NORTHERN ARIZONA UNIVERSITY

School of Informatics, Computing, and Cyber Systems

INF 110 Discovering Informatics Syllabus

Term	Class No.	Section	Units	Days & Times	Room	Mode
Spring 21	9110	001	3	TuTh 9:35-10:50AM	Engineering 314	In person

Enrollment Requirements

Pre-requisite or Corequisite: MAT 125 or MAT 125H or Math Placement Test Results (ALEKS/MATHA 50+; MATHC 50+; PLACE 55+)

Course GitHub Page

https://github.com/marctollis/INF110-Discovering-Informatics-Spring22

Course BBLearn Page

http://bblearn.nau.edu

Instructor

Dr. Marc Tolliss
Email: Marc.Tollis@nau.edu
Office Hours: T, Th 1:00 – 2:00PM (or by appointment)
https://nau.zoom.us/j/84898643271
Meeting ID: 848 9864 3271
Password: 810269

Course Purpose

This course provides learning opportunities in the foundations of informatics, an interdisciplinary area fusing computer science, programming, and data analysis skills used to solve problems in any field, particularly the natural sciences, business, and the arts. This course will particularly focus on problems drawn from areas that provide significant benefits to human and environmental health. The course does not require any prior experience in programming and is intended for students of any background and major. This course also provides an opportunity for students to explore their interest in topics that are central to the Bachelor of Science in Informatics, Computer Science, and Applied Computer Science programs, and therefore be more informed in considering further study in one of these programs.

The course emphasizes broadly applicable skills in informatics that are applicable to many areas, so it is appropriate for students with an interest in applying informatics to an area of their own interest. The course will emphasize the Liberal Studies Essential Skill of quantitative reasoning by developing programs that apply numerical analyses to various data sets, followed by drawing inferences on the meaning of the analytic results to phenomena drawn from population health and ecological modeling. Furthermore, by focusing on foundational concepts central to informatics, the use of informatics-driven problem-solving methods, and the application of informatics to better understand and solve problems that benefit human and environmental health, the course also provides the necessary elements to satisfy NAU Liberal Studies requirements in the Science and Applied Science distribution block.

Course Student Learning Outcomes

Upon successful completion of this course, students will be able to demonstrate the following competencies:

- **LO1:** Describe and explain the foundational concepts of informatics, including concepts from computer science, numerical analysis, and applications in population health and ecological modeling (Science & Applied Science & Quantitative Reasoning);
- **LO2:** Select and apply informatics-driven problem-solving methods, including generally applicable high-level programming language control and data structures and data analysis techniques to various application domains (Science & Applied Science & Quantitative Reasoning);
- **LO3:** Select and synthesize algorithms and data structures with features appropriate to the problem being solved and within computational complexity requirements (Quantitative Reasoning);
- **LO4:** Select and synthesize programming techniques that promote high code-level quality, particularly unit testing (Science & Applied Science); and
- **LO5:** Apply and analyze results of data analyses and draw inferences on the meaning of these analyses, particularly in the context of population health and ecological modeling (Science & Applied Science & Quantitative Reasoning).

Assignments / Assessments of Course Student Learning Outcomes

Learning outcomes are assessed through a variety of means: A midterm and final exam assess student ability to describe and explain foundational concepts in informatics (LO1), supporting the assessment of Science and Applied Science distribution block outcomes relating to important theories, concepts, and taxonomies central to informatics.

Individual and team homework assignments assess student ability to synthesize and analyze informatics concepts and methods (LO2, LO3, LO4, and LO5), assessing Science and Applied Science distribution block outcomes relating to the application of informatics knowledge and techniques to problem-solving. Key homework assignments will include: History of programming languages and language design; practicing with functions and modules; object-oriented design and programming basics; source control and using git; identifying computational complexity patterns; implementing a singly-linked list; and implementing recursive solutions.

