Math 773: Adv. Methods in Graph Theory, Spring 2015

Instructor: Kevin Milans (milans@math.wvu.edu)
Class Meetings: TuTh 10:00am-11:15am in Armstrong Hall 313
Office Hours: TuWTh 11:30am-12:30pm, and by appointment, in Armstrong Hall 408H
Webpage: http://www.math.wvu.edu/~milans/teaching/sp15/math773/

Welcome: Welcome to Math 773: Advanced Methods in Graph Theory. I have the highest hopes and expectations for our class this semester. To truly learn advanced mathematics, you must actively engage the material in an aggressive way. Before you proceed to a proof, think about the theorem. Play around with some examples. What principles are at work? Why is the theorem true? How might the proof be structured? Thinking about these questions will build a bridge between the new material and your existing knowledge. Those connections will make it much easier to understand and remember the proof, appreciate its beauty, and to recognize when similar principles and techniques apply to new problems. After reading the proof, you might try some modifications. Can any of the hypotheses be weakened? Can any of the conclusions be strengthened? Is there any way to modify the proof to make it more natural or easier to understand?

Learning Outcomes and Course Goals: Students will be introduced to selected advanced techniques commonly used in research in graph theory, with particular emphasis on probabilistic and algebraic approaches. Probabilistic topics include concentration inequalities, the local lemma, and martingales. Algebraic topics include combinatorial nullstellensatz, spectral graph theory, and construction from algebraic objects.

Prerequisite: The assumed background is mathematical maturity (i.e. facility with proofs) and elementary graph theory. The course is intended for PhD students and advanced/ambitious Masters students.

Textbook: No text is required for the class. Material will come from a variety of research articles and texts, including: *The Probabilistic Method* by N. Alon and J. H. Spencer; *Graph Colouring and the Probabilistic Method* by M. Molloy and B. Reed; *Algebraic Graph Theory* by C. Godsil and G. Royle.

Homework: Homework is crucial to gain a full understanding of course material. Homework is assigned roughly once every two weeks. Discussions with fellow students and the instructor are permitted, and indeed, encouraged. Your written work must be entirely your own, which implies that *you must fully understand everything written down on your paper under your own name.*

External sources: Homework problems are designed to be challenging. If you become stuck, try thinking about the problem in a different way. Try out some small examples. After you have made a good faith effort, explain what you have thought about and ask your instructor for a hint. Set the problem aside and return to it an hour or two later. As a last resort, and only after expending considerable time and effort on a problem, you are permitted to consult external sources. An external source is any source of information or ideas besides class notes, students presently enrolled in the class, and the instructor. As part of your solution to a homework problem, *you must cite all external sources used.* Failure to cite an external source is cheating. Using and citing an external source does not change the requirement that all written work must be your own, and you must understand what you have written under your own name.

Homework Time Impact: Please plan to spend an average of about 20 to 25 hours per homework assignment (10 to 12.5 hours per week). Part of learning involves trying approaches that do not work. This takes time and can be frustrating, but take heart! Everyone who studies and conducts research in mathematics goes through the same struggle, so you are not alone. Just make sure you allot enough time.

Homework Grading Policy: Homework may be submitted up to 2 weeks late for a score of 85% of what its on-time score would have been. Homework that is more than 2 weeks late is not accepted. When computing your grade, your lowest scoring homework is dropped.

Exams: There will be no exams.

Evening Homework Sessions: Evening homework sessions will be held once a week. The evening sessions are dedicated to working on the current homework assignment in small groups (approximately 3 students per group). Students are encouraged to make serious attempts to solve some problems before the weekly sessions. Students will discuss the problems, brainstorm ideas, and find solutions together. The instructor will be available for assistance and to offer hints. Attendance is optional but recommended. The instructor reserves the right to cancel the evening homework sessions if they are consistently not sufficiently well-attended.

Grading Rubric: Course averages are converted to letter grades according to the scale on the right. The instructor reserves the right to lower these thresholds.

Homework	100%

A:	90–100	B:	80-89.9
C:	70-79.9	D:	60-69.9
F:	0-59.5		

Other Policy Notes: These policies cover all absences and contingencies, including those due to university Days of Special Concern. In truly exceptional cases, students may be excused from additional homeworks. Students with truly exceptional circumstances should contact the instructor as soon as possible, and appropriate arrangements will be made on a case by case basis.

Academic Integrity: You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will, at a minimum, result in an academic penalty of a score of zero on the assignment or test in question. Additional disciplinary measures are possible. For more information, see the university's Student Conduct Code.