Advanced Programming in Bioinformatics
The University of Toledo
Biomedical Science Program, Bioinformatics, Proteomics and Genomics, COMLS
BIPG 6200 Advanced Programming in Bioinformatics Section 001, CRN # 59666

Instructors: Sadik A. Khuder. Ph.D
Email: sadik.khuder@utoledo.edu &
Alexei.fedorov@utoledo.edu
Office Hours: By arrangement
Office Location: Room 12 RHC & 308 HSB
Office Phone: (419) 383-4089 **&** (419) 383-5270
Term: Fall 2021

Course Website: Blackboard Learn (if applicable)
Class Location: 127 HEB
Class Day/Time: Tuesday 8:00-11:00 am
Lab Location: 127 HEB
Lab Day/Time:
Credit Hours: 3

SPECIAL COURSE EXPECTATIONS DURING COVID-19

Maintaining a safe campus during the ongoing COVID-19 pandemic remains a top priority. UToledo continues to follow the guidance of the U.S. Centers for Disease Control and Prevention and Ohio Department of Health to keep our campus safe.

ATTENDANCE
The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Before coming to campus each day, students should take their temperature and complete a self-assessment for symptoms of COVID-19, such as cough, chills, fatigue or shortness of breath. Anyone with a temperature at or above 100.0 degrees Fahrenheit or who is experiencing symptoms consistent with COVID-19 should not come to campus and contact their primary care physician or the University Health Center at 419.530.5549. For more information on the symptoms of COVID-19, please go to https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

COVID-19 testing for sick students is available on both Main Campus and Health Science Campus. Call 419.383.4545 for an appointment. Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences. Students should notify their instructors and follow the protocols summarized in this document on Navigating COVID-Related Course Concerns.

In the event that you have tested positive for COVID-19 or have been diagnosed as a probable case, please review the CDC guidance on self-isolation and symptom monitoring, and report the disclosure to the Division of Student Affairs by emailing StudentAffairs@utoledo.edu or by connecting with their on-call representative at 419.343.9946. Disclosure is voluntary and will only be shared on a need to know basis with staff such as in the Office of Student Advocacy and Support, The Office of Residence Life,

and/or the Office of Accessibility and Disability Resources to coordinate supportive measures and meet contact tracing requirements.

FACE COVERINGS
Face coverings are required while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. Students will not be permitted in class without a face covering. If you have a medical reason preventing you from wearing a face covering due to a health condition deemed high-risk by the CDC, submit an online application to request an accommodation through the Office of Accessibility and Disability Resources. Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. Students already affiliated with the Office of Accessibility and Disability Resources who would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs. You may connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

VACCINATION
Doctors and other health care professionals agree that the best way to protect ourselves and each other is to get vaccinated. Case data clearly show that vaccines remain highly effective at preventing serious illness from COVID, including the highly contagious delta variant. If you have not yet received your COVID vaccine, the University encourages you do so as soon as possible. No appointment is needed to get the shot at the UTMC Outpatient Pharmacy, University Health Clinic or Main Campus Pharmacy. Once you receive the COVID vaccination, please register on the COVID Vaccine Registry site at:
https://utvaccinereg.utoledo.edu/.

SPECIAL NOTES
It's important to note, that based on the unpredictability of the COVID-19 virus, things can change at any time. So please be patient and understanding as we move through the semester. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.

COURSE/CATALOG DESCRIPTION

This course introduces students to programming methods commonly used in bioinformatics. The course consists of two parts. The first part focuses on Python programming and the second part focuses on R programming. The Python part of the course provides a general overview of the Python programming. Students will learn and practice programming concepts using the Python

programming language. Focus lies on how to think computationally and students will learn and practice to write programs to tackle problems in bioinformatics. The course will also contain a section on how to use code written by other programmers in your own Python programs. The R part of the course provides the programming tools needed for data analysis in bioinformatics. The student will learn how to access and summarize big dataset using the R program. Each section will be driven by a particular problem in bioinformatics and students will gain experience in R programming addressing bioinformatics problems.