Individual and team programming assignments assess student ability to select and apply informatics-driven methods, algorithms and data structures, programming techniques, and data analysis inference (LO2, LO3, LO4, and LO5), supporting the assessment of Science and Applied Science distribution block outcomes relating to the application of informatics techniques to problem-solving, particularly in the areas of population health and ecology. While all programming assignments combine skills and support the Quantitative Reasoning and Scientific Inquiry Essential Skills, they can be categorized in two groups based on their primary purpose: One primarily aimed toward building and assessing programming skills through the implementation of analyses (more oriented toward Quantitative Reasoning) and another toward supporting and building skills for the investigation of scientific hypotheses in population health and ecology (more oriented toward Scientific Inquiry). Key programming assignments primarily aimed toward Quantitative Reasoning will include: introduction to cryptography and user and file I/O; developing a multi-class, object-oriented system and associated unit tests using unittest to ensure correctness; implementing a doubly-linked list and unit testing for edge cases; and implementing and exploring the complexity characteristics of sorting and strong processing algorithms. Key programming assignments primarily aimed toward Scientific Inquiry will include: using numerical analyses to assess the impact of diseases on populations; simulating animal population growth and testing hypotheses on predator-prey relationships and nutrient dispersal; using k-means clustering to make and validate disease epicenter hypotheses; implementing DNA sequence alignments to build phylogenetic models to examine disease spread patterns; and modeling social network structures and examining connectivity and segmentation to make disease transmission inferences.

Grading System

A weighted sum of assessment components is used to determine your final grade in the course:

- Homework assignments: **35%**
- Quizzes: 1**5%**
- Midterm Exam: **25%**
- Final Exam: **25%**

Grades will be assigned using the weighted sum described above using this scale:
A ≥ 90%, **B** ≥ 80%, **C** ≥ 70%, **D** ≥ 60%, **F** < 60%.

There is no "curve". Each student's grade is based on their own outcomes assessments and not affected by the grades of other students. Extra credit opportunities may present themselves throughout the semester and will be announced on the course website. Mistakes in grading may happen, and students are encouraged to discuss such concerns with the instructor during office hours.

Readings and Materials

Students will be required to use one online textbook for this class:

Inferential Thinking (IT) free at:
https://www.inferentialthinking.com

Students will also need access to a computer with the Anaconda distribution.

https://www.anaconda.com/download/

Class Outline and Tentative Schedule

The course topics and a tentative schedule serve as an outline for the class. Unless otherwise noted, materials for a module will be made available on the Friday prior to the module's start date. All assignments and quizzes are due on Sundays at 11:59pm except where otherwise noted.

BB Learn Week	**Topics**	**Date**	**In-class Plans**	**Reading**	**Assignment**
1	Course intro + Causality and Experiments	1/11	Lecture 1: Course Introductions Watch the Getting Started video and follow the instructions. Install the software ***before*** the next class.	IT Ch 1 & 2	Quiz 1
		1/13	Lecture 2: Causality and Experiments		
2	Python Expressions	1/18	Lecture 3: Simple Expressions	IT Ch 3	HW1, Quiz 2
		1/20	Literary Analysis		
3	Python Data Types	1/25	Lecture 4: More Expressions	IT Ch 4	Quiz 3
		1/27	Code snippets		
4	Python Sequences	2/1	Lecture 5: Arrays and Tables	IT Ch 5	Quiz 4
		2/3	Lecture 6: More Arrays		
5	Tables and Plotting	2/8	Lecture 7: More Tables	IT Ch 6	HW 2, Quiz 5
		2/10	Code snippets		
6	Visualization	2/15	Lecture 8: Charts	IT Ch 7	Quiz 6
		2/17	Lecture 9: More Charts		

