INF 405 & 505: *Advanced Concepts in Software Development* Fall 2021

I tell my students, 'When you get these jobs that you have been so brilliantly trained for, just remember that your real job is that if you are free, you need to free somebody else. If you have some power, then your job is to empower somebody else. This is not just a grab bag candy game.' – Toni Morrison

Course Staff

Instructor: George Berg
- Email: gberg@albany.edu (Probably the best way to reach me)
- Office: ETEC 350G
- Office Hours:
  - **Currently office hours are via Zoom (as opposed to in person).**
  - **Office hours may vary weekly owing to various factors. Please check the class calendar on Blackboard to make sure the instructor will be in.**
  - **Tuesdays, 1:30 – 3:00 PM:** https://albany.zoom.us/j/91810362109?pwd=OFoxK25LdGUycGtEMW9lZ0JvYzF1UT09&from=addon
  - **Thursdays, 3:30 – 5:00 PM:** https://albany.zoom.us/j/92009371634?pwd=S28yejRYdnNpMHpZRGNHOGw4dnVkdz09&from=addon
  - **Appointments:** You may also make appointments *via*: https://gberg.youcanbook.me/

- Phone: 1-518-250-9039 (Voice, voicemail, and text)
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Course Description (INF 405 and INF 505)

INF 405 *Advanced Concepts and Practices in Software Development* **(3 credits)**
A course in advanced software development techniques and practice. This will build on students' previous experience to enable them to create larger, more complicated projects. In addition to advanced language, library, etc. features, this course will emphasize concepts such as object-oriented design and development, software engineering, design thinking, etc. These will increase the scale of projects can achieve as well as increase their chances of successful development.

Prerequisites
The Prerequisite course for INF 405 is INF 308, *Programming for Informatics*, CSI 213, *Data Structures*, or permission of the Instructor.

The primary perquisite concepts necessary to attempt this course with a reasonable chance of success are:

- Knowledge and experience with a modern programming language equivalent to two full university level courses.
    - INF 108 and INF 308 or CSI 201 and CSI 213 are two typical pathways.
    - Python experience is *strongly* preferred.
      If you don't know Python, you'll have to pick it up during the run of the course.
- Significant experience:
    - Writing,
    - Debugging, and
    - Testing

  Non-trivial computer programs.

This course will build on these concepts and add several more.

Expected Student Outcomes

This is a senior/graduate level course that covers the wide range of skills and concepts that are necessary to design, implement, code, and test medium and large-scale computer software projects.

Course Goals

By the end of the semester, you should be able to

- As an individual, successfully **design**, **implement,** and **test** medium size computer programs in a modern programming language (currently Python).
- As part of a *team*, successfully **design**, **implement,** and **test** medium size computer programs in a modern programming language.
- **Evaluate** medium and large computer programs via a methodical testing regimen.
- **Demonstrate** a knowledge of how coding standards can improve the success of software projects.
- **Demonstrate** a knowledge of and ability to analyze the importance of end-user usability in programming projects.
- **Apply** the above concepts in assignments.
- Be **persistent** in solving medium to high complexity problems.
- **Develop** coherent problem-solving skills.
- **Work** effectively in teams.

Class Meetings

Lecture

This is an asynchronous online course. So, there are no lectures or meetings *per se*. The course is divided up into modules. Each module contains videos, assignments, evaluations, etc. Working through those, as well as interacting with the instructor and your fellow students make up the course.

Required Text

The required text for the course is:

- Allbee, Brian, *Hands-on Software Engineering with Python*. Packt Publishing. 2018. ISBN-13: 978-1788622011.
    - Buy/Rent the book from wherever you feel you can get your best deal.
    - Note: there are versions of the text that contain at least one extra chapter. That is fine. I'll identify chapters by name and by chapter number (in my version) to minimize confusion.

Recommended Text

There is no additional recommended text for this class.

Readings

In addition to the required text, there will be readings that will be available to the students online or *via* Blackboard. When these readings are assigned, the class will be told where they can be found.

