

## INQ 241, Fall 2021: Efficiency and Optimization

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Instructor	Dr. Karin Saoub Trexler Hall 270F	Phone: (540) 375-2348 Email: saoub@roanoke.edu																																		
Class Meetings	Mondays, Wednesdays, Fridays: 12:00 – 1:00 PM in Miller 013																																			
Office Hours	Drop-in times are listed below. Other times are available by appointment (just email me!), and can be conducted in person or on Zoom.  Mondays, Wednesdays, Fridays 11:00 – 11:45 AM																																			
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	<i>A Tour through Graph Theory</i> ; Saoub, Karin <i>EasyWriter</i> ; Lunsford, Andrea A. A basic hand held calculator Recommended: Laptop computer																																			
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. <table><tr><td>Homework/Quizzes</td><td>15%</td></tr><tr><td>Paper</td><td>10%</td></tr><tr><td>Projects</td><td>25%</td></tr><tr><td>Tests (12% each)</td><td>36%</td></tr><tr><td>Final Exam</td><td>14%</td></tr></table> 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. <table><tr><td>B+</td><td>87-89</td><td>C+</td><td>77-79</td><td>D+</td><td>67-69</td></tr><tr><td>A</td><td>94-100</td><td>B</td><td>83-86</td><td>C</td><td>73-76</td><td>D</td><td>63-66</td><td>F</td><td>0-59</td></tr><tr><td>A-</td><td>90-93</td><td>B-</td><td>80-82</td><td>C-</td><td>70-72</td><td>D-</td><td>60-62</td></tr></table>		Homework/Quizzes	15%	Paper	10%	Projects	25%	Tests (12% each)	36%	Final Exam	14%	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
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Expected Work Hours	This course expects you to spend at least 12 hours of work each week inside and outside of class.																																			

Face Mask  
Policy

The College has issued a mask mandate for the start of the semester that requires masks to be worn in indoor common spaces such as our classroom. You must wear a mask in this class. If you arrive without a mask, you will not be allowed to stay and may lose credit for attendance or in-class work. The Bookstore sells masks if you need to make a quick purchase. If the mandate is extended, you will be required to continue to wear a mask. By wearing face coverings, we protect our college community and its most vulnerable members.

Attendance & Make-  
Up Work

Attendance is critical to the understanding of the material in the course; however, you should not attend class if you are ill.

If you have a temperature of 100.4 or higher or other coronavirus symptoms, don't come to class. Call Health Services IMMEDIATELY. Do not come to class or go to any public area on campus. Do keep up with all readings, assignments, and deadlines. In order for your absence to be excused, you must give Health Services permission to notify me that you have consulted them about coronavirus symptoms. If Health Services informs you that you should isolate and not attend class for multiple days or weeks, inform me so that we can make a plan to keep you current in the course. All absences caused by consultation with Health Services about coronavirus symptoms or isolation ordered by Health Services will be excused but you will need to do the work and graded assignments even if we extend a deadline for you.

This course's policy for all other absences is that 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.*

No late work will be accepted unless you have contacted me prior to the due date and obtained permission to turn in late work. Permission will be granted only for rare circumstances outside your control, such as illness. Do not wait until the last minute to submit work that is due online.

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 may 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 in-class 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.

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. Each project will apply the concepts from a class unit to a business scenario, and therefore 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. A grading rubric will be provided along with the assignment instructions.

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, four of the projects will be compiled into a longer paper whose grade will more heavily rely on the written portion, though the correctness of the mathematics will still be emphasized. The paper will be a formal report that could be submitted to a business, and therefore must be a polished document with all figures and tables labeled and referenced appropriately.

Tests & Final Exam Three tests will be given (roughly according to the schedule on the last page) 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 block 4: Friday December 17, 2:00 – 5:00 PM.**

Co-Curricular Engagement The MCSP Department offers a series of talks (MCSP Conversation Series) that appeal to a broad range of interests related to these fields of study. These co-curricular sessions engage the community to think about ongoing research, novel applications and other issues that face our discipline.

