don't know how much time we'll need to spend on the different topics. I've taught much of this material in various courses at the undergraduate and graduate levels, but this is the first chance I've had to thread these pearls together in this particular order, to form this particular necklace. So you can expect me to have the enthusiasm a professor has when creating a new course. Also, spontaneity does not mean lack of preparation. Part of my contract with you is that each time we meet I'll have something new to tell you, that I'll tell it to you clearly and if possible entertainingly, and that I'll let you go by the time the bell rings.