INF 405 and 505 Grading

Category	Assignment Type	Weight Within Category	Category Weight in the Course
Individual Grades			60%
Team Grades			20%
Class Participation and Peer Evaluation			20%
	Peer Evaluation	25%	
	Class Participation (Instructor Determined)	75%	
Total			**100%**

The above formula is the definitive grading scheme. Any "Total," "Weighted Total," *etc*. given by Blackboard does not reflect the actual grading scheme and *should be ignored.*

Student Showcase
CEHC Showcase was designed as an opportunity for students to highlight and present interesting projects, research, and concepts they are learning within their courses. It also provides students with an opportunity to showcase their findings to others and develop highly desired presentation and people skills. We also use Showcase to recruit new students into our programs. The CEHC Virtual Showcase is Thursday, December 2, 2021. The Showcase may be virtual this fall (see the Spring 2021 Virtual Showcase for an example: https://ualbanycehc.blogspot.com/p/welcome.html).

Grades are assigned based upon the percentage of points achieved by the student in the course, as weighted per the above table. The overall course will not be curved, although the professor retains the right curve individual assignments if the grade distribution is extreme enough to unfairly weight the overall course against the students. Major letter grades will be assigned by the following thresholds:

Percentage Score	Grade
90 – 100%	A
80 – up to 90%	B
70 – up to 80%	C
60 – up to 70%	D
Below 60%	E

INF 505

This same course is offered as INF 405 and as INF 505. The latter is an enhanced version intended for graduate students. Students in INF 505 will do all the work in INF 405. In addition, INF 505 students will do substantially augmented (potentially) team projects relative to INF 405, and make a presentation at the UAlbany Student Showcase on December 2nd.

For the term project, INF 505 students have a set of additional set of deadlines (included in the class schedule, below).
The milestones for the project are:

- Project Topic Proposal (Due September 30th)
- Project Outline Proposal (Due October 14th)
- Showcase Presentation Outline Proposal (Due November 18th)
- Showcase presentation (Due December 2nd)

- Project final writeup (Due December 14th)

The University at Albany/CEHC Showcase event(s) are December 2nd. As mentioned above all INF 505 students will be expected to participate in the showcase either in person with a presentation. Additional details will be forthcoming later on in the semester but mark your calendars.

Succeeding as a Person, and as a Student (and in INF 405/505)

Being a successful student is more than doing well in your classes. It means that you are well, both mentally and physically. If you feel that you (or maybe someone you know on campus) are not doing well, you should definitely seek help for that situation.

Student Health Services: If you are feeling ill, or there is some other physical condition that is bothering you should go visit student health services. (https://www.albany.edu/health_center/). Your health and well-being are critical to your quality of life; you should take steps to preserve it.

Campus Counseling Center: Almost everyone at one time or another runs into problems that they cannot handle by themselves. In those situations, there is no shame or stigma associated with seeking help. On this campus, the Campus Counseling and Psychological Services (https://www.albany.edu/counseling_center/) is there to help. Whether your issue is stress, depression, sleep, or something else entirely, their staff have a number of ways to help you out. And remember, that you are not alone in these kinds of situations.

Disability Policy: Reasonable accommodations will be provided for students with documented physical, sensory, systemic, medical, cognitive, learning and mental health (psychiatric) disabilities. If you believe you have a disability requiring accommodation in this class, please notify the Disability Resource Center (518-442-5490; drc@albany.edu). Upon verification and after the registration process is complete, the DRC will provide you with a letter that informs the course instructor that you are a student with a disability registered with the DRC and list the recommended reasonable accommodations. You can review the Equity and Compliance website as well for additional information.

Student Emergency Fund: Are you (or again maybe someone you know on campus) facing an unforeseen financial hardship or emergency? These kinds of situations can be a serious obstacle to a student's being able to stay and successfully complete their degree. The University has a Student Emergency Fund program that may be able to help (https://www.albany.edu/studentaffairs/emergencyfund.shtml). These grants may be able to help.

UAlbany library: The University Libraries (https://library.albany.edu/) are much more than a book and journal repository. They offer a conducive place to study, and offer arrange of information services. Not really relevant to this class, but maybe in general, the University Library has **Library Research Resources** (http://libguides.library.albany.edu/c.php?g=537164&p=3677741) that can be of immense help with projects involving various kinds of research.

