Course Name: Data Structure
Course Code: CS214

I. Basic Course Information

Major or minor element of program: Genera l
Department offering the course: Computer Science Department

Academic level: 200 Level
Semester in which course is offered: Second (spring) Semester
Course pre-requisite(s): Programming – 1 [CS112]

Credit Hours: 3
Contact Hours Through:

Lecture	Tutorial*	Practical*	Total
2.5	0.0	1.5	4.0

* 1.5 hours for **either** Tutorial or Practical

Approval date of course specification: January 2015

II. Overall Aims of Course

Error! Not a valid bookmark self-reference., binary tree, binary search tree, simple graphs, and hash tables. In addition they must be able to describe and compare quadratic and sub-quadratic (e.g., quick sort, merge sort, and heap sort) sorting algorithms.

III. Program ILOs covered by course

Program Intended Learning Outcomes (By Code)			
Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
K1,K7,K15	I1,I3,I5	P2,P6	G2,G6

IV. Intended Learning Outcomes of Course (ILOs)

a. Knowledge and Understanding

On completing the course, students should be able to:

K.1 Explain asymptotic performance of algorithms and operations.
K.2 Describe the tests to measure the impact of the way data is structured on program performance and functionality.
K.3 Differentiate between a data structure and its implementations.
K.4 Define the basic data structures, such as lists, stacks, and queues, with their linked list and array-based implementation.
K.5 Define intermediate data structures, such as binary trees, binary search trees, graphs, and hash tables.
K.6 Recall the basic types of trees and graphs.
K.7 List the sorting algorithms and recognize their types.

b. Intellectual/Cognitive Skills

On completing the course, students should be able to:

I.1 Analyze running time of algorithms and operations using asymptotic analysis.
I.2 Validate and construct loop invariants of basic sorting algorithms.
I.3 Evaluate the appropriateness of a particular data structure to a particular problem.
I.4 Examine linked list operations to spot memory errors.

c. Practical/Professional Skills

On completing the course, students should be able to:

P.1 Analyze programming problems and select appropriate data structures and sorting algorithms.
P.2 Use data structures to solve problems.
P.3 Apply advanced problem solving techniques, such as recursion and data abstraction.
P.4 Practice object-oriented concepts, such as inheritance, data abstraction, templates, operator overloading, and polymorphism.

d. General and Transferable Skills

On completing the course, students should be able to:

G.1 Plan a group-based mini-project.
G.2 Use team-working skills.
G.3 Practice presentation skills.
G.4 Apply time-management skills.

V. Course Matrix Contents

	Main Topics / Chapters	Duration (Weeks)	Course ILOs Covered by Topic (By ILO Code)			
			K & U	I.S.	P.S.	G.S.
1-	Introduction to data structures and performance measures	1	K1,K2,K3	[ ]	[ ]	[ ]
2-	Basic searching and sorting algorithms	1	K7	I1, I2	P1	[ ]
3-	Recursion	1	[ ]	I1	P1,P3	[ ]
4-	Lists: array-based and linked lists; Stacks and queues	3	K4	I1,I3,I4	All	[ ]

5-	Advanced sorting algorithms	1	K7	I1	P1	
6-	Trees: binary trees and binary search trees	2	K5,K6	I1,I3	P1,P2,P4	
7-	Graph representation and basic operations	1	K5,K6	I1,I3	P1,P2,P4	
8-	Priority queues and heaps	1	K5	I1,I3	P1,P2,P4	
9-	Hash tables	1	K5	I1,I3	P1,P2,P4	
10-	Project coaching and presentations	1				All
	Net Teaching Weeks	**13**				

VI. Course Weekly Detailed Topics / hours / ILOs

Week No.	Sub-Topics	Total Hours	Contact Hours	
			Theoretical Hours	Practical Hours*
1	Introduction to data structures and the importance of data organization, performance measures	2.5	2.5	
2	Searching Algorithms (Linear Search, Binary Search) Sorting Algorithms (Bubble Sort, Selection Sort, Insertion Sort)	4	2.5	1.5
3	Recursion (Recursive Binary Search) Project coaching session	4	2.5	1.5
4	Lists (Static vs. Dynamic Arrays), Pointers, Introduction to Linked Lists	4	2.5	1.5
5	Linked lists variants (single, doubly, and circular)	4	2.5	1.5
6	Stacks & Queues (using static arrays, dynamic arrays, and linked lists)	4	2.5	1.5
7	**Midterm Exam**			
8	Hash Tables (Hash table, Hash functions, open and closed hashing, probing methods)	4	2.5	1.5
9	Advanced sorting algorithms: quick sort and merge sort	4	2.5	1.5
10	Trees (General trees, Binary trees, BST, Tree Traversal)	4	2.5	1.5
11	Trees (Red-Black-Trees)	4	2.5	1.5
12	Graphs (adjacency list, adjacency matrix, edge list, graph traversal and cycle detection)	4	2.5	1.5
13	Priority Queue, Heap, and Heap sort	4	2.5	1.5
14	Project presentations	4	2.5	1.5
15	**Final Exam**			
Total Teaching Hours		**51**	**33**	**18**

* **No Practical/Tutorial during the first week of the semester**

VII. Teaching and Learning Methods

Teaching/Learning Method	Selected Method	Course ILOs Covered by Method (By ILO Code)			
		K & U	Intellectual Skills	Professional Skills	General Skills
Lectures & Seminars	*	K1,K5,K6,K7	I1-I4		
Tutorials	*				
Computer lab Sessions	*	K2		P1-P4	
Practical lab Work	*	K3,K4		P1-P4	
Reading Materials	*				
Web-site Searches	*				
Research & Reporting					
Problem Solving / Problem-based Learning	*				
Projects					G1-G4
Independent Work	*			P1-P4	
Group Work	*				G1-G4
Case Studies					
Presentations					G1-G4
Simulation Analysis					
Others (Specify):					

VIII. Assessment Methods, Schedule and Grade Distribution

Assessment Method	Selected Method	Course ILOs Covered by Method (By ILO Code)				Assessment Weight / Percentage	Week No.
		K & U	I.S.	P.S.	G.S.		
Midterm Exam	*	K1-K4	I1-I4			10%	7
Final Exam	*	K1-K7	I1-I4			60%	15
Quizzes	*						
Course Work	*	K5,K6				15%	
Report Writing							
Case Study Analysis							
Oral Presentations	*			P2,P3	G3		
Practical	*	K2,K3		P1-P4		5%	3, 5, 9
Group Project					G1-G4	10%	14
Individual Project							
Others (Specify):							

IX. List of References

Essential Text Books	• Data Structures ,Algorithms in C++ Second Edition By Adam Drozdek. • Data Structures and Algorithms in Java second edition by Adama Drozdek
Course notes	• Slides available on course web site and board notes.
Recommended books	• Data Structures and Algorithm Analysis in C++by Clifford A. Shaffer. • Data Structures: A Pseudo code Approach with C++ by Richard F. Gilberg and Behrouz A. Forouzan - ISBN 053495216X • Data Structures via C++: Objects by Evolution by A. Michael Berman ISBN - 0195108434
Periodicals, Web sites, etc …	• http://algoviz.org/

X. Facilities required for teaching and learning

- Lecture Room
- Labs prepared with IDEs

Course coordinator: Dr. Basheer Abd El-Fatah

Head of Department: Prof. Abeer El Korany

Date: January 2015