**ADVANCED BIOLOGICAL DATA ANALYSIS, BIOL 696**

Spring 2020 and Year

# COURSE INFORMATION

Class Days: TTh and Friday

Class Times: 1000-1050am

Class Location: SH-213 (TTh); NLS-126(Friday)

Mode of Delivery: lecture, lab, face-to-

Instructor: Dr. Scott Kelley

Phone: (619) 594-5371

Email: skelley@sdsu.edu

Office location: SLS373

Office hours: By Appointment

Instructor prefers to be addressed as “Dr. Kelley”. The preferred way of contacting the instructor is in class followed by email. Email responses could take a few days.

Project email: All assignments should be emailed to <biol696advbioldata@gmail.com>

# STUDENT LEARNING OUTCOMES

* Provide 5 - 8 SLOs consistent with purpose / scope of course that specify measurable, assessable knowledge, skills and abilities.
* Understand architecture of operating systems and databases.
* Learn theory and practice of the Linux command line operating system.
* Learn the iPython and Jupyter notebook systems, and the sci-kit bio libraries.
* Understand the theory and utility of data structures and how to apply them to biological data analysis.
* Learn and apply basic theory behind artificial intelligence algorithms, supervised and unsupervised.
* Understand fundamentals of statistical theory and practice relevant to programming statistical software and learn statistical programming, scripting and bioinformatics applications in the R language.
* Learn the fundamentals of object-oriented programming in the Python language, how to write basic classes and use objects for biological data analysis and be able to apply these concepts to lab projects.
* Master and apply computational algorithms for biological research, including completing a research project using open-source biological data.

# UNIVERSITY POLICIES

**Accommodations:** If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

**Student Privacy and Intellectual Property:** The [Family Educational Rights and Privacy Act](http://bfa.sdsu.edu/hr/oerc/students/ferpa.aspx) (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Blackboard to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

**Religious observances:** According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

**Class etiquette:** Please be considerate of your neighbors *and* the lecturer. Abstain from distractions such as carrying on conversations or entering and exiting during lectures. **Cell phones must be turned off during the lecture and lab.** If you must be available for a potential emergency, set your phone to vibrate.

**Academic Honesty:** The University adheres to a strict [policy prohibiting cheating and plagiarism](http://go.sdsu.edu/student_affairs/srr/cheating-plagiarism.aspx). Examples of academic dishonesty include but are not limited to:

● copying, in part or in whole, from another's test or other examination;

● obtaining copies of a test, an examination, or other course material

without the permission of the instructor;

● collaborating with another or others in work to be presented without the permission of the instructor;

● falsifying records, laboratory work, or other course data;

● submitting work previously presented in another course, if contrary to the rules of the course;

● altering or interfering with grading procedures;

● assisting another student in any of the above;

● using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);

● copying and pasting work from an online or offline source directly and calling it your own;

● using information you find from an online or offline source without giving the author credit;

● replacing words or phrases from another source and inserting your own words or phrases.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

**Resources for students:** A complete list of all academic support services--including the [Writing Center](http://writingcenter.sdsu.edu/) and [Math Learning Center](https://mlc.sdsu.edu/) – is available on the Student Affairs’ [Academic Success](http://go.sdsu.edu/student_affairs/academic_success.aspx) website. [Counseling and Psychological Services](http://go.sdsu.edu/student_affairs/cps/Default.aspx) (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at <http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx> between 4:00pm and 10:00pm or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

**Classroom Conduct Standards:** SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

● Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.

● Participating in an activity that substantially and materially disrupts the normal operations of the University or infringes on the rights of members of the University community.

● Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.

● Conduct that threatens or endangers the health or safety of any person within or related to the University community, including

1. physical abuse, threats, intimidation, or harassment.

2. sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

**Medical-related absences:** Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact of an absence, as well as any arrangements for making up work, rest with the instructors. [Student Health Services](http://shs.sdsu.edu/index.asp) (SHS) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student’s consent, communicate with the student’s instructors via the Vice President for Student Affairs and may communicate with the student’s Assistant Dean and/or the [Student Ability Success Center](http://go.sdsu.edu/student_affairs/sds/).

**SDSU Economic Crisis Response Team:** If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit [sdsu.edu/ecrt](http://sdsu.edu/ecrt), email ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.

