



جمهورية مصر العربية

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research



المعهد العالى للحاسبات وتكنولوجيا المعلومات  
مدينة الشروق - القاهرة  
شعبة علوم الحاسب

## Course specification

**Course Code: CS201**

**Course Title: Data structures**

**Academic Year: /**

**Course specification**  
**(CS201- Data structures)**

**Course Outline**

<b>Faculty:</b>	<i>HICIT- (Higher Institute for Computers &amp; Information Technology-El Shorouk Academy)</i>		
<b>Programme(s) on which the course is given:</b>	Undergraduate program in Computer Science		
<b>Major or minor element of programme:</b>	Compulsory		
<b>Department offering the program</b>	Department of Computer Science		
<b>Department offering the course:</b>	Department of Computer Science		
<b>Level</b>	Second Level		
<b>Date of specification approval</b>	/ /2023		

**Basic Information**

<b>Code:</b>	CS 201	<b>Title:</b>	Data structures
<b>Prerequisites:</b>	CS 102 Computer Programming		
<b>Weekly Hours:</b>			
<b>Lecture: 2</b>	<b>Exercise: -</b>	<b>Practical : 2</b>	<b>Total: 3 credit hours</b>

**Professional Information**

**Course Aims:**

The objective of CS2102 is to teach ways and techniques of efficiently organizing and manipulating data in main memory

After completing this course students must be able to:

- Understand the fundamental concepts of data structures and their applications.
- Analyze and compare the performance of different data structures.
- Implement various data structures using appropriate programming languages.
- Develop efficient algorithms for common data manipulation tasks.
- Apply data structures to solve real-world problems.

**Program Intended learning outcomes (ILOs)**

**a. Knowledge and understanding:**

On successful completion of this program, graduates should be able to:

a2	Deep understanding the concepts of the different high-level programming languages.
a13	Demonstrate strong knowledge of fundamentals of programming and the construction of computer-based systems.
a14	Demonstrate strong knowledge of fundamentals of Data Warehousing, data structures and algorithms.

**b. Intellectual skills:**

On successful completion of this program, graduates should be able to:	
b2	Perform comparisons between (algorithms, methods, techniques, etc.).
b3	Perform classifications of (data, results, methods, techniques, algorithms, etc.).
<b>c. Professional and practical skills:</b>	
On successful completion of this program, graduates should be able to:	
c1	Use appropriate programming languages and design methodologies.
<b>d. General and transferable skills:</b>	
On successful completion of this program, graduates should be able to:	
d2	Work effectively as an individual and as a member of a team.
d5	Demonstrate efficient IT capabilities.

Program ILOs Covered by Course			
Knowledge and understanding	Intellectual Skills	Professional and practical skills	General and Transferable skills
A2, A13, A14	B2, B3	C1	D2, D5

Intended learning outcomes of course (ILOs)
<p><b>a. Knowledge and Understanding:</b></p> <p>a1. Understand the fundamental concepts and principles of data structures and algorithms.</p> <p>a2. Understand the characteristics and properties of different data structures.</p> <p>a3. Understand the implementation details of different data structures, including algorithms for insertions, deletions, and searches.</p> <p>a4. Understand the advantages and disadvantages of different data structures and be able to select the appropriate data structure for a given problem.</p> <p>a5. Understand the basics of complexity theory and be able to analyze the time and space complexity of different algorithms using Big-O notation.</p>
<p><b>b. Intellectual Skills:</b></p> <p>b1. Analyze and compare the time and space complexity of different data structures and algorithms.</p> <p>b2. Design efficient algorithms to solve problems using appropriate data structures.</p> <p>b3. Evaluate the suitability of different data structures for different applications.</p> <p>b4. Apply knowledge of data structures to analyze and solve real-world problems.</p>
<p><b>c. Professional and practical skill</b></p> <p>c1. Implement data structures using appropriate programming languages.</p> <p>c2. Develop algorithms for common data manipulation tasks, such as searching, sorting, and traversing</p> <p>c3. Test and debug data structures and algorithms using appropriate testing and debugging techniques.</p> <p>c4. Apply data structures to solve real-world problems.</p>
<p><b>d. General and transferable skills</b></p> <p>d1. Communicate effectively about data structures and algorithms with peers and instructors through oral and written reports.</p> <p>d2. Work collaboratively with peers to develop and implement data structures and algorithms for group projects.</p>