IT Services: Even if you are not in a technical degree program, every modern student uses digital technology and is affected by it (if you don't see that now, you will at the end of this course). The University Information Technology Services (ITS) offers a wide range of help and services for students (https://www.albany.edu/its/svc_list.php).

Copyright Policy

All course material and documents developed by the instructor are copyrighted and may not be reproduced or distributed without express written permission.

POTENTIAL SUBSTITUTION

Materials provided to you as part of this course are provided under Fair Use and the TEACH Act. These materials are provided for your educational use only and should not be shared, reposted, or further distributed. In addition, all materials and documents developed for this course are copyright protected and may not be reproduced or distributed without express written permission. Finally, you must follow appropriate citation practices for materials you reference in your work for this course. If you have questions, please ask.

Courtesy: In class discussions the instructor and students are expected to demonstrate professional behavior. This means cooperating and interacting in a courteous, supportive, and tactful manner based on mutual respect for each other's ideas.

Students and the professor should be professional at all time. Faculty should be addressed as Prof. XXX or Dr. XXX. Emails should be professionally written. For instance, they should begin "Dear…" and end with a "Thank you" or similar. *Disrespect in any form in any CEHC class will not be tolerated.*

Respect for Diversity: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.[1]

In General: It may not be cool or sexy, but a key to success is simply to be *reliable*. If you make a promise to your family or friends, keep it. The easiest way to succeed in a class is to attend class every time, do the reading, and complete the assignments. Not only do you get credit for attendance and the assignments, but this work helps you learn, and will pay off on subsequent assignments, tests, etc., as well as in grades, and in future career and grad school opportunities. Like the old Nike ad says, "Just do it!"

In addition, it is important to know what is expected of you, so that you can manage those expectations and balance them against your other commitments, energy, etc. For instance, a 3-credit UAlbany class implies an average nine-hour commitment each week (three in class, six outside for reading, assignments, study, etc.) So, you should budget an average of six hours per week for each of your classes. Sometimes it will take more, often less. But, that way you can avoid surprise time crunches.

[1] Respect for Diversity statement from https://www.brown.edu/sheridan/teaching-learning-resources/inclusive-teaching/statements

Course Policies

Make-up Policy: There are generally no make-up opportunities for missed assignments except in extenuating circumstances. Instead of asking to make up missed work, please use the course 'safety valves' described below.

Since there will be situations in your life when missing a class meeting is simply unavoidable, this course has 2 no-fault safety valves.

Safety Valve 1:

1. The lowest 10% of quiz scores are dropped.
2. The lowest 10% of other non-program scores are dropped.
3. The tokens system can potentially allow resubmission of some assignments (details TBA).

Peer Evaluations and programming assignments are *not* dropped.
A missed assignment will count against these (*i.e.* a zero from a miss would be your low score; you don't get a miss and a drop).

Safety Valve 2: If you become seriously ill during the semester, or become derailed by unforeseeable life problems, and have to miss so many assignments that it will ruin your grade, schedule a meeting with the instructor in order to make arrangements for you to drop the course to save your grade point average. Don't wait until it's too late to do this when you get in trouble.

Excused Absences: Some absences (e.g. military duty, jury duty, court appearances, documented medical illnesses and appointments, student athlete obligations, significant academic or professional opportunities, critical family emergencies) can be counted as excused absences. For these (the above and others; check with the professor if you have questions) to count, you must request an excused absence. Please email the Professor for excused absence requests.
The Professor will reply to your request. Accepted excused absences will not count against the student (i.e. those assignments will not count when calculating the student's course average). Denied requests and all other absences will count as unexcused. For unexcused absences, students will miss without credit all assignments for the day missed.

Late Assignments: Out of class assignments are due on the due date, by the assigned time. Late individual assignments will be accepted, but at the cost of a full letter grade for initially missing the deadline, and an further letter grade for each additional 24 hours late.

