INQ 241A, Fall 2017: How to Run the World Efficiently

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Class Meetings Mondays, Wednesdays, Fridays: 1:10 – 2:10 PM in West 319

Office Hours

Mondays 2:30 - 3:30 PM Tuesdays
1:00 - 2:00 PM Wednesdays
2:30 - 3:30 PM Thursdays
10:30 - 11:30 AM and by appointment (email me)

About the Course

An important aspect of mathematical reasoning is modeling real world problems with various mathematical methodologies. This course applies a specific mathematical discipline, Graph Theory, to problems concerning optimization and efficiency. The course is split into six units, each of which focuses on a specific question. The first three units focus on various routing problems, the fourth on maintaining connections, the fifth on pairings, and the sixth unit focuses on resource management. Graph theory provides an avenue for advancing critical thinking skills, formulating complex problems into a mathematical structure, and applying and understanding limitations of solution techniques.

Required Materials

A Tour through Graph Theory; Saoub, pre-print
A Writer's Reference, Hacker
A basic hand held calculator

Intended Learning Outcomes

- Students will be able to describe and apply methodologies of mathematics or computer science appropriate for the course's discipline and topic.
- Students will be able to write about course topics clearly and effectively.
- Students will be able to interpret quantitative information related to the course topic.

Course Grades

The following table lists the weights for the various forms of assessment for this class.

Homework	12%
Paper	8%
Projects	30%
Tests (12% each)	36%
Final Exam	14%

A grade scale will be determined after final grades are computed, but will be no worse than the scale given below. Attendance and class participation will be considered when determining marginal grades.

B+ 87-89 C+ 77-79 D+ 67-69
A 94-100 B 83-86 C 73-76 D 63-66 F 0-59 A- 90-93 B- 80-82 C- 70-72 D- 60-62

Academic Integrity

Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work! No collaboration is allowed on quizzes

or tests. Unless otherwise stated, you many work together on the homework, but should write up your solutions separately.

Cell phones must be turned off prior to entering the classroom. Laptops may be used for note-taking during regular class sessions, if this seems useful to you, but you may not log on to the internet or to an email server unless specifically told to do so. The use of laptops and other electronic devices during an exam is strictly prohibited. This includes tablets, smart phones, and iPods. Any use of such devices during a quiz or exam will be considered a breach of academic integrity. Note that looking at or using your cell phone during a test or quiz is considered a violation of Academic Integrity regardless of your purpose or intent in doing so.

Attendance & Make-Up Work

Attendance is critical to the understanding of the material in the course; it is both required and expected. Any absence that is not discussed with the instructor prior to the missed class is considered unexcused. I will assume that if you accumulate 4 unexcused absences you are not interested in completing the course. After the 3rd unexcused absence, you, your advisor, and the registrar will be warned that another absence will result in your removal from the class (DF).

When absent, excused or unexcused, you are responsible for all material covered in class.
You will not be allowed to make up any work missed due to an unexcused absence.

Reading and Participation

The key to learning a topic in mathematics is participation. We will strive to have an active, rather than passive, classroom environment. The last page of the syllabus is a daily outline of the topics that will be discussed in class. You are fully expected to have read the appropriate section of the textbook **before** the class meeting! Lecture slides will also be available on Inquire. You should plan to print these out and bring them to class.
Additional notes will be written on the board.

Homework

Homework will be assigned regularly in this class (virtually every class period). You are expected to attempt every problem before the next class period and these will be due at the start of the class period immediately following the assigning of homework. Some problems will be graded for correctness (5 points), while the remainder will be graded for completion (5 points), for a total of 10 points.

If you will be absent, turn in your homework before the class period it is due, or have a friend turn it in for you. Late homework will only be accepted within 2 days of the original due date and will automatically lose the completion points.

Quizzes

There may be quizzes in this class. They may either be in-class quizzes or take-home quizzes. I may occasionally warn you about an upcoming quiz but you should be prepared to take a quiz on any given day. These will generally test definition knowledge and recognizing main concepts.

Projects

Projects will be assigned throughout the term. These are more in-depth and open ended than problems appearing in the homework and quizzes. Instructions will be handed out well in advance and I will gladly help you with the assignments up until the night before they are due. Projects will be graded on the correctness of the mathematics and models used, explanations of concepts, and the overall form of the document.

