

James Madison University, Department of Mathematics and Statistics

Math 248 – Computers and Numerical Algorithms, Spring 2014

Section 3: MW 1:25-2:15, Miller G080, TuTh 2:00-3:15, Miller G080

Instructor: Dr. Stephen Lucas.

To contact me: In Person: Roop 112, Office Hours Monday 12:20-1:10, Tuesday 11:12:15 and 3:30-4:10, Wednesday 2:30-3:20 or by appointment. Phone: 568-5104, Email: lucassk@jmu.edu

Textbook: Notes by Dave Pruett and Anthony Tongen, made available on-line via Canvas. There are also a variety of introductions to programming (some with Matlab) available on the web.

Computing: We will be using Matlab as a programming environment, which can be purchased at the bookstore, or online (student edition) at http://www.mathworks.com/academia/student_version/. Matlab should also be available in all JMU computing labs. A flash drive (or online storage option) for storing your files is highly recommended.

Nature of the Course Content: Math 248 is a unique course, in which 1) you will learn the basics of programming in the high-level computer language MATLAB and 2) you will write efficient and well-structured programs to implement a variety of numerical algorithms to solve basic mathematical problems like: find the roots of a nonlinear equation, find the solution of a linear system of equations, numerically evaluate a definite integral, and determine and evaluate an interpolating polynomial. The relative emphases on these two objectives will be approximately 1/3 to 2/3. Most people, even those proficient in the daily use of computers, are unaware that computers can sometimes provide inaccurate or erroneous results, even when they are functioning correctly. Consequently, we will spend a good deal of effort identifying sources of error and performing error analyses. When all is said and done, you will not only be able to program numerical algorithms, you will be able to argue that your answers are (almost) correct! *Prerequisite: MATH 236, or co requisite MATH 236 and consent of instructor. This course is not open to students who have previously earned credit in MATH/CS 448.*

Goals of the Course:

- To develop an understanding of the logical structure and style of mathematics by:
 - Using reason in an orderly, cogent fashion.
 - Writing clear, well-organized solutions to problems.
- To develop an ability to use mathematics tools to solve problems and to transfer this knowledge to analogous situations by
 - Using polynomial, trigonometric, algebraic, exponential, and logarithmic functions in mathematical computations and modeling applications.
- To develop computational skills such as:
 - Constructing and algorithm to perform a specific task.
 - Writing a computer program in a high-level computer language.

Attendance: Attendance is one of the most important aspects of any mathematics course. In fact, there is a strong correlation between attendance and success. I will **not** accept any late work (i.e. exam, programming assignments, homeworks, etc.). If you miss an exam without first being excused, you will not be allowed to make it up. While my sympathy is directly proportional to your response speed, I do not guarantee sympathy. You or a family member should contact me as soon as possible if you have an extended illness or other extenuating circumstance.

Course grading: Homework (weekly): 36%, Completing Surveys: 4%, Programming Projects (2): 25%, Midterm Exam: 15%, Final: 20%.

- Your weighted average (as a percentage) determines your grade for the course on a scale that will be roughly A=85-100, B=65-84, C=50-64, D=40-49.
- Homework will be assigned weekly, will be due the following week, and will often be collected electronically. All electronic submission will be via Canvas.
- There will be two programming projects that are larger scale than the weekly homework. These will be quite challenging and will take **most** students a large block of time to complete properly. It is important to start as soon as possible, and only spend the few days before the due date writing up. Specific instructions will be on the projects.
- Exams will be taken on the dates listed below. The midterm exam will cover material from the proceeding sections; the final exam will be cumulative. Both will include a practical portion.

Getting Help: While working in groups is encouraged (one of the best ways of learning something is explaining it to someone else), I encourage you to ask a lot of questions, in lectures, by email or by phone. Office hours are an under-utilized resource that is there for you.

Disability and Special Circumstances: I strongly encourage students who require special arrangements to contact me during the first week of class. Students with disabilities need to register with the Office of Disability Services (ODS). Any discussion of special circumstances will remain confidential except for any necessary communication with ODS in case of a disability.

Academic Integrity: Academic integrity is extremely important. Therefore, we will strictly abide by the honor code found at <http://www.jmu.edu/honor/code.shtml>. Any breach of the honor code results in failure in this course. I encourage *working* in groups but not *copying* in groups. Functionally or logically identical programs are considered violations of the honor code to be prosecuted rigorously. If you have any questions about what does or does not fit under the umbrella of academic integrity, please contact me.

Vision and Encouragement: Please remember that Computers and Numerical Algorithms is only one part of your life, but right now it is an important one. Do not expect to understand the material immediately when it is presented in class. You must practice, read the textbook, practice, read the examples in the book carefully, practice, spend time programming, practice, spend more time programming, and practice. I expect an earnest effort; my job is to encourage you and give you the tools to succeed. Study habits formed now will have long-term effects.

Tentative Schedule, depending on snow: (please try and do the reading before class)

Week	Classes	Topic	Reading	Exam/Lab/Projects
1	1/13 – 1/17	History and Program Structure	Part I Chap. 1 & 2	HW 1 ass. 1/15, due 1/21
2	1/20 – 1/24	Programming Concepts I	Part I Chap. 3 & 4	HW 2 ass. 1/22, due 1/28
3	1/27 – 1/31	Programming Concept II	Part I Chap. 5 & 6	HW 3 ass. 1/29, due 2/4
4	2/3 – 2/7	Computer Arithmetic	Part II Chap. 1 & 2	HW 4 ass. 2/5, due 2/11 Project 1 ass. 2/3
5	2/10 – 2/14	Computer Error	Part II Chap. 2 & 3	HW 5 ass. 2/12, due 2/18
6	2/17 – 2/21	Fixed Point	Part II Chap. 4	No homework, work on project!
7	2/24 – 2/28	Rootfinding	Part II Chap. 5	HW 6 ass. 2/26, due 3/4 Project 1 due 2/27
8	3/3 – 3/7	Review	Review	Midterm Exam 3/6
	3/10 – 3/14	<i>Spring Break</i>		
9	3/17 – 3/21	Linear Algebra	Part II Chap. 6	Project 2 ass. 3/17
10	3/24 – 3/28	Linear Algebra & Interpolation	Part II Chap. 6 & 7	HW 7 ass. 3/26, due 4/1
11	3/31 – 4/4	Interpolation	Part II Chap. 7	HW 8 ass. 4/2, due 4/8
12	4/7 – 4/11	Differentiation	Part II Chap. 8	HW 9 ass 4/9, due 4/15
13	4/14 – 4/18	Integration	Part II Chap. 9	HW 10 ass 4/16, due 4/22
14	4/21 – 4/25	Languages & The Future,	Review	
15	4/28 – 5/1	Review, Group Presentations		Project 2 due 5/7
	5/2 – 5/8	Final Exam, Sec. 3	Fri 5/2 10:30-12:30 or Wed 5/7 1:00-3:00 (TBD)	

Advice from past 248 students:

- Make this class your top academic priority in terms of the amount of time you spend on it outside of class. Don't give up when programming; most errors you will encounter will be minor errors.
- Take this class seriously. Study hard and do NOT slack off!
- Ask a lot of questions during class time! Try to get as much help as possible before you have to try to write your program on your own. Also, clear up your weekends for the semester, you're going to be spending a lot of time in the computer lab.
- Do the programs early!!!! Do not wait till the last night to do them.
- My biggest advice would be to be prepared. The subject matter isn't easy and the amount of work is hard. ... Also, don't let the programs be the only thing that you work on ... And remember it's only one semester of your life.
- Keep up with the reading, do the homework, and ask questions.