Syllabus **Spring 2018**

AMS 303 Graph Theory

INSTRUCTOR:	Suil O
	Assistant Professor, Department of Applied Math & Statistics, SUNY Korea
CLASS:	Mon, Wed 10:30 am - 11:50 pm, Room: A116
OFFICE:	Academic Building B523
OFFICE HOUR:	Tu 3 pm - 5 pm, Th 10 am - noon or by appointment.
	I also welcome questions by email.
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Test: Robin J. Wilson, *Introduction to Graph Theory,* (5th Ed.), Prentice Hall
Text: Alan Tucker, *Applied Combinatorics,* (6th ed.), Wiley
Text: Abraham Sinkov, *Elementary Cryptanalysis,* (2nd ed.), Mathematical Association of America
subtext: Douglas B. West, *Introduction to Graph Theory,* (2nd ed.), Prentice Hall

Course Outline:
1. General Graph Theory Foundations (Wilson, Chap. 1, 2) 4 class hours
2. Planar Graphs and Duality (Wilson, Chap. 4) 6 class hours
3. Graph Coloring (Wilson, Chap. 5) 6 class hours
4. Polyas Enumeration Formula (Tucker, Chap. 9) 4 class hours
5. Network Flows (Tucker, Chap. 4) 8 class hours
6. Graphs and Games (Tucker, Chap. 11) 2 class hours
7. Cryptanalysis (Sinkov, Chap. 1, 2) 8 class hours
8. Examinations and Review 4 class hours

Homework: Homework will be assigned weekly (approximately), posted on blackboard. Each homework needs to be turned in on the due date at the beginning of lecture. There will be approximately 10 homework sets, equally weighted, and I will drop the lowest two scores before computing your average. **No late homework will be accepted.** (Since I drop the 2 lowest scores, missing a homework due to illness should not be a problem.) You may discuss homework problems with other students taking the course, with the TA, and with the instructor. But the work that you turn in should always be your own write-up, and you should show that you personally understand everything that you write. **Please make certain that your writing is neat and clear, and that you have expressed your reasoning, not just the final answer**.

Tests

Midterm:	Wednesday, April 4, in class
	Wednesday, May 16, in class
Final:	Take-home and Presentation

Grading of Tests and Homework

Your total average score will be computed based on 5% Attendance, 5% Quiz, 15% Homework, 30% per midterm, and 15% Take-home Final. The final letter grade is assigned using the scale :

A: 93-100, A-: 90-92, B+: 87-89, B: 83-86, B-: 80-82, C+: 77-79,

C: 73-76, C-: 70-72, D+: 67-69, D: 63-66, D-: 60-62, F: < 60

Learning Outcomes

1. Develop skill with proofs in graph theory (this is the only Applied Math course that teaches proofs), including:
   - the careful use of definitions and stated conditions, and their consequences;
   - direct arguments;
   - indirect arguments, i.e., proof by contradiction;
   - proof with generalized figures.
2. Examine graph theory topics in greater depth (than AMS 301) with a focus on studying and extending theoretical results:
   - general graph properties;
   - planar graphs;
   - graph coloring, including edge and face coloring.
3. Understand the theory behind Polyas Enumeration Formula and use this understanding in applied problem-solving.
4. Develop the network algorithms for:
   - maximal minimal flows;
   - maximal matching;
   - the transportation problem.
5. Understand the set-theoretic constructions underlying the theory of progressively finite games and apply this knowledge to develop winning strategies for such games:
   - kernel of a game;
   - level-by-level construction;
   - Grundy functions;
   - direct sums of games, including Nim.
6. Use combinatorial reasoning to efficiently solve cryptograms based on keyword transpose encodings; extend this reasoning to solve polyalphabetic codes.

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

Americans With Disabilities Act

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Academic Affairs. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

Course Evaluations

Stony Brook University values student feedback in maintaining the high quality education it provides and is committed to the course evaluation process, which includes a mid-semester assessment as well as an end-of-the-semester assessment, giving students a chance to provide information and feedback to an instructor which allows for development and improvement of courses. Please click the the following link to access the course evaluation system: http://stonybrook.campuslabs.com/courseeval/

Attendance Policy

(1) All students of SUNY Korea are required to attend every class.
(2) Unexcused absences will affect seriously the students final grade in the course.
(3) If a student has over 20% unexcused absence, the students final course grade will be an F.

Example)
i) If the class is a 150 minute class, and is held once a week, the 4th unexcused absence of a student will lead to an F grade of the course.
ii) If the class is a 75 minute class, and is held twice a week, the 7th unexcused absence of a student will lead to an F grade of the course.
iii) If the class is a 50 minute class, and is held three times a week, the 10th unexcused absence of a student will lead to an F grade of the course.
iv) In Intensive English Course (IEC), if a student misses the class more than 40 hours in a semester, the student will receive an F grade on the course.

(4) Students should report the reason of absence to the instructor in advance, or immediately after the absence.
(5) When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the instructor.
(6) The instructor of the course reserves the right to excuse absences.
(7) The course instructor may excuse the absence if the submitted documentation fulfills the conditions below.

i) Extreme emergencies (e.g. death in the family)
ii) Severe medical reasons with doctors note (Not a slight illness)
iii) Very important events (e.g. national conference, official school event)

(8) At the end of semester, the course instructor should submit a copy of the attendance sheet to the Academic Affairs Office.

Tentative course schedule

Week	Date	Section	Material Covered
1	2/26	1.1	Definitions (Wilson)
		1.2	Examples (Wilson)
	2/28	1.4	Three puzzles (Wilson)
		2.1	Connectivity (Wilson)
2	3/5	2.2	Eulerian graphs and digraphs (Wilson)
	3/7	2.3	Hamiltonian graphs and digraphs (Wilson)
3	3/12	4.1	Planar graphs (Wilson)
		4.2	Euler's formula (Wilson)
	3/14	4.3	Dual graphs (Wilson)
		4.4	Graphs on other surfaces (Wilson)
4	3/21	5.1	Colouring vertices (Wilson)
5	3/26	5.2	Chromatic polynomials (Wilson)
	3/28	5.3	Colouring maps (Wilson)
		5.4	The four-color theorem (Wilson)
6	4/2		Review
	4/4		Exam 1
7	4/9	9.1	Equivalence and symmetry groups (Tucker)
	4/11	9.2	Burnside's Theorem (Tucker)
8	4/16	9.3	The cycle index (Tucker)
	4/18	9.4	Polya's formula (Tucker)
9	4/23	4.3	Network flows (Tucker)
	4/25	4.3	Network flows (Tucker)
10	4/30	4.4	Algorithmic matching (Tucker)
	5/2	4.5	The transportation problem (Tucker)
11	5/9	10.1	Progressively finite games (Tucker)
12	5/14		Review
	5/16		Exam 2
13	5/23	1.1	The caesar Cipher (Sinkov)
		1.2	Modular arithmetic (Sinkov)
14	5/28	1.3	Additive alphabets (Sinkov)
		1.4	Solution of additive alphabets (Sinkov)
	5/30	1.6	Multiplications (Sinkov)
15	6/4	1.7	Solution of multiplicative alphabets (Sinkov)
16	6/11	2.1	Mixed alphabets (Sinkov)
	6/14	2.2	Solution of mixed alphabet ciphers (Sinkov)