Withdrawal from the Course: The **drop date** for the Fall 2021 semester is

- **Monday, November1, 2021 for both undergraduate and graduate students.**

That is the last date you can drop a course and receive a 'W'. It is your responsibility to take action by this date if you wish to drop the course. In particular, grades of "incomplete" will not be awarded to students because they missed the drop deadline. Given that dropping a course can have financial aid implications, please see your advisor or the Financial Aid office before dropping a course so you understand the implications that action can have on your aid.

Students with Disabilities: Students who feel that they have disabilities that require special arrangements for them to take the course *must* register with the Disability Resource Center. Students are eligible for special services to which both the Center and the professor agree. In general, *it is the student's responsibility* to contact the professors at least one week before the relevant assignment to make arrangements. You can contact the Disability Resource Center in Campus Center 137, or at 442-5490, if needed.

Incompletes: As per the Undergraduate Bulletin, the grade of Incomplete (I) will be given "only when the student has nearly completed the course requirements but because of circumstances beyond the student's control the work is not completed." A student granted an incomplete will make an agreement specifying what material must be made up, and a date for its completion. The incomplete will be converted to a

normal grade on the agreed upon completion date based upon whatever material is submitted by that time.

Important: Incompletes will *not* be given to students who have not fulfilled their classwork obligations, and who, at the end of the semester, are looking to avoid failing the course. This is asking for special treatment.

Responsible Use of Information Technology: Students are required to read the University at Albany Policy for the Responsible Use of Information Technology available at the ITS website: https://wiki.albany.edu/display/public/askit/Responsible+Use+of+Information+Technology+Policy

Academic Integrity

In this class, some course work and examinations are *individual* exercises. The individual work that you do must be *yours* – not that of other students, friends, tutors, *etc*. While it may seem like the easy way out of doing the assignments to copy them from others, this strategy will backfire on the tests, when you will not know the material you would have learned from doing the assignments. You may of course form study groups, discuss assignments and techniques in general terms, *etc.*, but the assignments themselves *must* be your own work. In particular, two or more people may not create an individual assignment together and submit it for credit. *Please ask if you have any questions about academic integrity.*

I am also personally offended by cheating, in part because it hurts the honest students in the class. We will try our hardest to catch cheaters. If we catch a student cheating, we will not go easy on him or her. Given that, is it really worth it?

The Undergraduate Bulletin states the university's policies on academic integrity. You will be held to these policies. You are expected to be familiar with them.

A (non-exhaustive) list of unacceptable activities is:

- Allowing other students to see or copy your assignments.
- Examining or copying another student's assignments.
- Allowing other students to see or copy your work during an exam.
- Examining or copying another student's work during an exam.
- Getting answers or help from people, or other sources (*e.g.* research papers, web sites) without acknowledging them.
- Defacing or deleting class shared documents.
- Lying to the Professor about issues of academic integrity.

Any incident of academic dishonesty in this course, no matter how "minor" will result in

- No credit for the affected assignment.
- A written report will be sent to the appropriate University authorities.
- One of -
    - A final mark reduction by *at least* one-half letter grade (*e.g.* B → B-, C- → D+),
    - A Failing mark (E) in the course, and referral of the matter to the University Judicial System for disposition.

Policies from Undergraduate Bulletin: http://www.albany.edu/undergraduate_bulletin/regulations.html

Timeline

Week	Week Date	Topic	Reading (Ch)	Activity
1	8/23/21	Introduction & Module 1: *Python Foundations*	Text: *Development Tools and Best Practices* (5 – Print Version/6 – Electronic Version)	Program 1 Video Quizzes
2	8/30/21	Module 1	Text: *Development Tools* (5/6) Materials: Coding Standards • PEP 8 Style Guide for Python: https://www.python.org/dev/peps/pep-0008/	Program 1 (Continued) Video Quizzes
3	9/6/21	Module 1	Materials: *Basics of Python*	Program 1 (Continued) Video Quizzes Discussion Assignment
4	9/13/21	Module 2: Advanced Python, Larger Scale Programming Projects	Materials: *Advanced Python Concepts* • *Ten Topics Intermediate Python Programmers Should Know:* https://towardsdatascience.com/10-topics-python-intermediate-programmer-should-know-3c865e8533d6 • *Python3 Intermediate Level Topics:* https://www.geeksforgeeks.org/python3-intermediate-level-topics/ Larger Scale Programming Projects: • Text: *System Modeling* (2/3)	TBA
5	9/20/21	Module 2: Advanced Python – Objected Oriented Programming	Materials: Text: *Development Paradigms* (3/4) Object Oriented Programming • The SOLID Principles of Object Oriented Programming Explained in Plain English: https://www.freecodecamp.org/news/solid-principles-explained-in-plain-english/?fbclid=IwAR1ubovVabuhWEcuoCT7VU91BI1qyGDdii298ONWVX1jtqPA9WtK0DHHtQ0 Design Patterns • Design Patterns: https://sourcemaking.com/design_patterns • Design Patterns in Python: https://refactoring.guru/design-patterns/python	TBA
6	9/27/21	Module 2: Advanced Python – APIs and Packages	Materials: *APIs and Packages* Readings: • *The Python Standard Library*: https://docs.python.org/3/library/	TBA

