INQ 241A, Spring 2016: How to Run the World Efficiently

Instructor

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Class Meetings

Mondays, Wednesdays, Fridays: 12:00 – 1:00 PM in Trexler 263
This course expects you to spend at least 12 hours of work each week inside and outside of class.

Office Hours

Mondays, Thursdays: 9:00 - 10:00 AM
Tuesdays: 1:00 - 2:00 PM
Wednesdays, Fridays: 10:45 - 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	10%
Papers	13%
Projects	25%
Tests (12% each)	36%
Final Exam	16%

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, though most projects can be done in small groups as detailed on the assignment. It is especially important to cite and discuss your sources on written work.

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 or any other electronic device, except for a calculator, during a quiz or 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.

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 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.

Papers

Even though this is a math course, we will be spending some time on written communication. We will be reading at least two articles related to the material in class and you will be asked to write short papers in response to these articles. In addition, 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 4: Wednesday, April 27th, 8:30 – 11:30 AM.

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.

Tentative Course Schedule

Week	Date		Section	Topic	Assignment Due
	Mon	Jan 18	1.1 – 1.2	Königsberg Bridge Problem	
1	Wed	Jan 20	1.3	Touring a Graph	
	Fri	Jan 22	1.4	Euler Circuit Algorithms	Paper #1
	Mon	Jan 25	1.5	Eulerizing a Graph	
2	Wed	Jan 27	1.5	Chinese Postman Problem	
	Fri	Jan 29	2.1	Hamiltonian Cycles	
	Mon	Feb 1	2.2	HC Algorithms	Project 1
3	Wed	Feb 3	2.2	HC Algorithms	
	Fri	Feb 5	2.2	HC Algorithms	
	Mon	Feb 8	2.3	Digraphs	Project 2
4	Wed	Feb 10		**Review**	
	Fri	Feb 12		**Test 1**	
	Mon	Feb 15	3.1	Shortest Paths	
5	Wed	Feb 17	3.1	Dijkstra's Algorithm	
	Fri	Feb 19	3.2	Project Scheduling	
	Mon	Feb 22	3.2	Project Scheduling	Paper #2
6	Wed	Feb 24		Additional Topics	
	Fri	Feb 26	4.1	Trees	
	Mon	Feb 29	4.2	Spanning Trees	
7	Wed	Mar 2	4.2	Spanning Trees	
	Fri	Mar 4	4.3	Shortest Networks	Project 3
				Spring Break	
	Mon	Mar 14	4.3 – 4.4	Shortest Networks & TSP	
8	Wed	Mar 16	5.1	Bipartite Graphs	
	Fri	Mar 18	5.2	Matching Strategies	Project 4
	Mon	Mar 21		**Review**	
9	Wed	Mar 23		**Test 2**	
	Fri	Mar 25		**No Class** (Good Friday)	
	Mon	Mar 28	5.2 – 5.3	Matching Strategies & Stable Matching	
10	Wed	Mar 30	5.3 – 5.4	Stable & Non-bipartite Matching	
	Fri	Apr 1	5.4	Stable Roommates	
	Mon	Apr 4	6.1	Four Color Theorem	
11	Wed	Apr 6	6.2	Coloring Bounds	
	Fri	Apr 8	6.3	Coloring Strategies	Final Paper
	Mon	Apr 11	6.3	Online Coloring	
12	Wed	Apr 13	6.4	Interval and Tolerance Graphs	
	Fri	Apr 15	6.5	Weighted Coloring	
	Mon	Apr 18		Additional Topics	Project 5
13	Wed	Apr 20		**Review**	
	Fri	Apr 22		**Test 3**	
14	Mon	Apr 25		**Review for Final**	
	Wed	Apr 27		**Final Exam: 8:30 - 11:30 AM**	

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