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CS103a:
Fundamentals of Software Engineering

Contact Details

Professor Timothy Hickey
Location: TBD
and on zoom at https://brandeis.zoom.us/j/94374699470

Office Hours on Zoom at https://brandeis.zoom.us/j/994399878
Mon 4:00-5:00
Wed 2:00-3:00
Thu: 2:00-3:00
Telephone: (617) 935-9065 (cell)
Email: tjhickey@brandeis.edu

Meeting Times

Classes
MWR 1:00-1:50
Recitation: Thu 5:00-6:30pm

Office Hours
M 4-5, W 2-3, R 1-2

Course Description

From the bulletin:
In this course, you will learn (and practice) the design and construction of large bodies of software using modern software engineering practices, including object oriented design, test driven development, working data, and project management. You will be challenged to solve different kinds of problems, using different approaches and different tools. The course also aims to teach the basic and expected knowledge and practice within industry for entry level developers. Usually offered every year.

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Learning Goals:

After successfully completing this course you will have mastered the following skills:

1. shell programming and scripting using bash and makefiles
2. releasing apps using containers using docker
3. distributed source control using git/github
4. object-oriented design in Python and Javascript
5. checkpoint and step debugging with modern IDEs (PyCharm, Eclipse)
6. continuous integration with automated testing suites
7. performance monitoring and profiling
8. analysis of large data sets with Pandas and Numpy
9. analysis of large data sets with SQL
10. visualization of data in Python with matplotlib, seaborn, plotly, and datapane
11. model/view/controller design of web apps with nodejs/express/ejs/mongoose
12. debugging and profiling of web apps
13. integration testing of web apps
14. using and creating REST APIs
15. creation of effective video presentations
16. development of clear and informative software documentation

Teaching/learning strategies

The course will require you to read online textbooks. Daily lessons will mix lectures, problem challenges, alone and also with others, and reflections.. You will be assessed on your mastery of the content with weekly quizzes consisting of questions designed for each of the core learning objectives. You will also demonstrate mastery by creating applications that use these skills to solve interesting problems of your own design.

Prerequisites

You must have taken (and passed) CS12b to take this course.

Credit Hours:

This course gives you 4 credit hours and will require 3 hours/week of class time and 9 hours of time outside of class working on your projects and preparing for classes.

Course Requirements

Academic Integrity

Every member of the University community is expected to maintain the highest standards of academic integrity. A student shall not submit work that is falsified or is not the result of the student's own effort. Infringement of academic honesty by a student subjects that student to

serious penalties, which may include failure on the assignment, failure in the course, suspension from the University or other sanctions (see section 20 of R&R). Please consult Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity. Students may be required to submit work to TurnItIn.com software to verify originality. A student who is in doubt regarding standards of academic honesty as they apply to a specific course or assignment should consult the faculty member responsible for that course or assignment before submitting the work. Allegations of alleged academic dishonesty will be forwarded to the Department of Student Rights and Community Standards. Citation and research assistance can be found at Brandeis Library Guides - Citing Sources (https://guides.library.brandeis.edu/c.php?g=301723).

Assignments

This course will have ungraded in class assignments and ungraded weekly assignments that are designed to prepare you for the quizzes and for the programming assignments.

Exams/Quizzes

Every week or so you will take a quiz to assess your mastery of the concepts covered so far. The Quizzes cover the core skills and concepts covered in the course. We will use Mastery Grading for the Quiz questions. Each question will correspond to a particular skill and you will have multiple chances to demonstrate mastery of each skill (at least 4 chances). Your quiz grade will be based on the number of skills you have mastered. The Final Exam will contain questions for each of the skills covered in the class. The Quizzes will be in the Recitations on every Thursday.

Programming Assignments and Creative Assignments

Every week or so you will be asked to complete a programming assignment. Some assignments are rigidly specified whereas others require you to use your creativity to apply what you have learned to solve a problem of your choice. Some will be team assignments, but most will be individual assignments. Although most software development is done in teams, working on solo projects will help you build confidence in your mastery of the key software engineering skills we will be covering.

