COMP 760B Random Graphs and Complex Networks

Advances in computational technology have made possible the creation and study of large complex networks. This has led to the development of random models of such networks. These random networks can then be compared and contrasted with their real world counterparts. To the extent that the real world networks behave like a specific random model, we can learn about the real network by analyzing the model. If a real world network differs from a random model then determining how and why deepens our understanding of it.

We will study various random models of networks and determine their properties. At first we focus on the degree distribution of such networks, the size of their components, and the expected distance between two vertices which lie in the same component. We will then go on to consider various other connectivity and routing parameters, and random walks on such graphs, as time permits.

We will consider the classical Erdos-Renyi random graph model, uniformly random graphs with a given degree sequence, preferential attachment models, random geometric graphs, random subgraphs of the square lattice, and other models.

We will need to use various probabilistic tools, specifically inequalities which bound the concentration of a random variable around its mean and results on the behaviour of branching processes.

Each student will be expected to give a presentation on empirical studies of some real world network and a comparison with an appropriate random model.

We will rely on Remco Van Der Hofstad's two volumes of course notes entitled *Random Graphs and Complex Networks* initially. This can be downloaded from the web. We will use other sources later in the course, these will also be made available electronically.

We will try and develop our understanding using the Moore method, so students should refrain from reading ahead in the book.

Evaluation will be 25% participation in class discussions, 15% presentation, 60% final.

My office is MC301, and my office hours are 10:00-12:00 on Wednesday.

In case you have not heard: McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures.