COLLEGE OF INFORMATION TECHNOLOGY
DEPARTMENT OF INFORMATION TECHNOLOGY
COURSE SYLLABUS/ SPECIFICATION

Course Code & Title: ITCS 224 - Data Structures

Weight: **(2 - 2 - 4)**

Prerequisite: ITCS 201

NQF Level Allocated: Level 6

NQF Notional Hours / Credits: 120 notional hours/ 12 NQF credit

Description:

This course introduces different data structures such as: arrays, linked list, stacks, queues, hash tables, and graphs. It covers the design and analysis of different algorithms to manipulate these data structures, such as: create, traverse, delete data, and insert data. The students will implement the data structure algorithms and apply them using a programming language.

Objective:

1. To overview various types of data structures.
2. To explain the algorithms associated with each data structure and their implementations.
3. To provide an analysis of the efficiency of algorithms associated with each data structure in terms of both time and space.
4. To demonstrate the effective use of data structures in computational problem solving.

SEMESTER: ACADEMIC YEAR:

INSTRUCTOR:
OFFICE TEL:
EMAIL:

Intended Learning Outcomes (ILOs):

A. Knowledge and Understanding		NQF Descriptor/ Level
A1	**Concepts and Theories:** Demonstrate a broad knowledge of the concepts and theories of various data structures and their algorithms.	Knowledge: theoretical understanding [Level 6]
A2	**Contemporary Trends, Problems and Research:** N/A	N/A
A3	**Professional Responsibility:** N/A	N/A

B. Subject-specific Skills		NQF Descriptor/ Level
B1	**Problem Solving:** Identify problems and choose the appropriate and efficient data structures to solve these problems.	Knowledge: Practical Application [Level 6] Skills: Communication, ICT & Numeracy [Level 6]
B2	**Modeling and Design:** Formulate data model, and design software solution through the application of the appropriate data structures.	Knowledge: Practical Application [Level 6]
B3	**Application of Methods and Tools:** Use a programming language to implement various data structures and apply different methods of designing algorithms.	Knowledge: Practical Application [Level 6] Skills: Communication, ICT & Numeracy [Level 6]

C. Critical-Thinking Skills		NQF Descriptor/ Level
C1	**Analytic:** Evaluate and analyze the performances of algorithms associated with the various data structures.	Generic Problem Solving & Analytical skills [Level 6]
C2	**Synthetic:** N/A	N/A
C3	**Creative Thinking and innovation:** N/A	N/A

	D. General and Transferable Skills (other skills relevant to employability and personal development)	NQF Descriptor/ Level
D1	**Communication:** Express and communicate ideas in written and oral form.	Communication, ICT and Numeracy Skills [Level 6]
D2	**Teamwork and Leadership:**	N/A
D3	**Organizational and Developmental Skills:** Demonstrate ability to organize ideas and effectively allocate time in given assignment.	Competence: Autonomy, Responsibility and Context [Level 6]
D4	**Ethics and Social Responsibility:**	N/A

Course Structure (Outline)

Course Structures (Outline)						
Week	**Hours**		**ILOs**	**Unit/Module or Topic Title**	**Teaching Methods**	**Assessment Method**
	Lec.	**Labs**				
1	2	2	A1	Syllabus- Introduction	Lecture	-
2-3	4	4	A1, B1, B2, B3, C1	**Arrays:** -Array creation and initialization. -Insertion and deletion of an element. -Multidimensional arrays and their representations. -Performance Analysis.	Lecture/ In-Class Supervised Work / In-Lab Supervised Work	In-Class Exercises/ In-Lab Exercises
4	2	2	B2, B3, C1, D1, D3	**Arrays:** -Sequential and binary search operations. -Selection and insertion sort operations.	Lecture/ In-Class Supervised Work / In-Lab Supervised Work	Assignment 1

5-6	4	4	A1, B1, B2, B3, C1	**Stack:** -Applications of stack. -Push and pop operations. -Performance Analysis.	Lecture/ In-Class Supervised Work / In-Lab Supervised Work	In-Class Exercises/ In-Lab Exercises/ Major Test
7-8	4	4	A1, B1, B2, B3, C1	**Queue:** -Types of queues like circular one. -Insertion and deletion operations on queues. -Performance Analysis.	Lecture/ In-Class Supervised Work / In-Lab Supervised Work	In-Class Exercises/ In-Lab Exercises
9-10	4	4	A1, B1, B2, B3, C1, D1, D3	**Linked list:** - Linked list, doubly linked list and circular linked list. -Insertion and deletion operations on linked list. -Performance Analysis.	Lecture/ In-Class Supervised Work / In-Lab Supervised Work	Assignment 2/ In-Class Exercises/ In-Lab Exercises
11-12	4	4	A1, B1, B2, B3, C1	**Hash Tables:** -Hash function. -Collision resolution. -Performance Analysis.	Lecture / In-Class Supervised Work / In-Lab Supervised Work	In-Class Exercises/ In-Lab Exercises
13-14	4	4	A1, B1, B2, B3, C1	**Trees:** -Definitions and basic terminologies. -In-order, pre-order and post-order traversal. -Tree creation, insertion and deletion of a node. -Performance Analysis.	Lecture/ In-Class Supervised Work / In-Lab Supervised Work	In-Class Exercises/ In-Lab Exercises

| 15 | 2 | 2 | A1, B1, B2 | **Graphs Concepts:**
-Undirected and directed graphs.
-Representing graphs. | Lecture/ In-Class Supervised Work | Lab Test |
| 16 | 2 | - | A1, B1, B2, C1 | All Topics | | Final Exam |

Teaching Materials:

Textbook(s):	1. Goodrich M. T., Tamassia R. and Goldwasser M. H. (2014) *Data Structure and Algorithms in Java*, 6th Edition, Wiley.
Handout(s):	Available on Moodle i.e. http://www.ahlia.edu.bh/moodle
Reference(s):	1. Weiss M. A. (2011) *Data Structures and Problem Solving using Java*, 4th Edition, Pearson Education. 2. Dale N., Joyce D. and Weems C. (2011) *Object Oriented and data structures using Java*, