**Keck Graduate Institute**

*School of Pharmacy and Health Sciences*

**GENE 5110**

Programming for the Biosciences

*Syllabus*

Fall 2022

**Course description:** Genetics, bioinformatics, and the broader health sciences depend deeply on computing. Creative and effective professionals in those fields use computing proactively: they are comfortable and capable across many different computational ecosystems. Specifically, computationally-empowered professionals draw on an experiential foundation of learning and problem-solving in bioinformatics and computing problem-spaces. They have worked in both -- at the same time -- and have worked through uncertainty and novelty from both directions. This class is a one-semester investment in precisely these foundational experiences.

**Course Hours/Credit: 3 credit hours**

|  |  |  |
| --- | --- | --- |
| **Course Coordinator and Instructor** | **Contact Information** | **Office Hours** |
| Dr. Zachary Dodds | Office: HMC McGregor 326Email: zdodds@gmail.com | W 7-9pm, HMC McGregor 205 or by appt |

**Course Goals:** In this class, every student will (1) read, run, author, and test their own small software programs (scripts). [In recent years, the scripting language used has been Python; we will continue to adapt.] In addition, each student will (2) explore genomic/bioinformatic data and processes through their own, and others', scripts, (3) build familiarity and problem-solving experience across several libraries, environments, and computing traditions which are common across bioscience communities, and (4) investigate, complete, and reflect on a sizable, self-designed computational project -- one that, if desired, can springboard into further, future computational pursuits.

**Teaching-Learning Activities:** The class will consist of presentation, context, and motivation (of new material), discussion/problem-solving in groups, a variety of weekly homework assignments, and a self-designed final project.

* Students will develop skills and experience in Python using Jupyter notebooks -- on their own machines/laptops. Introductory experiences will happen in class, reinforced by weekly homework challenges.
* Students will develop skills and experience using the command-line terminal, aka "the shell," including the handling and processing of large files on special purpose external hardware.
* Students will use computing in order to analyze and draw insights from bioinformatics and the biosciences.
* In the final weeks of the term, students will propose a self-designed computational project that overlaps with a professional and/or personal interest of their own. Then they will scaffold progress on that project, capping with a full-class presentation and a deliverable of software, slides, and a reflection on the experience.

**Schedule:**

|  |  |
| --- | --- |
| Week 0 | Introduction to computation: CS, Python, and information-parsing |
| Week 1 | From data to information: strings, structures, and slicing |
| Week 2 | CS's fundamental building blocks: *functions* and *files* |
| Week 3 | Self-similarity as design strategy: *recursion* |
| Week 4 | Top-down vs. bottom-up problem solving: analysis and synthesis of algorithms |
| Week 5 | Computation's building blocks: files and folders |
| Week 6 | Using the web via Python: gathering, parsing, and composing content |
| Week 8 | Python's primary strength: its *Libraries*, with **many** supporting the biomedical sciences |
| Week 9 | Python's biomedical and machine-learning ecosystems, Part 2 |
| Week 10 | Python's biomedical and machine-learning ecosystems, Part 3 |
| Week 11 | Piecing everything together: large-scale problem solving |
| Week 12 | Piecing everything together: final projects |
| Week 13 | Final projects... |
| Week 14 | Final projects... |

**Assessments and Academic Progress:** The student must achieve a score of 70% or greater on the cumulative score to pass the course.

**Formative assessments:** The in-class exercises (these are entirely participation-based); the weekly hw assignments (these are assessed each week).

**Summative assessments:** The student-designed final project.

**Grading criteria:**

Your final grade will be calculated as follows and will correlate to the percentage cutoffs of the Course Grading Scale described below:

Quizzes, In-Class Activities, and Participation 150 points 10% of course grade

Homeworks (9 x 100 pts) 900 points 60% of course grade

Final project 300 points 20% of course grade

Final Presentation 150 points 10% of course grade

**Total 1500 points 100%**

**Course Grading Scale:**

|  |  |  |
| --- | --- | --- |
| **Grade** | **Percentage Score** | **Quality Points** |
| A | 93 to 100 | 4.0 |
| A- | 90 to 92  | 3.7 |
| B+ | 87 to 89  | 3.3 |
| B | 83 to 86 | 3.0 |
| B- | 80 to 82 | 2.7 |
| C+ | 77 to 79 | 2.3 |
| C | 70 to 76 | 2.0 |
| F | <70 | 0 |

*Final percentages ending in the decimal 0.45 or higher will be rounded up. Numbers ending in 0.44 or lower will be rounded down. There will be no exceptions to this policy.*

Students whose attendance, behavior, or course performance is cause for concern may be sent an Early Warning Letter to encourage them to reach out to their instructor, advisor, peer mentor, and/or the Student Affairs office to make a plan for improving performance.

**Student Expectations:**

As with all courses, students are expected to exhibit professional, respectful, and sensitive behavior throughout the course. Behavior unbecoming of a professional will not be tolerated. Students are expected to follow all policies listed in the current Student Handbook including but not limited to:

* Student Grievance Policy and Procedures
* Grade-Related Grievances
* Student Professionalism and Conduct
* Academic Policies & Procedures

**Student Accommodations:**

Keck Graduate Institute is committed to providing an enriching academic experience for all students. In compliance with the Americans with Disabilities Act, it is the policy of KGI to provide reasonable accommodations for students with disabilities. Any student with a documented disability who requires reasonable accommodations should contact KGI Student Accessibility Services by e-mail at student.accessibility@kgi.edu.

**Copyright Policy:**

KGI respects copyright protection of original works of authorship (including but not limited to instructor slides, lecture notes, videos, and exam questions) and requires that students follow copyright laws as a condition of their relationship with the Institute. Information about the copyright policy can be found in the KGI Student Handbook.

**Mental Health and Wellness Resources:**

KGI values the full participation of all students in academic and campus life. We recognize that a variety of stressors can impact mental health, learning, and connecting with others. If you are having difficulty coping with life’s challenges, need someone to talk to, or just want some extra support, know that help is available and you are not alone. The Division of Student Affairs can offer you support and resources (kgistudentaffairs.slack.com). Some resources include, but are not limited to:

* **Campus Health:** <https://timely.md/faq/7c-health-the-claremont-colleges/> provides free 24/7 on-demand access for students to get quality medical and mental health care online or from their phone, anytime they need it. Use your student SSO login information to access.
* **Monsour Counseling and Psychological Services (MCAPS**)**:** 909-621-8202 <https://services.claremont.edu/mcaps/>; MCAPS is committed to promoting psychological wellness for all students served by The Claremont Colleges Services.
* **Campus Safety:** From cell phone or off-campus phone, call (909) 607-2000 or (909) 607-7233. Campus Safety can provide non-emergency assistance or information in a variety of areas.
* **National Suicide Prevention Lifeline:** 1(800) 273-TALK (8255) – 24/7 on call [www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org); The lifeline provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.
* **Office of Title IX**: (909) 607-7150 or deanofstudents@kgi.edu; The Office of Title IX provides information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources.