BRONX COMMUNITY COLLEGE of the City of New York DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

SYLLABUS: CSI 33 Data Structures

2 rec 2 lab, 3 credits

PREREQUISITE: CSI 32 and CSI 35; and CUNY English Proficiency, or ENG 100 or 110, if required

TEXT: Data Structures and Algorithms Using Python and C++

by David M. Reed and John Zelle, Franklin Beedle and Assoc.

Goals of the course: To introduce students to working with data structures and algorithms as a way to develop solutions to various computational problems.

Objectives: To provide experience to students in using these skills:

- 1. Analysis of algorithms,
- 2. Class design, in Python and C++, based on performance requirements,
- 3. Understanding dynamic structures and their use in resource management, and
- 4. Correctly applying the fundamental searching and sorting algorithms.

Programming Projects: Students will complete 8-10 programming projects taken from the list of programming projects or comparable projects developed by the instructor.

Sections of the text	Suggested exercises and projects	
Chapter 1: Abstraction and Analysis (1/2 week)		
1.2 Functional Abstraction	p. 33:1-10	
1.3 Algorithm analysis	p. 36:1,3,4,8	p.38:9
Chapter 2: Data Abstraction (1 week)		
2.2 Abstract Data Types	p.68:1-10	
2.3 ADTS and Objects	p. 71:1,2	p.71:1,3
2.4 An Examples ADT: Datasets		
2.5 An Example ADT: Rational		
Chapter 3: Container Classes (1 week)		
3.2 Python Lists	p.100:1-13	p.104:6,10
3.3 A Sequential Collection: A Deck of Cards	p.101:1,2,5,6,7	
3.4 A Sorted Collection: Hand		
3.5 Python List Implementation		
3.6 Python Dictionaries		
Chapter 4: Linked Structures and Iterations (11/2 week	ks)	
4.2 The Python Memory model	p.148:1-10	p.152:1,4
4.3 A linked Implementation of Lists	p.149:1,3	
4.4 Linked Implementation of a List ADT	p.151:1,2	
4.5 Iterators		
4.7 Lists vs. Arrays		

Chapter 5: Stacks and Queues (1 week)		
5.2 Stacks	p.181:1-10	p.184:1
5.3 Queues	p.182:1,2,5,6,7	
5.4 Queue Implementation	p.183:1,3	
5.5 An Examples Application: Queueing Simulations		
Chapter 6: Recursion (1 week)		
6.2 Recursive Definitions	p.212:1-10	p.215:5,7
6.3 Simple Recursive Examples	p.213:1,2,3	
6.4 Analyzing Recursion	p. 214:1	
6.5 Sorting		
6.6 A "Hard" Problem: The Tower of Hanoi		
Chapter 7: Trees (1 ¹ / ₂ weeks)		
7.2 Tree Terminology	p.245:1-10	p.248:1,3,4
7.3 An Example Application: Expression Trees	p.246:4,7,8	
7.4 Tree Representations	p.247:2,4,6	
7.5 An Application: A Binary Search Tree		
Chapter 8: C++ Introduction for Python (2 weeks)		
8.2 C++ History and Background	p.313:1-12	p.316:8
8.3 Comment, Blocks of Code, Identifiers, and Keywords		
8.4 Data Types and variable declarations	p.314:1,3,4	
8.5 Include Statements, Namespaces, and Input/Output		
8.6 Compiling	p.315:4,5,6	
8.7 Expressions and Operator Precedence		
8.8 Decision Statements		
8.9 Type Conversion		
8.10 Looping Statements		
8.11 Arrays		
8.12 Function Details		
8.13 Header Files and Inline Functions		
8.14 Assert Statements and Testing		
8.15 The Scope and Lifetime of Variables		
8.16 Common C++ Mistakes by Python Programmers		
Chapter 9: C++ Classes (½ week)		
9.1 Basic Syntax and Semantics	p.348:1-10	p.352:3
9.2 Strings	p.349:1,3,4,5	
9.3 File Input and Output	p.351:7	
9.4 Operator Overloading		
9.5 Class Variables and Methods		
Chapter 10: C++ Dynamic Memory (1 week)		
10.2 C++ Pointer	p.395:1-10	p.400:1
10.3 Dynamic Arrays	p.397:6,7	

10.4 Dynamic Memory Classes	p.399:3,4,5			
10.5 Dynamic Memory Errors				
Chapter 11: C++ Linked Structures (1 week)				
11.2 A C++ Linked Structure Class	p.422:1-5	p.424:1		
11.3 A C++ Linked List	p.423:1,3,5			
11.4 C++ Linked Dynamic Memory Errors	p:424:1,2			
Chapter 12: C++ Templates (½ week)				
12.2 Template Functions	p.440:1-5	p.442:5		
12.3 Template Classes	p.440:2,5, p.442:3			
Chapter 13: Heaps, Balanced Trees, and Hash Tables (1 week)				
13.2 Priority Queues and Heaps	p.478:1,2,7-10	p.483:2		
13.5 Hash Tables	p.479:1,3,5, p.481:1			
Chapter 15: Algorithm Techniques (1/2 week)				
15.2 Divide and Conquer	p.546:1-5			
15.3 Greedy Algorithm	p.546:1			

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- Using your BCC email account, please email all your in-person and/or hybrid professors of your status.
 - Please include your emplid # and current phone number in your email.
 - Please also email us at <u>healthservices@bcc.cuny.edu</u>.
 - Your professor will work with you to complete class work while you are in quarantine.
- You will be called by a Health Services staffer. It is critical that you connect in a timely matter with this staff member for contact tracing information.
- You will need to submit a negative COVID test to Health Services (<u>healthservices@bcc.cuny.edu</u>) before you are allowed access to the campus.
- Your negative test result must come from your doctor or a medical provider (e.g. CityMD, Urgent Care, etc.). We will <u>not</u> accept a negative home test result.

Fall 2009 for Python/SEP/GL August 2022 for prerequisite update EA 01/23 for COVID EA