Syllabus - Spring 2021
BINF-734 Advanced Programming for Bioinformatics
CSI-739 Topics in Bioinformatics
CHEM-579 Special Topics

January 14, 2021

1 Information

Title: BINF-734 Advanced Programming for Bioinformatics
CSI-739 Topics in Bioinformatics
CHEM-579 Special Topics
Instructor: Dr. Jason M. Kinser
Location: SciTech Campus: K. Johnson Hall 252
Time: Tuesday 4:30pm-7:10
Text: Documents provided by the instructor. Some of the course will be based on "Python for Bioinformatics" J. Kinser, Jones & Bartlett, 2008. But this book is 12 years old and the Python scripts are outdated.
Prerequisite: Experience with any procedural programming language (C, C++, Java, Fortran, etc.) **Class Portal**: We will use Blackboard as a repository, discussion forum, posting grades, turning in homework, etc.

2 Purpose

The purpose of this class is for the student to gain an understanding of how to create a variety of programs to perform different bioinformatics tasks. The course will include descriptions of algorithms and methods by which these can be implemented into computer codes. This course will also attempt to replicate some recent bioinformatics publications.

3 Prerequisites

Previous programming experience is not required but is an advantage. Students with experience in Java, C/C++, C# or other procedural languages will be able to draw on this experience.

4 Course Pedagogy

Grading in this course is based upon:
BINF-734 Students

- 70% of the grade is based upon the programming assignments, and
- 30% of the grade is based upon a final project.

4.1 Schedule

We will adjust the schedule to accommodate class speed. It is possible to advance the timeline of the syllabus.

- Week 1: Intro to the course and Python and SQL.
- Week 2: Genbank files.
- Week 3: Building a database in SQLite.
- Week 4: Genbank to SQL
- Week 5: Sequence Alignments. Python arrays and numpy.
- Week 6: Dynamic Programming.
- Week 7: Multiple Alignments.
- Week 8: Clustering (Genetic algorithms and k-means)
- Week 9: Principle Component Analysis
- Week 10: Phylogenetic Trees
- Weeks 11-13. Topics will be selected based on student Master's or PhD research interests. Typical topics are:
  - Numerical and Image Representations of sequences
  - Self organizing maps
  - Basic Image Analysis
  - Skew Analysis
  - n-grams
  - Decision Trees
  - Normalization of gene expression arrays
  - New topics in recent publications
- Week 14: Semester Project Presentations

4.2 Programming Assignments

Student's will be required to write small programs for bioinformatics applications. These assignments are given out weekly excepting the first week, the last week, and on occasions where some topics last two weeks. Historically, there are 9 - 11 assignments within a semester.

Each programming assignment will consist of the following:

- Codes generated by the student,
- A small 1 or 2 page report that includes instructions on how to run the student's program and the results, and
- Data files generated by the student's program.

5 The Final Project

The final project constitutes 30% of the total grade for BINF-734 students.

The final project consists of the following steps:

1. Select a recent publication in the field of bioinformatics,
2. Obtain approval for the use of this publication, (you may change later but approval is required),
3. Obtain or generate data for this problem,
4. Identify the algorithms that are needed to replicate this paper,
5. Obtain or write the necessary programs, (In some cases, authors provide Python scripts. These can be used but will not be considered as part of your contribution to the project. You still need to add value to the project.)
6. Replicate a portion of the published work,
    - See the instructor about the amount of work that needs to be done,
    - In almost all cases the student will replicate only a small part of the published work,
7. Create an oral presentation.
8. Present the work on the last day of classes. (In some years it is necessary to also present on the day when the final would have been given.)

There are multiple project deadlines throughout the semester. The percentages are represent the contribution to the Project Grade:

- Week 3. (5%) Submit a chosen publication for instructor approval. You may submit more than one, but indicate your level of choice,
- Week 6. (5%) Submit a list of algorithms that your project will require. This can be as simple as a list such as,
    - Simulated Annealing,
    - Neural Networks,
- Week 8. (10%) Data collected or generated.
- Week 12. (10%) Working programs.
- Week 14. (70%) Presentations

6 Pandemic Policies

These policies are in effect for the Spring 2021 semester solely due to the pandemic.

