National Computing Education Accreditation Council
NCEAC

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE

BS(CS)

EVALUATED

Course Description

Course Code	CS2001
Course Title	Data Structures
Credit Hours	3+1
Prerequisites by Course(s) and Topics	Object Oriented Programming (CS1004)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-1: 15 Mid-2: 15 Project: 10 Assignments & Quizzes: 10 Final: 50
Course Coordinator	Anam Qureshi
URL (if any)	-
Current Catalog Description	-
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Textbook:** Data Structures and Algorithms in C++ 4th Edition by Adam Drozdek **Reference books:** Data Structures & Algorithm Analysis in C++ Author: Mark Allen Weiss Publisher: Pearson Education Data Structures Using C++ by D. S. Malik

Reference Material	Uploaded on Google Classroom link for the course:
Course Goals	

A. Course Learning Outcomes (CLOs)

1. *Use & explain* concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations
   [Bloom's Taxonomy Level: 3, Learning Domain: Cognitive]

2. *Solve* recursive problems efficiently using Backtracking
   [Bloom's Taxonomy Level: 3, Learning Domain: Cognitive]

3. *Compare* different data structures in terms of their relative efficiency and *design* effective solutions and algorithms that make use of them.
   [Bloom's Taxonomy Level: 6, Learning Domain: Cognitive & Psychomotor]

4. *Transform* cycling-bearing graphs into acyclic tree structures for minimum cost traversal
   [Bloom's Taxonomy Level: 6, Learning Domain: Cognitive & Psychomotor]

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	CLO-1
2. Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	CLO-2
3.Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	CLO-3
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	CLO-4

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2		✔										

| | | 3 | | | ✔ | | | | | | | | | |
| | | 4 | | | | ✔ | | | | | | | | |

Topics Covered in the Course, with Number of Lectures on Each Topic
(assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
ADT, C++ Language Specification, Pointers revisited, Rule of Three	1	3	1
Recursion, it's types, issues and Backtracking (with examples)	1	3	2
List (Singly Linked List), List (Doubly Linked List), List (Circular Linked List)	2	6	1, 3
Elementary Sorting Techniques	1	3	1, 3
========== Mid-term 1 Exam ==========			
Advanced Sorting Techniques and their issues, Linear, Binary & Interpolation Search	1	3	3
Stack, Queue, their implementation strategies and applications	1	3	1, 3
Priority Queues, Heaps as Priority Queues	1	3	1, 3
Binary trees and their properties (Full Binary Tree, Complete Binary Tree), Multi-way Trees/Tries Binary Search Trees, their operations and applications, skewness and issues	3	7	1, 2, 3
========== Mid-term 2 Exam ==========			
Balance in Binary Search Trees, AVL Trees	1	3	2, 3
Hashing, Hash Functions, Collision-resolution Techniques, Rehashing	1	3	1, 3
Graphs and their representation and traversal, Shortest Path Problem, Minimum Spanning Trees, Graph Algorithms, Topological Sort	2	3	4
Revision	1	3	
========== Final Exam ==========			
Total	**16**	**43**	

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Laboratory Projects/Experiments Done in the Course	There will be weekly labs starting from the first week. The following is a summary of the Lab exercises given to Students: • Introduction to Data Structures and their implementation. • Writing & using dynamic safe arrays • Solving recursive problems using Backtracking in programs • Implementation of Linked Lists • Linked List based implementation of primitive Data Structures • Implementing Sorting Algorithms • Implementing Binary Trees and writing functions for their properties • Implementing Binary Search Trees using Structures and Classes • Writing functions for tree traversal and maintaining balance • Implementing graphs and writing functions for their traversal			
Programming Assignments Done in the Course	Assignments related to Linked List and its variants, Recursion and Backtracking, Stacks & Queues, Binary Search Trees and Traversal			
Class Time Spent on (in credit hours)	Theory	Problem Analysis	Solution Design	Social and Ethical Issues
	15	15	13	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: **Anam Qureshi**

Instructor Signature: _____

Date: January 31, 2022

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