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Unit Code	
Unit Name	Data structures and algorithms
Prerequisite	Introduction to Computer Programming
Cohort	
Lecturer	Wairagu G.R
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Purpose

To enable the students understand the concepts and application of data structures and algorithms.

Course Objectives:

a) Develop sound techniques on designing, developing, and documenting well-structured programs using proper software engineering principles.

b) Understand the purpose and mathematical background of algorithm analysis and be able to apply this to determine the run time and memory usage of algorithms

c) Describe and implement common data structures--lists, stacks, queues, graphs, and trees--for solving complex programming problems.

d) Explain the different sorting and searching techniques

Course Description

Abstract data types, concepts, data models; Elementary data structures: arrays, unions, structures, enumerated data types, lists, records, sets, stacks, queues, graphs and trees; Algorithms: definition, features and analysis, sorting, searching and merging; Recursion; Application of structures in memory management, file indexing, and organization hashing.

Course Content

WEEK	COURSE CONTENT	REMARKS
Week 1	a) Introduction. Course overview. Introduction to data structures and algorithms b) Fundamentals of C++ programming. c) Lab – C++ Syntax	
Week 2	Introduction a) Basic Definitions b) Structured Data Types c) Arrays –Implement arrays Lab – C++ data types, operators.	
Week 3	Lists • Lists as an Abstract Data Type • Implementation Lab - Selection control structures in c++	

Week 4	Stacks • Stack as an Abstract Data Type • An Array Implementation of Stacks Application of Stacks Lab – loops in c++ Queues • Queue as an Abstract Data Type • An Array Implementation of Queues Applications of Queues	
Week 6	Trees • Binary Trees • Binary Search Trees • Tree Traversal • Lab –implementing arrays in C++	
Week 7	CAT 1 Revision of CAT 1	
Week 8	• Heaps Graphs • Definition • Representation • Traversing • Minimum spanning tree • Topological sort • Shortest Path Lab – implementing linked lists in C++	•
Week 9	Sorting Algorithms Selection Sort • Selection Sort • Bubble Sort • Insertion Sort Lab – implementing stacks in C++ Implementing BST in C++ •	
Week 10	Sorting Algorithms • Quick Sort • Merge Sort • Heap Sort Lab – implementing Queues in C++ Lab- Implement Heap •	
Week 11	Searching algorithms • Sequential Search • Binary Search Lab –Implementation of bubble sort	

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Week 12	Algorithms • Analysis • Performance Evaluation • Asymptotic notations Infix, Prefix and Postfix expressions • • Lab – Implement quick sort • Lab – Implement sequeatial search	
Week 13	CAT2	
Week 14	a) Evaluation b) Revision	
Week 15 and16	End of Semester Exams	

Teaching Methodologies

Lectures, practical sessions and Tutorials.

Instructional Materials/Equipment

1. LCD Projector
2. Whiteboard
3. Textbooks, Computers and Internet.

Course Assessment Mode:

Laboratory Practicals	10%
Continuous Assessment Tests	20%
Total Continuous Assessment	**30%**
End of Semester Examination	**70%**

Practicals/Laboratory sessions

a) Lab 1 – C++ Syntax
b) Lab 2 – Data types, Operator
c) Lab 3- Selection control structures in c++
d) Lab 4– loops in c++
e) Lab 5 –implementing arrays in C++
f) Lab 6– implementing linked lists in C++
g) Lab 7– implementing stacks in C++
h) Lab 8 – implementing Queues in C++
i) Lab 9 –Implementation of bubble sort
j) Lab 10– Implement quick sort
k) Lab 11 – Implement sequeatial search

Core Reading Materials:

Course Text books

1. Narasimha K. (2011). *Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles*, (1st Ed.). CreateSpace Independent Publishing Platform. ISBN-13: 978-1456549886

2. Weiss M.A. (2006). *Data Structures and Algorithm Analysis in Java*, (2nd Ed.). Addison Wesley. ISBN-13: 978-0321370136

3. Drozdek A. (2012). *Data Structures and Algorithms in C++* (4th Ed.). Cengage Learning. ISBN-13: 978-1133608424

Course Journals

1. *Journal of Computer and System Sciences.* ScienceDirect. ISSN: 0022-0000
2. *International Journal of Advanced Computer Science and Technology (IJACST).* IJACST. ISSN: 2249-3123
3. *Advances in Computational Sciences and Technology (ACST).* ACST. ISSN: 0974-4738

Reference Materials:

Reference Textbooks

1. Ford W.H. (2001). *Data Structures with C++*, (2nd Ed.). Prentice Hall. ISBN-13: 978-0130858504
2. Standish T.A. (1998). *Data Structures in Java.* Addison-Wesley. ISBN: 978-0201305647
3. Yedidyah AU, L. (2011). *Data Structures using C and C++*, (2nd Ed.). ISBN-13: 978-8120311770

Reference Journals

1. *International Journal of Computational Science and Engineering,* IJCSE. ISSN: 2249-4251
2. *International Journal of Information Science and Education (IJISE*). IJISE. ISSN: 2231-1262
3. *Global Journal of Computational Intelligence Research (GJCIR).* GJCIR. ISSN 2249-0000

Approved for use: Sign: (CoD) ________________________________Date________________