COURSE OVERVIEW
The course will introduce students to a variety of programming and computational tools for addressing common problems in bioinformatics. Students will learn Python and R programming language through hands on exercises and assignments. Students will acquire knowledge and programming skills essential in the practice of bioinformatics.

STUDENT LEARNING OUTCOMES

After completion of the course, students should be able to:

L_1. Make use of the Linux/UNIX environment for parallel computing and program scripting.
L_2. Construct and experiment with basic programs in Python
L_3. Use external libraries with Python
L_4. Design a Python program to solve problem in bioinformatics
L_5. Construct and experiment with basic programs in R
L_6. Use R for handling big data
L_7. Use R-packages in statistics and data mining

TEACHING STRATEGIES
A variety of teaching methods will be used, including in class lectures, exercises, quizzes, project, and online instructional lectures and videos.

PREREQUISITES AND COREQUISITES
None

REQUIRED TEXTS AND ANCILLARY MATERIALS
There is no required text. All the required materials will be available on Blackboard. Readings will consist of original literature, review articles, and Python and R based books.

TECHNOLOGY REQUIREMENTS
None

ACADEMIC POLICIES

Graduate Policies: **http://www.utoledo.edu/policies/academic/graduate/**

UNIVERSITY POLICIES*

Policy Statement on Non-Discrimination on the Basis of Disability (ADA)*

The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

Students can find this policy along with other university policies listed by audience on the University Policy webpage (http://www.utoledo.edu/policies/audience.html/#students).

Academic Accommodations*

(Include the following, verbatim; please refer to the face-to-face syllabus guidelines for more guidance/details.) The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the Student Disability Services Office (http://www.utoledo.edu/offices/student-disability-services/) by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

ACADEMIC AND SUPPORT SERVICES*

Please follow this link to view a comprehensive list of Student Academic and Support Services (http://www.utoledo.edu/studentaffairs/departments.html) available to you as a student (please refer to the face-to-face syllabus guidelines for more guidance/details).

SAFETY AND HEALTH SERVICES FOR UT STUDENTS*Please use the following link to view a comprehensive list Campus Health and Safety Services available to you as a student (please refer to the face-to-face syllabus guidelines for more guidance/details).

INCLUSIVE CLASSROOM STATEMENT

In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

GRADING
Assignments   50%

There are 12 assignments in this course. These assignments are intended to improve skills in R and Python programming. The lowest assignment score will be dropped from the calculation of your final grade.

Quizzes   15%

There are 5 quizzes in this course. Each quiz will cover the material presented in that particular week. Few questions from previous quizzes may also be included. Further instructions will be supplied for each particular quiz.

Project   35%

A project will involve programming in both R and Python. A written report, along with a power point presentation, is required. More detailed descriptions of the project along with suggested topics will be posted to the course webpage at the appropriate times during the term. The due date for project submission is last week of the course.

COURSE SCHEDULE

Week	Date	Topic	LEARNING OUTCOME(S)	A/Q*
1	9/01	Introduction to UNIX/Linux systems Parallel computing, and Python scripting.	L_1 , L_2	A1
2	9/08	Python Basics	L_2, L_3	A2
3	9/15	Functions and Modules in Python	L_2, L_3	A3
4	9/22	String manipulation and regular expression	L_2, L_3	A4Q2
5	9/29	Object-Oriented Programming	L_3, L_4	A3
6	10/06	Text mining	L_3, L_4	Q3
7	10/13	Overview of the R program	L_5	A4
8	10/20	R Language Fundamentals	L_5	A5
9	10/27	Data types and structures	L_5	A6, Q4
10	11/03	Big data manipulation in R	L_6	A7
11	11/10	Functions and Modules in R	L_5, L_6	A8, Q5
12	11/17	The Bioconductor	L_7	A9
13	11/24	Analyzing of mutation in Python	L_3, L_4	A10
14	12/01	Statistical models in R	L_5, L_6, L_7	A11
15	12/08	Sequence analysis in R and Python	L_3, L_4, L_7	Final exam

Assignments/Quizzes