Contents		
Topic	Contact Hours	
	lecture	Lab
Introduction to Data Structures and Algorithms (1 week) - Overview of Data Structures and Algorithms	2	
Analysis of Algorithms (1.5 week) - Big-O Notation	3	2
Recursion (1.5 week)	3	2
Arrays (1 weeks) - Arrays and their Implementation - Analysis of Algorithms for Arrays	2	2
Linked Lists (2 weeks) - Linked Lists and their Implementation - Analysis of Algorithms for Linked Lists	4	4
Stack and Queue Implementation using Arrays and Linked Lists (2 weeks)	4	4
Trees (2 weeks) - Binary Trees and their Implementation - Tree Traversal Algorithms	4	4
Graphs (1 week) - Graphs and their Implementation - Graph Traversal Algorithms	2	2
Sorting and Searching Algorithms (2 weeks) - Bubble Sort, Selection Sort, and Insertion Sort - Merge Sort and Quick Sort - Binary Search Algorithm	4	4
Course project	-	4

Teaching and learning methods	
Teaching and learning methods	Used
Lectures	√
Tutorial Exercises	
Practical Lab	√
Discussions.	√
Self – Learning (Reading material, Websites search,)	√
Self-studies	-
Group work	√
Presentation	√
Problem solving/problem solving learning based	√
Case study	√
Synchronous E-Learning	-
Video lectures	√
Asynchronous E-Learning	√

Student assessment methods & Schedule		
Methods	Used	Week#
Midterm Exam	√	8
Final Exam	√	16
Course Project	√	3-14
Course Work & Quizzes	√	2-14
Practical Exam	√	15

Assessment Weight	
Assessment	Weight %
Mid Term Exam	10%
Practical Exam and Project	10%
Final Exam	60%
Course Work & Quizzes	20%
Total	100

Course Work & Quizzes
Short Exams, Assignments, Research, Reports, Presentations
Class/Project discussion

List of references	
Essential books (textbooks)	Data Structures and Algorithms Using C#, By Michael McMillan, Cambridge University Press, 2007
Course notes	E-Learning Portal
Recommended books	Data Structures and Algorithm Analysis in C++, Clifford A. Shaffer, 2013. Problem Solving in Data Structures & Algorithms Using C# 2 <sup>nd</sup> , Hemant Jain, 2018
Periodicals, website	
Videos link	E-Learning Portal

Required Facilities		
Tools & SW (Technology facilities):	- NET framework	
Teaching facilities:	Whiteboard	√
	Computer Lab	√
	Data show	√

	E-Learning	√
	Videos	√
	Website	√

Course Content/ILO Matrix																
Course Contents	Knowledge & understanding					Intellectual skills				Professional and practical skills				General and transferable skills		
	a1	a2	a3	a4	a5	b1	b2	b3	b4	c1	c2	c3	c4	d1	d2	
Introduction to Data Structures and Algorithms	√	√							√					√		
Analysis of Algorithms					√	√										
Recursion					√		√									
Arrays		√	√		√	√	√	√	√	√	√	√	√	√	√	
Linked Lists		√	√		√	√	√	√	√	√	√	√	√			
Stack and Queue Implementation using Arrays and Linked Lists		√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Trees		√	√		√	√	√	√	√	√	√	√	√	√	√	
Graphs		√	√		√	√	√	√	√	√	√	√	√	√	√	
Sorting and Searching Algorithms					√	√					√					

Learning Method /ILOs Matrix																
Learning Methods	Knowledge & understanding					Intellectual skills				Professional and practical skills				General and transferable skills		
	a1	a2	a3	a4	a5	b1	b2	b3	b4	c1	c2	c3	c4	d1	d2	
Lectures	√	√	√	√	√	√	√	√	√	√	√	√	√			
Practical Lab	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Reading material	√	√	√	√	√	√	√	√	√	√	√	√	√			
Websites search	√	√	√	√	√	√	√	√	√	√	√	√	√			
Research and reporting		√	√		√	√	√	√	√	√	√	√	√			
Group work														√	√	
Case study										√	√	√	√	√	√	
Discussions.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	

### Assessment Methods /ILOs Matrix

Assessment Methods	Knowledge & understanding					Intellectual skills				Professional and practical skills				General and transferable skills	
	a1	a2	a3	a4	a5	b1	b2	b3	b4	c1	c2	c3	c4	d1	d2
Mid Term Exam	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Practical Exam										✓	✓	✓	✓		
Final Exam	✓	✓	✓	✓	✓	✓	✓	✓	✓						
Course Work & Quizzes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### Course ILOs Vs Program ILOs

Prog ILOs / Course ILOs		Knowledge & understanding			Intellectual skills			Professional and practical skills	General and transferable skills	
		A2	A13	A14	B2	B12	B13	C1	D1	D2
Knowledge and Understanding	a1			✓						
	a2			✓						
	a3	✓	✓	✓						
	a4			✓						
	a5			✓						
Intellectual skills	b1				✓					
	b2				✓					
	b3					✓				
	b4						✓			
Professional and practical skills	c1							✓		
	c2							✓		
	c3							✓		
	c4							✓		
General skills	d1								✓	
	d2									✓

**Course Coordinator** : Dr.Osama Shafik Elshehry ( )

**Head of Department** : Dr. Ahmed El-Abbassy ( )

**Date:** 29/05/2023