Participation

Class participation is critical for success in this course. We will form you into teams/study groups and you will be working with your team in class and the class time will provide you the opportunity to ask questions and discuss challenges. Participation will be tracked using the Peer Review App. Your participation score will be based on the number of questions you answer (with a good faith attempt), not whether the answer is correct or not.

Evaluation

You will receive a weekly, individual, grade for your participation in the course and for your quizzes and for your programming assignments. We will use Mastery Grading for the quizzes. This means that each quiz has points for particular skills and you either get the point or you don't, there is no partial credit. You can however (and should) take makeup quizzes and revise and resubmit your assignments. For the Programming Assignments, we will allow a limited number of revisions.

Grading:

Participation 10%
Traditional Programming Assignments: 10%
Creative Programming Assignments: 40%
Quizzes 40%

Essential Resources

Accommodations

Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, I want to support you. In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability of requesting accommodations, please contact Student Accessibility Support (SAS https://www.brandeis.edu/accessibility/) at 781.736.3470 or access@brandeis.edu.

Course Materials

We will use free and open source online resources to learn these skills and concepts.

Apps or Tools/Equipment

We will use Zoom in class if you are remote (and it is recommended if you are in-person). We will also use several web apps developed by the instructor and his students. The main app will be the Peer Review App.

LATTE

LATTE is the Brandeis learning management system: http://latte.brandeis.edu. Login using your UNET ID and password.

Library

The Brandeis Library collections and staff offer resources and services to support Brandeis students, faculty and staff. These include workshops, consultations, collaboration, materials and instruction on emerging trends in technologies such as machine learning, emerging trends in research such as data visualization, and emerging trends in scholarship such as open access. Librarians at the Circulation Desk, Research Help Desk, Archives & Special Collections, Sound & Image Media Studios, MakerLab, AutomationLab, and Digital Scholarship Lab are available to help you. https://www.brandeis.edu/library/about/index.html

Privacy

This class requires the use of tools that may disclose your coursework and identity to parties outside the class. To protect your privacy, you may choose to use a pseudonym/alias rather than your name in submitting such work. You must share the pseudonym/ alias with me and any teaching assistants as needed. Alternatively, with prior consultation, you may submit such work directly to me.

Student Support

Brandeis University is committed to supporting all our students so they can thrive. The following resources are available to help with the many academic and non-academic factors that contribute to student success (finances, health, food supply, housing, mental health counseling, academic advising, physical and social activities, etc.). Please explore the many links on this Support at Brandeis page (https://www.brandeis.edu/support/undergraduate-students/browse.html) to find out more about the resources that Brandeis provides to help you and your classmates to achieve success.

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Course Plan

The course will cover the following topics, but this schedule is subject to change based on how things go this semester…. We may add or remove topics, and possibly change the order of the topics.

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1/17 Week  1 Intro/Overview
1/24 Week  2 Shells and Containers: bash, docker
1/31 Week  3 Distributed Version Control, Agile, Automation: git, make
2/ 7 Week  4 Object Oriented Design in Python
2/14 Week  5 Debugging, Testing, and Profiling in Python: PyCharm,…
2/21 Spring break
2/28 Week  6 Working with Large Data Sets in Python: Pandas and Numpy
3/ 7 Week  7 Relational Databases: SQLite
3/14 Week  8 Visualization: matplotlib, seaborn, plotly, datapane
3/21 Week  9 Model, View, Controller Architectures: NodeJS/Express/EJS
3/28 Week 10 NoSQL Databases, Debugging, and Profiling
4/ 4 Week 11 APIs and Rest Architectures: fetch, axios
4/11 Week 12 Integration Testing: github actions
4/18 Passover/Easter break
4/25 Week 13 Deployment: Heroku, AWS, Kubernetes.
5/ 2 Week 14 Final Project Showcase (Monday only)
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