Members of this class are invited be involved with all of these meetings. After attending, submit a one page paper reflecting on the discussion through Inquire. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience. These reflection papers earn extra credit, with .5% added to your course average for each attended, up to 2% total. In addition, individually you may request that other appropriate events count.

- Subject Tutoring** Subject Tutoring is located on the lower level of Fintel Library (Room 5) and is open 4 pm - 9 pm, Sunday -- Thursday. Subject Tutors are friendly, highly-trained Roanoke College students who offer free, one-on-one (and small group) tutorials in a variety of general education and major courses. Check out all available subjects and schedule 30- or 60-minute appointments at [subject\\_tutoring@roanoke.edu](mailto:subject_tutoring@roanoke.edu). If you have a question, feel free to stop by, or contact them at [subject\\_tutoring@roanoke.edu](mailto:subject_tutoring@roanoke.edu) or 540-375-2590. We hope to see you soon!
- Accessible Education Services** AES located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at [aes@roanoke.edu](mailto:aes@roanoke.edu) to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Becky Harman at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.
- Classroom Etiquette** I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.
- I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Week	Date	Section	Topic	Assignment Due	
1	Wed	Sept 1	1.1	Intro & Königsberg	
	Fri	Sept 3	1.2 – 1.3	Graph Terminology & Tours	
2	Mon	Sep 6	1.4	EC Algorithms	
	Wed	Sep 8	1.4 – 1.5	EC Algorithms	
	Fri	Sep 10	1.5	Eulerizing a Graph	
3	Mon	Sep 13	1.5	Chinese Postman Problem	
	Wed	Sep 15	2.1	Hamiltonian Cycles	
	Fri	Sep 17	2.2	HC Algorithms	Project 1
4	Mon	Sep 20	2.2	HC Algorithms	
	Wed	Sep 22	2.2	HC Algorithms	
	Fri	Sep 24	2.3	Digraphs	
5	Mon	Sep 27	3.1	Shortest Paths	
	Wed	Sep 29		<b>Review</b>	Project 2
	Fri	Oct 1		<b>Test 1</b>	
6	Mon	Oct 4	3.1	Dijkstra's Algorithm	
	Wed	Oct 6	3.1	Dijkstra's Algorithm	
	Fri	Oct 8	3.2	Project Scheduling	
7	Mon	Oct 11	3.2	Project Scheduling	
	Wed	Oct 13		Additional Topics	
	Fri	Oct 15	4.1	Trees	Project 3
<b>Fall Break</b>					
8	Mon	Oct 25	4.2	Spanning Trees	
	Wed	Oct 27	4.2	Spanning Trees	
	Fri	Oct 29	4.3	Shortest Networks	
9	Mon	Nov 1	4.3 – 4.4	Shortest Networks & TSP	
	Wed	Nov 3	5.1	Bipartite Graphs	
	Fri	Nov 5	5.2	Matching Strategies	
10	Mon	Nov 8	5.2	Matching Strategies	Project 4
	Wed	Nov 10		<b>Review</b>	
	Fri	Nov 12		<b>Test 2</b>	
11	Mon	Nov 15	5.3	Stable Matching	
	Wed	Nov 17	5.4	Non-bipartite Matching	

Tentative  
Course  
Schedule

	Fri	Nov 19	6.1	Four Color Theorem	
	Mon	Nov 22	6.2	Coloring Bounds & Strategies	Project 5
12				<b>Thanksgiving Break</b>	
	Mon	Nov 29	6.3	Online Coloring	
13	Wed	Dec 1	6.4	Interval and Tolerance Graphs	
	Fri	Dec 3	6.5	Weighted Coloring	Project 6
	Mon	Dec 6		<b>Review</b>	
14	Wed	Dec 8		<b>Test 3</b>	
	Fri	Dec 10		<b>Review for Final</b>	Final Paper
	<b>Fri</b>	<b>Dec 17</b>		<b>Final Exam: 2:00 - 5:00 PM</b>	

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