

## **PLAS 420/AGRO 820 Bioinformatics Applications in Agriculture Syllabus**

The overriding objective of the course is for participants to develop a working knowledge of data handling, manipulation, and analysis relating to agricultural data sets with a primary focus on high throughput DNA-based sequence analysis. The course will provide an introduction to applied programming strategies to analyze biological data, efficiently manipulate large data sets, and automate workflows using Python and Shell scripting. Participants will also apply different strategies for assembling and analyzing data generated by modern high throughput sequencing platforms. The course is organized as an applied course and designed to provide advanced undergraduate students or graduate-level students in an agronomy related field basic training in bioinformatics applications.

### **Student learning outcomes**

- Be able to apply computational methods to analyze biological data
- Know how to efficiently manipulate large data sets, and automate workflows.
- Understand strategies for assembling and analyzing data generated by modern high throughput sequencing platforms.

### **Course information**

The course meets on Mondays, Wednesdays, and Fridays from 9:00 to 9:50.

Room TBD.

Zoom link will be provided for remote students

Note: if you are attending via zoom, you are encouraged to use your camera so we can see you.

### **Instructor Information**

Keenan Amundsen, Ph.D.

Turfgrass Geneticist

134 Keim Hall

Email: kamundsen2@unl.edu

Phone: 402-472-8390

Office hours: When my door is open or by appointment

### **Course Prerequisites**

AGRO 215 Genetics or equivalent. Undergraduate students must be at the senior class level standing.

### **Required text and materials**

There is no required text for this course. Open source software manuals will be provided as necessary.

A personal laptop computer with WiFi capabilities is needed. Required software tools will be provided through the course website. Please note that the instructor will make every attempt to minimize the need for installing specific software tools on your personal computers.

### **Additional Resources**

- Course website discussion board Help!!!! Forum.
- Open source books and publications will also be recommended throughout the course and upon request
- Peer resource recommendations are encouraged.

### **Attendance policy**

Attendance is required (either in person or remotely)

### **Assessment and grading policy**

Assignments should be completed in the allotted class time or by their due date. Late assignments will be penalized 10% of total points per day late.

Exam and final course grades will be assigned based on percentage of the total points earned using the grading scale below.

#### Distribution of points

##### *Students enrolled in PLAS 420*

Assessment	Points Contributing to Grade
Daily Assignments¥	340 pts (10 pts each)
Exams	300 pts (100 pts each)
Participation	100 pts
Total	740 pts‡

##### *Students enrolled in AGRO 820*

Assessment	Points Contributing to Grade
Daily Assignments¥	340 pts (10 pts each)
Advanced Assignments†	120 pts (10 pts each)
Exams	300 pts (100 pts each)
Participation	100 pts
Total	860 pts‡

¥ One to two daily assignments will be distributed per class. The number of assignments may change if the instructor determines that more attention is needed to address specific topics.

†24 daily assignments have an additional advanced assignment for extra practice, to reinforce learning outcomes, and to apply the methods of the assignment to a different problem. The advanced assignments are optional for students enrolled in PLAS 420, but 12 of the assignments are required for students enrolled in AGRO 820.

‡Point totals are subject to change at the discretion of the instructor and progress made by the class as a whole.

### *Note on daily assignments*

Daily assignments are graded on a completion basis. In most instances homework assignments will be due 1 wk after they are assigned. Late assignments will incur a 10% penalty per day late. Every attempt should be made to complete assignments in the allotted class time or before the next class meeting time to avoid falling behind with the course material. Contact the instructor if you need any extra assistance completing assignments.

### *Grading Scale:*

A+	>97	A	94-97	A-	90<94
B+	87<90	B	84<87	B-	80<84
C+	77<80	C	74<77	C-	70<74
D+	67<70	D	64<67	D-	60<64
F	<60				

### **Academic Dishonesty Policy**

Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty. The Student Code of Conduct is found here: <https://studentconduct.unl.edu/student-code-conduct>. Students are encouraged to contact the instructor to seek clarification of these guidelines whenever they have questions and/or potential concerns. Additionally, each academic program has approved a policy for student appeals involving courses in that program.

### **Guidelines on Face Coverings**

Our class will follow University guidelines regarding the use of face coverings in a classroom.

### **Students with disabilities**

Students with disabilities are encouraged to contact the instructor for a confidential discussion of individual needs for academic accommodation. It is UNL policy to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or meet course requirements. To receive accommodation services, students must be registered with UNL Services for Students with Disabilities (SSD), 132 Canfield Administration, 402-472-3787 voice or TTY.

### **Mental Health and Well-being Resources**

UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS) is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. Big Red

Resilience & Well-Being provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

### **Classroom emergency preparedness and response information**

The below information is provided for your information and safety in case you find yourself in an applicable emergency.

Considerations if there is an emergency

If the Fire Alarm is activated, exit the building by the nearest safe exit.

If it is a weather emergency, follow the instructions for your building.

For other emergency situations, consider the following

If immediate evacuation seems to be the best option, move to the closest exits away from the source of the emergency. You should hold hands in the air when exiting the building.

If immediate evacuation does not appear to be safe or feasible, consider one of these options.

If your room has a solid door with a lock, lock the door. If there is a second door in the room, also lock that door.

If the room is unable to be locked, consider whether a door that opens inward can be blocked.

If the room is unable to be locked or the door blocked, consider hiding in locations where appropriate.

Turn off the lights

Get low and move away from the door

Silence all cell phones and stay quiet

When the emergency is over and the group is exiting, move slowly and hold hands in the air.

### **List of topics**

Introduction, pre-assessment quiz, accounts

Introduction To Linux - system access

Introduction To Linux - file transfer

Introduction To Linux - basic navigation

Introduction To Linux - basic commands

Essential coding elements

BASH shell scripting

Intro to Python

Python data structures

Python advanced data structures

Python conditional statements

Python loops

Python data IO

Python pattern matching

Automating workflows BASH  
Automating workflows Python  
Intro to HTS - read quality assessment  
Read trimming  
De novo assembly  
Read mapping  
Reference-based assembly  
Differential gene expression analysis  
Identifying sequence variation  
Genetic Marker Development and Applications  
Gene annotation  
Data visualization  
Essential Python libraries