CDS 251
Introduction of Scientific Programming
Course Syllabus
Fall 2021

1   General Information

Instructor: Dr Arie Croitoru (acroitor@gmu.edu)
STAR: Liam Whitenack (lwhitena@gmu.edu)
Class Days: Tuesdays and Thursdays 1:30 PM - 2:45 PM
Place: On-line Zoom session (synchronous instruction)
Alternative Place: BlackBoard Collaborative Ultra
Course website: Blakboard
Credits: 3.0
Office Hour: Mondays 3:00 PM - 4:00 PM online or by appointment.
Contact method: Via Blackboard discussion board (preferred) or direct email to the course team. Messages will typically be answered within 24-36 hours Monday to Friday; Messages sent during the weekend will be answered on the following Monday.

General information (please take note):

- Please follow Mason's health check and safe return to campus regarding COVID-19

- The modality for the the section is online synchronous "in-class" and students are expected to attend every online class meeting.

- During class sessions you will engage in hands-on work, and you are expected to be ready to work at the beginning of each session. Credit is given for the labs attempted in class only. If you miss a class, you should still attempt lab and submit it via blackboard for feedback as most labs lead directly into the homework.

- Some/All of our synchronous meetings in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Blackboard [or other secure site] and will only be accessible to students taking this course during this semester.

2   Course Objectives

Description:
This course focuses on elements of scientific programming using the Fortran language with

emphasis on the aspects used in the computational and data sciences. The "R" language is also covered in the spirit of program prototyping and visualization. The main goal of this class is to familiarize students with basic concepts of programming in computational sciences. This course has the following objectives:

- Introduce readily available tools using in scientific programming.

- Explore algorithms and analyze their performance.

- Survey algorithms that solve basic mathematical problems.

- Introduce methods of simulation to explore scientific problems.

3   Learning Outcomes

By the end of the course, each student will be able to:

- Understand capabilities and limitations of computers as pertaining to scientific programming.

- Utilize various software for the preparation, execution, and analysis of scientific problems.

- Apply fundamental algorithms to the solution of scientific problems.

- Manage the input and output of data.

- Code algorithms in Fortran.

4   Course Schedule (tentative)

The course schedule is divided into weekly learning units, where each unit focuses on a specific course topic. The actual Midterm date will be announced in class.

Week 1: Introduction to Scientific Computing. Why Fortran. Software you will need. GMU resources. POSIX/Unix/Linux quick primer with BASH. Fortran basic program structure. "Hello World". How to compile and run.

Week 2: Binary representations of numbers. Truncation, Rounding, Precision, Accuracy. Data Types. Flow Control. Operators.

Week 3: Arrays. Statistics. Sorting. Big O. Indexing. Intrinsic Functions. File I/O.

Week 4: Functions and Subroutines. Matrix multiplication. Determinant. 2x2 inverse. Easy encryption.

Week 5: Bubble Sort. Big O()

Week 6: Recursion. Factoral. Fibinacci. Quick Sort. Linear Algebra. Gaussian Elimination.

Week 7: Midterm Exam!

Week 8: Least Squares.

Week 9: Non-Linear equations.

Week 10: Taylor Series. Differentiation. Numerical Integration.

Week 11: Random Numbers. Histograms.

Week 12: Ordinary Differential equations.

Week 13: Simulations.

Week 14: "R" programming.

5 Course Format

- The course sessions will be part lecture / part lab. roughly half the class time will be lecture and half will be in class programming practice.

- Labs are done in class through active student participation

- Generally, a homework assignment will be given each week.

- Most homework assignments will be due in one week. Consult each homework on Blackboard for actual due date.

- The course offers a generous late policy (see below) but expect to loose points if your submission is late.

- In general, submitting incomplete work is better than no submission.

6 Technology Requirements

- Activities and assignments in this course will regularly use the Blackboard learning system, available at https://mymason.gmu.edu. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed settings using the speed test on this website.)