			Lecture 10: Maps		
7	Python Functions	2/22	Lecture 11: Functions Lecture 12: Joins	IT Ch 8	Mini HW1, Quiz 7
		2/24	Midterm Review		
8 and 9	Midterm exam	3/1	Written Midterm	None	**Coding Midterm due 3/6 11:59PM**
		3/3	Coding Midterm		
10	Probability	3/8	Lecture 13: Probability	IT Ch 9	Mini HW2, Quiz 8
		3/10	Coding snippets		
NAU SPRING BREAK 3/14-3/18 NO CLASS					
11	Sampling and Modeling	3/22	Coding snippets	IT Ch 10 & 11	Quiz 9
		3/24	Coding snippets		
12	Comparing Samples and Estimation	3/29	Lecture 14: Estimation	IT Ch 12 & 13	HW 3, Quiz 10
		3/31	Code snippets		
13	Prediction	4/5	Means and Prediction	IT Ch 14 & 15	HW 4, Quiz 11
		4/7	Coding snippets		
14	Informatics Lecture	4/12	Background	IT Ch 16	INF HW
		4/14	Coding snippets		
15	Wrapping Up + Review	4/19	Final Review	None	
		4/21	Final Review		
16	Final exam	4/26	Written Final	None	**Coding Final due 4/29 11:59PM**
		4/28	Coding Final		

It is important that students understand that these topics and due dates are intended to serve only as a rough outline of the course, and the specific topics and due dates are liable to change. Due dates for quizzes and homework are posted on BBLearn. Please check BBLearn frequently for updates.

Course Policies

The following policies will apply to this course:

• Students who have not completed the prerequisite(s) for this course, or who are absent from the class during the first week may be administratively dropped from the course.

• The makeup and late work policies are as follows:
  o Quizzes: No make-ups or late submissions allowed.
  o Homework: No make-ups or late submissions allowed.
  o Exams: Make-up exams will be given only in the case of a documented emergency (preferentially supported by a class missed memo from Student Life https://nau.edu/student-life/classes-missedmemos/) and with approval from the instructor. Make-up exams may be considerably different than the original exam. Make-up exams must be taken within 3 business days of the original exam.

• Cheating and plagiarism are strictly prohibited. All academic integrity violations are treated seriously. All work you submit for grading must be your own. You are encouraged to discuss the intellectual aspects of assignments with

other class participants. However, each student is responsible for formulating solutions on their own and in their own words. Academic integrity violations will result in penalties including, but not limited to, a zero on the assignment, a failing grade in the class, or expulsion from NAU.

• Electronic device usage must support learning in the class. All cell phones, PDAs, music players and other entertainment devices must be turned off (or in silent mode) during lecture, and may not be used at any time. Laptops or workstations (if present) are allowed for note-taking and activities only during lectures; no web surfing or other use is allowed. I devote 100% of my attention to providing a high-quality lecture; please respect this by devoting 100% of your attention to listening and participating.

• Grades will be entered in BBLearn but your final grade will be calculated in Excel using the grading system described above and then entered in LOUIE. Your final course grade will not necessarily appear in BBLearn. Please check LOUIE for your final grade.

• Email to the instructor and teaching assistants must be respectful and professional. Specifically, all emails should:
  - o Contain a salutation, (for example, "Dear Austin")
  - o Contain a closing, (for example, "Best, Jane Doe")
  - o The body should contain complete sentences and correct grammar including correct usage of lowercase and uppercase letters. Composing emails on a mobile device is not an excuse for poor writing.
  - o The body of your message should also be respectful and explain the full context of the query.
  - o The subject should be prefixed with "INF110" so that the message can be easily identified or placed in an auto-folder. The subject should also use lower case and upper case correctly.
  - o Although email will typically be answered quickly, you should allow up to 24 hours for a response. If I do not get back to you within 24 hours, please send another message.
  - o If you have a question that would require a long response or you have a lot of questions, please come to office hours or schedule an appointment with the instructor.

• Visiting the instructor(s) during office hours is encouraged! I am happy to talk about the class, careers, research, and topics related (even loosely) to this course.