# COURSE MATERIALS

|  |  |  |
| --- | --- | --- |
| Materials (including texts, readings, course fees, equipment, and any technology requirements) | Required or optional | Where and how it can be obtained |
| Linux Command Line | Req | Free pdf on blackboard |
| R Cookbook | Req | Free pdf on blackboard |
| A Little Book of R For Bioinformatics | Req | Free pdf on blackboard |
| Laptop | Req | Student must provide |

# COURSE DESIGN

The format of the course will be 2 weekly lectures and a lab course. The lectures will present material that is important for understanding Bioinformatics algorithms and fundamentals behind the Biology. This course includes hands-on learning in lab. The first part of each lab will include a short problem, to introduce the students to biological database analysis programming language basics. The rest of the lab will then be spent practicing on the computer. The professor will be available during the lab time to provide additional instruction and help students debug their code during the completion of in-class exercises or class projects. Students will also be encouraged to help one another with concepts and exercises.

All information for the course will be posted on Blackboard. Please be sure to consult Blackboard for scores, PDF files, notes, etc. A separate document lists specific lecture topics and dates, including due dates for assignments and exams.

# GRADING POLICIES

* Provide policies relating to course grading and final course grades.

Exams and Assignments

**NOTE 1:** ALL ASSIGNMENTS WILL BE EMAILED TO THE INSTRUCTOR USING THE FOLLOWING EMAIL ADDRESSES: [biol696advbioldata@gmail.com](mailto:biol696advbioldata@gmail.com)

**NOTE 2:** YOU HAVE UP TO ONE WEEK AFTER A GRADE IS ASSIGNED TO ASK QUESTIONS ABOUT THE GRADING OF YOUR ASSIGNMENT.

The following table details the combined total assignments for lecture and lab. The labs are all started in class and are due by the beginning of lab the next week. These labs include both the web-based bioinformatics labs and the programming labs.

*20% of the final grade will be based on the Final Research Project, which will include writing programs and analyzing a real biological dataset in collaboration with a faculty member at SDSU and involvement of the instructor.*

|  |  |
| --- | --- |
| **Assignment** | **Percentage** |
| Unix/Linux Assignment | 20 |
| R Project | 20 |
| Bioinfo Project | 10 |
| AI Project | 10 |
| Python Project | 20 |
| Final Project | 20 |
|  |  |

**Grading Range**

A: 93-100%

A-: 90-92%

B+: 88-89%

B: 83-87%

B-: 80-82%

C+: 78-79%

C: 73-77%

C-: 70-72%

D+: 68-69%

D: 60-67%

F: >=59%

Grades are rounded to the nearest percent.

# SCHEDULE

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Topics** | **Reading** | **Project** |
| 1/23-1/24 | CLASS INTRO | Web | Software Installation |
| 1/28-1/31 | Beginning Unix | Linux Command Line | Unix Lab 1 |
| 2/4-2/7 | Advanced Unix I | Linux Command Line | Unix Lab 2 |
| 2/11-2/14 | Advanced Unix II | Linux Command Line | Unix Lab 3 (BASH) |
| 2/18-2/21 | Basic R Stats & Jupyter | R Cookbook | **Unix Project Due** |
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| 2/25-2/28 | R for Bioinformatics | R Bio |  |
| 3/3-3/6 | Advanced Python I | TBD | **R Project Due** |
| 3/10-3/13 | Advanced Python II | TBD |  |
| 3/17-3/20 | Advanced Python III | TBD |  |
| 3/24-3/27 | *TBD* | TBD | **OOP Project Due** (*NO CLASS*) |
| 3/31-4/3 | **SPRING BREAK** |  |  |
| 4/7-4/10 | RNA Seq Analysis | TBD | RNA Seq Lab |
| 4/14-4/17 | Genomics & Metagenomics | TBD | Metagenomics Lab \* |
| 4/21-4/24 | AI: Machine Learning | TBD | Random Forests | **Bioinfo Project Due** |
| 4/28-5/1 | AI: Neural Networks | TBD | Neural Networks |
| 5/5-5/7 | WORK ON PROJECTS (*TBD*) | 5/7-last day of classes | **AI Project Due** |
| 14-May |  |  | **FINAL PROJECT DUE 5/9** |