- **The course requires the use of a Fortran compiler and other freely available open source software**. This will be discussed on the first week of the class.

7 Course Expectations

- Students are expected to already be comfortable using a computer, accessing the internet, and have word processing skills.

- Student will be expected to learn to use developmental tools on their computer.

- Students work should show attention to detail. Getting the right answer is insufficient. Following the guides posted on the class page is required.

- Students are required to regularly check Blackboard for updates, announcements, and general information.

8 Assessment

8.1 Lab Work

- Labs are in class work and typically begin on the third week.

- Credit is given for attempting the lab in class whether or not it is completed.

- Students may do other work/homework/questions in class only if their lab is completed.

- No credit is given for late Labs but students are encouraged to complete the lab anyway as most lead directly into the homework.

- One lab participation grade is dropped.

8.2   Assignments

- All assignments are required to be completed.

- Most assignments have one week due dates. A few may be two week, please check each assignment for the exact due date.

- Assignments might not have equal weights.

- Reports and files should be submitted only through the "Assignments" section of Blackboard. Do not email assignments to the instructor's email or through the Blackboard email.

8.3   Late Policy

- Up to three weeks late, there will be a penalty of 2% per day. (Weekdays)

- Turned in before reading day, 30% penalty.

- Exceptions to this policy may be made on a case- by-case basis at the discretion of the Instructor.

- Deferral of course work is a privilege and not a right; there is no guarantee that a deferral will be granted.

8.4   Exams

- There will be one midterm exam and one final exam. The material covered in the exams will be announced in advance.

8.5   Course Grades

Homework assignments will be worth between 50 to 100 points each depending on their complexity. Some assignments may have bonus points available. At the end of the term, the weighted average of the assessments are as follows:

- In Class Lab Participation: 30%

- Assignments and Blackboard Quizes: 45%

- Midterm Exam: 10%

- Final Exam: 15%

The course follows Mason's incomplete (IN) grade policies [See https://registrar.gmu.edu/topics/incomplete/ for additional information]. Any requests for an incomplete grade must be submitted in writing .

9   Other Important Dates

Please refer to Mason's academic calendar for information on important dates and follow Mason's announcements on any calendar changes during the semester. The Mason calendar is available at https://registrar.gmu.edu/calendars/fall_2021/

10   Student Expectations

10.1   Academic Integrity

Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See https://oai.gmu.edu].

10.2   Honor Code

Students must adhere to the guidelines of the George Mason University Honor Code [see https://oai.gmu.edu/mason-honor-code/].

10.3   Mason Email

Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account. [See https://mail.gmu.edu].

10.4   Patriot Pass

Access to Mason's online system is done through a personal username and password known as the Patriot Pass. Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Blackboard, University Libraries, MasonLive, myMason, Patriot Web, Virtual Computing Lab, and WEMS. [See https://password.gmu.edu/index.jsp , this link also enables you to reset your password].

10.5   Responsible Use of Computing

Students must follow the university policy for Responsible Use of Computing. [See https://universitypolicy.gmu.edu/policies/responsible-use-of-computing/].

10.6 Students with Disabilities

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See https://ods.gmu.edu]. Please be proactive and let me know how I can help you with any disability issue.

11 Student Services

11.1 University Libraries

University Libraries provides resources for students. [See https://library.gmu.edu].

11.2 Writing Center

The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing.
[See https://writingcenter.gmu.edu]. You can now sign up for an Online Writing Lab (OWL) session as well as face-to-face session in the Writing Center (see the Tutoring section in the link above).

11.3 Counseling and Psychological Services

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See https://caps.gmu.edu].

11.4 Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights. [See https://registrar.gmu.edu/privacy].

12 Final Notes

- Any typographical errors in this Course Outline are subject to change and will be announced in class.

- The date of the final examination is set by the Registrar and takes precedence over the final examination date reported by the instructor.

- Recording of any kind (audio, video), reuse or remixing of course materials (including recorded videos), and further dissemination of course content is not permitted unless prior written consent of the professor and George Mason University has been given.