CS218 Data Structures

Fall 2019 - NUCES, Peshawar Campus

Course Code:	CS218
Course Title:	Data Structures
Batch:	BS CS18
Total Credits:	3
Instructor:	Dr. Nauman
Contact:	(091) 111-128-128 (Ext 110)
Grade Distribution:	Assignments (20%)
	Quizzes (10%)
	Midterms (30%)
	Final Exam (40%)

1 Objectives

This course aims to introduce what data structures are, why they are needed and how to use them. It also aims to build some basic data structures from scratch in order to inculcate an appreciation of the theoretical foundations.

The second aspect of the course is related to how these data structures aid in understanding and implementing different algorithms to solve real world problems.

One of the distrinctions of the course is that it does not limit itself to the theoretical aspects of data structures and algorithms. We would also include some practical aspects of data structures and algorithms that would allow the student to get a better appreciation of how the theoretical concepts studied in the course can be used to solve real world problems.

2 Course Books

1. Miller, Brad, and David Ranum. **Problem Solving with Algorithms and Data Structures**. (2013).
2. Goodrich, Michael T., Roberto Tamassia, and Michael H. Goldwasser. **Data structures and algorithms in Python**. Vol. 1. Hoboken: Wiley, 2013.
3. Guttag, John V. **Introduction to computation and programming using Python**. Mit Press, 2013.

3 Reference Materials

- Abelson, Harold, Gerald Jay Sussman, and Julie Sussman. Structure and interpretation of computer programs. Justin Kelly, 1996.
- Knuth, Donald. The Art of Programming. Addison-Wesley. 1968.
- Cormen, Thomas H., et al. Introduction to algorithms. Section III. MIT press, 2009.
- Course specialization on Data Structure and Algorithms. `https://www.coursera.org/specializations/data-structures-algorithms`

4 Course Policies

Attendance: At least 80% attendance is required by each student. Students failing to have the required attendance will not be allowed to appear in the final exam resulting in 'F' grade in the course. No relaxation shall be given in this regard.

Quizzes: Quizzes will be closed book. Most quizzes will be announced a day or two in advance but unannounced quizzes are also possible.

Marks Contest Deadlines: The marks contest deadlines for all instruments is 3 days after marks are announced. NO changes will be entertained after that.

Plagiarism Policy: Copying, cheating or any other academic dishonesty will be penalized with zero marks in that category. This applies much more rigidly to the semester project.

Reading Tasks: Reading tasks will be given each week. Presentations will also be required from the students on topic of relevance from time to time.

Mode of presentation: Methods of presentation will be lectures, demonstrations and practical sessions.

5 Topic Breakdown

This breakdown is subject to minor changes in topics during the semester.

Week	Topics
Week 1	Introduction to the course, Why Python, Python refresher Object Oriented Programming in Python Fibonacci numbers and order of growth
Week 2	Linked list Doubly linked list
Week 3	Circular linked list Stack, Stack case studies
Week 4	Queue data structure with arrays Set data structure
Week 5	Recursion, types of recursion Tower of hanoi, fib revisited, summing a list
Week 6	**Sessional - I** Introduction to Trees
Week 7	Tree traversal Binary search tree
Week 8	Heap Sorting introduction, how humans sort
Week 9	Bubble sort, merge sort, insertion sort Quick sort, selection sort
Week 10	Hashing and collision detection Greedy algorithms
Week 11	Dynamic programming **Session - II**
Week 12	Introduction to the graph data structure Graph traversal
Week 13	Finding shortest paths in graphs
Week 14	Metrices and vectors in Python Python collections module
Week 15	Standard library for OS traversals and other case studies
Week 16	Scaling dictionaries to real world Course review