Paper

Even though this is a math course, we will be spending some time on written communication. Each project will contain a writing component, but the initial grade will primarily focus on the mathematics completed. By the end of the semester, one project will be expanded into a longer paper whose grade will more heavily rely on the written portion, though the correctness of the mathematics will still be emphasized.

Tests & Final Exam	Three tests will be given (roughly according to the schedule on page 4) throughout the semester. Each test will focus on the material learned since the last test, but as with most mathematics classes, the exam will necessarily require you to understand and remember things from the past. If you miss or will be missing a test for reasons beyond your control (college sports team event, sickness, family tragedy, etc.), notify me as soon as possible. An appropriate letter of documentation will be required to make up a test. The final exam will be comprehensive and given during the scheduled time for the final exam for Block 5: Wednesday, December 13th, 2:00 – 5:00 PM.
MCSP Conversation Series	The MCSP department offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications and other issues that face our discipline. You are invited be involved with all of these meetings; however participation in **at least one of these sessions is mandatory**. After attending, submit a one page paper reflecting on the discussion. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience. This reaction paper will be counted as a quiz and should be uploaded to Inquire using the appropriate link. If you are caught leaving the talk early or being disruptive, you will receive a 0 on the assignment.
Expected Work Hours	This course expects you to spend at least 12 hours of work each week inside and outside of class.

Week	Date		Section	Topic	Assignment Due
	Wed	Aug 30	1.1 – 1.2	K¨onigsberg Bridge Problem	
1	Fri	Sep 1	1.3	Touring a Graph	
	Mon	Sep 4	1.4	Euler Circuit Algorithms	
2	Wed	Sep 6	1.5	Eulerizing a Graph	
	Fri	Sep 8	1.5	Chinese Postman Problem	
	Mon	Sep 11	2.1	Hamiltonian Cycles	Project 1
3	Wed	Sep 13	2.2	HC Algorithms	
	Fri	Sep 15	2.2	HC Algorithms	
	Mon	Sep 18	2.3	Digraphs	Project 2
4	Wed	Sep 20		**Review**	
	Fri	Sep 22		**Test 1**	
	Mon	Sep 25	3.1	Shortest Paths	
5	Wed	Sep 27	3.1	Dijkstra's Algorithm	
	Fri	Sep 29	3.1	Dijkstra's Algorithm	
	Mon	Oct 2	3.2	Project Scheduling	
6	Wed	Oct 4	3.2	Project Scheduling	
	Fri	Oct 6		Additional Topics	
	Mon	Oct 9	4.1	Trees	
7	Wed	Oct 11	4.2	Spanning Trees	
	Fri	Oct 13	4.2	Spanning Trees	Project 3
				Fall Break	
	Mon	Oct 23	4.3	Shortest Networks	
8	Wed	Oct 25	4.3 – 4.4	Shortest Networks & TSP	
	Fri	Oct 27	5.1	Bipartite Graphs	
	Mon	Oct 30	5.2	Matching Strategies	Project 4
9	Wed	Nov 1		**Review**	
	Fri	Nov 3		**Test 2**	
	Mon	Nov 6	5.2 – 5.3	Matching Strategies & Stable Matching	
10	Wed	Nov 8	5.3 – 5.4	Stable & Non-bipartite Matching	
	Fri	Nov 10	5.4	Stable Roommates	
	Mon	Nov 13	6.1	Four Color Theorem	
11	Wed	Nov 15	6.2	Coloring Bounds	

Tentative Course Schedule

	Fri	Nov 17	6.3	Coloring Strategies	Final Paper
	Mon	Nov 20	6.3	Online Coloring	
12				**Thanksgiving Break**	
	Mon	Nov 27	6.4	Interval and Tolerance Graphs	
13	Wed	Nov 29	6.5	Weighted Coloring	
	Fri	Dec 1		Additional Topics	Project 5
	Mon	Dec 4		**Review**	
14	Wed	Dec 6		**Test 3**	
	Fri	Dec 8		**Review for Final**	
	Wed	Dec 13		**Final Exam: 2:00 - 5:00 PM**	

Note: The dates for assignments are approximate and may change by ±1 *class period. See Inquire or assignment instructions for exact due dates.*