			• *Modules and Packages:* https://www.learnpython.org/en/Modules_and_Packages	
7	10/4/21	Module 3: Software Project Management	Materials: *Design Thinking* • Text: *Development Practices* (3/4) • What is DevOps: https://intellipaat.com/blog/what-is-devops/ • An Introduction to DevOps: https://devops.com/introductiontodevops/ • A Beginner's Guide to Software Evaluation: https://wonderfulengineering.com/a-beginners-guide-to-software-evaluation/	TBA
8	10/11/21	Module 3	Text: *Process Standards* (5/6) • *An Overview of Packaging for Python*: https://packaging.python.org/overview/	TBA
9	10/18/21	Module 3	Materials: • Text: *Setting Up Projects and Processes* (6/7) • *An Introduction to Github*: https://digital.gov/resources/an-introduction-github/ • *An Intro to Git and Github for Beginners (Tutorial)*: https://product.hubspot.com/blog/git-and-github-tutorial-for-beginners • *How to Install Git on Linux, Mac or Windows*: https://www.linode.com/docs/development/version-control/how-to-install-git-on-linux-mac-and-windows/	TBA
10	10/25/21	Module 4: Database Integration	Materials: • Text: *Thinking About Data Object Persistence* (9/10) • SQL: https://www.sohamkamani.com/blog/2016/07/07/a-beginners-guide-to-sql/	TBA
11	11/1/21	Module 4	Materials: • *SQLite Python Tutorial*: https://www.sqlitetutorial.net/sqlite-python/	TBA
12	11/8/21	Module 5: Testing	Materials: • Text: *Testing Business Objects* (8/9) • *Getting Started Testing in Python*: https://realpython.com/python-testing/	TBA
13	11/15/21	Module 6: Advanced Topics	Materials: • Introduction to Pandas in Python: https://www.geeksforgeeks.org/introduction-to-pandas-in-python/ • Text: *Anatomy of A Service* (14/15) • *How to Make Sense of Distributed Processing with Python Daemons*: https://medium.com/better-programming/how-to-make-sense-of-distributed-processing-with-python-daemons-586ee12f7f4d	TBA

			• *PEP 3143: Correct Daemon Behavior*: https://www.python.org/dev/peps/pep-3143/#correct-daemon-behaviour • *Processes Intercommunication:* https://www.tutorialspoint.com/concurrency_in_python/concurrency_in_python_processes_intercommunication.htm	
14	11/22/21	Module 6: Advanced Topics	*Machine Learning and Data Science* Material: • *Installing Packages Using Pip and Virtual Environment*: https://packaging.python.org/guides/installing-using-pip-and-virtual-environments/ • *Your First Deep Learning Project:* https://machinelearningmastery.com/tutorial-first-neural-network-python-keras/	TBA
15	11/29/21	Module 6: Advanced Topics	*TBA*	TBA

Miscellaneous

Extra credit opportunities
During the semester the university and others hold events that may be of interest to students in this course. If you attend an event and write a summary and reflection piece on the event (specified in individual assignments) you may receive extra credit worth up to 1% of the course value. A maximum of 5% of extra credit can be accrued this way. There are no other extra credit mechanisms available in this course.