Habib University

CS 102– Data Structures & Algorithm

"*Bad Programmers worry about the code. Good programmers worry about data structures and their relationships."* Linus Torvalds

Spring' 2020

Course Schedule

Section	Instructor	Timings	Room
1			
2			
3			
4			

Course Staff & Office Hours

I. Course Objectives/Description:

The objective of this course is to give students a programming intensive experience of commonly used data structures and algorithms to solve problems of moderate complexity. The data structures to be covered during the course include Stacks, Queues, Dictionaries, Trees, and Graphs. Various algorithms or algorithmic techniques will also be introduced that include Searching, Sorting, Tree/Graph traversals, and Divide-and-conquer. The course will also expose students to the basics of algorithmic complexity analysis and will introduce O-notation and Master Theorem to assess and compare the performance of different algorithms.

II. Specific Course Learning Outcomes(CLOs):

CLO	Description	Learning Domain Level
CLO1	Given a problem, correctly choose and implement suitable data structures (such as stacks/queues, graphs, tree) to solve that problem	Cog-3
CLO2	Understand, Implement and analyze algorithms for searching, sorting, and graph related problems	Cog-4
CLO3	Use asymptotic complexity to analyze and compare different algorithms	Cog-5
CLO4	plan and implement a programming project of moderate complexity	Cog-6

Course Assessments mapped to Course Learning Outcomes (CLOs)

	CLO1	CLO2	CLO3	CLO4
Assignment 1				
Assignment 2				
Assignment 3				
Quiz 1				
Quiz 2				
Quiz 3				
Quiz 4				
Quiz 5				
Quiz 6				
Quiz 7				
Quiz 8				
Midterm				
Final Exam				
Project				

Program Learning Outcomes (PLOs) mapped to CS 102 CLOs

PLOs addressed by the CLOs of CS 102
PLO 2 - Problem Analysis
PLO 3 - Design and Development of Solutions
PLO 4 - Investigation

	CLO 1	CLO 2	CLO 3	CLO 4
PLO 2				
PLO 3				
PLO 4				

III. Prerequisites:

- CS101 – Programming Fundamentals

IV. Course Requirements:

Students are required to attend classes and submit assignments on time. Before each class, they should review the topics covered in the last class. Students' performance will be assessed using different instrument including theory and lab exams, assignments, project, and class participation. See Section 5 for grade distribution.

Assignments on different topics will be given during the semester. There will a project towards end of the course in which students will apply the learned techniques to solve some real-world problem.

Course Readings:

Required Text:

- Data Structures and Algorithms in Python by Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser,

Reference Text:

- Introduction to Algorithms (Third Edition) by Cormen, Leiserson, Rivest, and Stein
- Algorithms, by Dasgupta, Papadimitriou, and Vazirani.

V. Grading Procedures: Tentative grading plan is given below:

Assignments	15%
Project	20%
Lab Participation	07%
Quizzes	08%
Class Participation	05%
Mid Term Exam	15%
Final Exam	30%

VI. Format and Procedures:

The class will meet twice a week for three hours and each session will be divided into theory and lab session of 90 min each.

VII. Attendance Policy:

As per standard attendance policy of Habib University, this course requires all juniors and seniors must maintain at least 75% attendance for each class in which they are registered. Non-compliance with minimum attendance requirements will result in automatic failure of the course and may require the student to repeat the course when next offered. It is the responsibility of the student to keep track of their own attendance and speak with their faculty member or the Office of the Registrar for any clarification.

VIII. Office Hours:

Office hours have been scheduled, circulated, and posted. During these hours the course instructor will be available to answer questions or provide additional help. Every student enrolled in this course must meet individually with the course instructor during course office hours at least once during the semester. The first meeting should happen within the first five weeks of the semester but must occur before midterms. Any student who does not meet with the instructor may face a grade reduction or other penalties at the discretion of the instructor and will have an academic hold placed by the Registrar's Office.

VIII. Academic Integrity

Each student in this course is expected to abide by the Habib University Student Honor Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Scholastic dishonesty shall be considered a serious violation of these rules and regulations and is subject to strict disciplinary action as prescribed by Habib University regulations and policies. Scholastic dishonesty includes, but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

The project is an exception in which students will work in groups and will collaborate with their group members.

PLAGIARISM: Plagiarism is the act of taking the work created by another person or entity and presenting it as one's own for the purpose of personal gain or of obtaining academic credit. As per University policy, plagiarism includes the submission of or incorporation of the work of others without acknowledging its provenance or giving due credit according to established academic practices. This includes the submission of material that has been appropriated, bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.

CHEATING: The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.

COLLUSION: Collusion is the act of providing unauthorized assistance to one or more person or of not taking the appropriate precautions against doing so.

Any student violating academic integrity a second time in this course will receive a penalty in the form of grade reduction or, in the worst case, failing grade for the course. Additional disciplinary sanctions may be administered through the Conduct Office.

X. Course schedule

Tentative Course Schedule [based on class schedule that meets twice a week for 75 minutes]: (*May change to accommodate guest presenters and/or student needs*)

Week	Lecture	Submission
Week-1	Introduction, Problem Solving – Search to Speak Case Study, Nested Lists	
Week-2	Stacks. Queues, Circular/Priority Queues Infix/Postfix Evaluation	Assignment 1 out
Week-3	Search Algorithm (Linear & Binary Search), Complexity	
Week-4	Analyzing Complexity, Order of growth, Big-O Notation	
Week-5	Sorting Algorithms (Bubble Sort, Insertion Sort, Selection Sort)	
Week-6	Sorting Algorithms (Merge Sort, Quick Sort)	Assignment 2 out
Week-7	Dictionaries, Recursion	
Week-8	Graph Representation (Adjacency Matrix/List, Edge list) Graph Traversal (Breadth-First/Depth-First Traversal)	
	Mid-term Exam	
Week 9	Shortest Path– Dijkstra Algorithm	Assignment 3 out Project Proposal due
Week-10	Tree and Tree Traversal (Pre-order, Inorder, Post-order)	
	Spring Break	
Week-11	Binary Search Tree – Addition, Deletion, Searching, Finding Max/Min	
Week-12	Minimum Spanning Tree (Prim & Kruskal Algorithm)	
Week-13	Divide and Conquer, Tower of Hanoi	Project Interim Demo
Week-14	Recurrence, Solving recurrences Master Theorem	
Week-15	Recurrence, Solving recurrences Master Theorem	Final Project due
Week-16	Project Demos and Viva	

Tools

- Python