Course Description
Data structures are fundamental for working with real world data, they play an essential role in modern computer science. A set of good data structures allows algorithms to manipulate data efficiently. This course is a challenging course for undergraduate students with computer science as the major or minor degree in the college of arts and sciences. In this course, you will learn how these data structures are implemented and will practice implementing them in our programming assignments. You will develop skills for producing and evaluating quality data structures and algorithms.

Here are some questions that will be covered in this course:

- How to design algorithms. Designing algorithms is a creative human endeavor. As there is no automated method to generate a solution for a problem, you will learn some lines to be followed to design high performance algorithms.
- How to express algorithms. Pseudocode is a step-by-step written outline of your code that can be transcribed into programming language gradually. You will get to know how to write pseudocode to express your algorithms.
- Proving correctness. Correctness of an algorithm is asserted when it is said that the algorithm is correct with respect to a specification. We will focus on the input-output behavior of an algorithm and the method to prove its correctness.
- Efficiency analysis. As the programs you develop become more complex, the running time of various algorithms and their computational complexity should be analyzed. We will talk about how to analyze the efficiency of an algorithm.
- Optimality. Optimization is the selection of a best element from some set of available alternatives. We will introduce several kinds of optimization methods in this course. The advantages and disadvantages of these methods will be thoroughly discussed.

Course Goals and Objectives
The course aims to help you get the SDE offers from BIG IT companies.

Course Information
Instructor: Dr. Hongfu Liu (hongfuliu.com, hongfuliu@brandeis.edu)
Course Hour: (M,W,Th 9:00 am - 9:50 am) @ Olin-Sang Amer Civ Ctr101
Recitation: (Th 6:30 pm - 9:20 pm) @ Schwartz Hall 112
TAs: Han Yue (hanyue@brandeis.edu) & Peizhao Li (peizhaoli@brandeis.edu) & many
TA Office Hour: shorturl.at/bmvAO
Instructor Office Hour: https://calendly.com/hongfuliu/visiting

Prerequisite
Basic programming skills (Cosi 12b), linear algebra (Math 15a or 22a)

Textbook and Readings
Class lecture slides will be provided by the instructor. Students will be asked to find more self-learning content. Recommended textbooks with public electronic versions are:

- *Data Structures and Algorithm Analysis in Java*, by Mark A. Weiss
➢ Leetcode

**Grading**

Track-I
➢ The simulated programming interview, randomly selected some questions with different difficulty levels from Leetcode
➢ You can do the “interview” at any stage of this semester. If you pass, you will get A. If you already got the offer from big companies, A+
➢ You have three times

Track-II
➢ Students will be graded on class attendance and quiz (20%), assignment per week (50%), and three exams (30%)

**Critical Dates**

Brandeis days (Monday schedule): Oct. 3, Oct. 15
Exams: Oct. 3, Nov.13 & Final

**Course Outline**

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<th>Week</th>
<th>Topic</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>No class</td>
<td>Introduction (8/28)</td>
<td>Week 2</td>
<td>No class</td>
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<td>Week 3</td>
<td>Time/Space Complexity (9/9)</td>
<td>Brute Force (9/11)</td>
<td>Week 4</td>
<td>Pseudocodes (9/16)</td>
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<td>Week 5</td>
<td>Sort (9/23)</td>
<td>Binary Tree (9/25)</td>
<td>Week 6</td>
<td>Matrix Multiplication (10/2)</td>
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<td>Week 7</td>
<td>Decrease and Conquer (10/7)</td>
<td>No class</td>
<td>Week 8</td>
<td>DFS (10/15)</td>
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<tr>
<td>Week 9</td>
<td>No class</td>
<td>Heap (10/23)</td>
<td>Week 10</td>
<td>String (10/28)</td>
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<td>Week 13</td>
<td>TSP (11/18)</td>
<td>DP-I (11/20)</td>
<td>Week 14</td>
<td>DP-II (11/25)</td>
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<td>Week 15</td>
<td>TBA (12/2)</td>
<td>TBA (12/4)</td>
<td>Week 16</td>
<td>Course summary (12/9)</td>
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**Course Load**

Success in this four-credit course is based on the expectation that students will spend more than 10 hours of study time per week in preparation for class.

**Academic Integrity**

Although there are mature codes online, self-implementation and comparison are preferred, and you must be aware of Brandeis’s Rights and Responsibilities document for all policies and procedures related to academic integrity. Students may be required to submit work to TurnItIn.com software to verify originality. Allegations of alleged academic dishonesty will be forwarded to the Director of Academic Integrity. Sanctions for academic dishonesty can include failing grades and/or suspension from the university. Citation and research assistance can be found at LTS - Library guides.

**Communications**

Emails will be notified in advance for critical dates and class changes.

**Disabilities**

If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see me immediately.