6.1 Covid

All students taking courses with a face-to-face component are required to take Safe Return to Campus Training prior to visiting campus. Training is available in Blackboard (`https://mymason.gmu.edu`). Students are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (`www2.gmu.edu/safe-return-plan`). Similarly, all students in face to face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system, and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

6.2 Online

Due to the pandemic, students are invited to join the class through the **live** online broadcast if they are uncomfortable in being on campus. No one ... and I repeat ... no one will be penalized for viewing the class online instead of in-person. Please note that attendance during class time is required whether it be online or in-person. The instructor reserves the right to pivot to online if the pandemic causes problems in attending on-campus classes.

If you choose to view this class online, then you are required to have sufficient hardware, Internet connection, and a web camera.

One way or another, we will make this class work. I look forward to seeing you all on the other side of this pandemic.

6.3 Snow Days

If the campus is closed due to weather-related issues (or similar), we may still hold class through an online portal. This will prevent you from having extra classes at the end of the semester, as the anxieties of finals from other classes are piling up. If a closure situation arises, then we will communicate on the best plan of action.

6.4 Final Project Presentations

In most years, all students are required to give an oral presentation in front of the class. In this pandemic year, we may make adjustments which will include some students making professional quality video presentations. We will discuss this as the semester progresses.

7 Assistance and Legalities

Below are just of few support services available to students. The full list is at: `https://stearnscenter.gmu.edu/knowledge-center/knowing-mason-students/student-support-resources-on-campus/`

7.1 Recording a Class

You may not record this class. Recording a class can result in copyright violations and FERPA violations. Likewise, you may not record any meeting (such as a Zoom meeting) which includes other students. If you wish to record a meeting with just you and the instructor, then you must clearly inform the instructor that recording is taking place and must have the instructor's permission.

7.2 Active Military Service

If you are part of the US military and are activated during the semester, then please notify your instructor. We will abide by the Mason policy `https://catalog.gmu.edu/archives/2019-2020/student-services/military-services`

7.3 IT Support

If you are having difficulties with your Mason network account, or with software on the Mason network , please contact IT support: support@gmu.edu . Or pay them a visit in Innovation Hall: ITS Support Center, Innovation Hall, Room 226. You can also call them: 703-993-8870.

7.4 Academic Integrity

It is expected that students adhere to the George Mason University Honor Code as it relates to integrity regarding coursework and grades. The Honor Code reads as follows: "To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this: Student members of the George Mason University community pledge not to cheat, plagiarize, steal and/or lie in matters related to academic work." More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at `http://oai.gmu.edu/honor-code/`.

7.5 Accommodations

If you are a student with a disability and you need academic accommodations, please contact Disability Services (DS) at 703-993-2474. All academic accommodations must be arranged through DS.

7.6 Digital Communication

Privacy is important for faculty and student communications. Students are required to use their Mason email when communicating their instructors. Instructors, being employees of the State of Virginia, are required to use their Mason email when communicating with students.

7.7 Respect for Diversity

We at George Mason are proud of our leadership in diversity and inclusion. We also wish to respect all traditions. At the beginning of the semester, please inform the instructor about upcoming occasions (celebrations, remembrances or observances) which will affect your attendance in this class. By having this information at the beginning of the semester, it will become possible to make any necessary adjustments to accommodate.

7.8 Title IX

Notice of Mandatory Reporting of Sexual Assault, Interpersonal Violence and Stalking: As a faculty member, I am designated as a "Responsible Employee," and must report all disclosures of sexual assault, interpersonal violence and stalking to Mason's Title IX Coordinator per University Policy 1412. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as the Student Support and Advocacy Center (SSAC) at 703- 380-1434 or Counseling and Psychology Services (CAPS) at 703-993-2380. You may also seek assistance from Mason's Title IX Coordinator by calling 703-993-8730 or emailing cde@gmu.edu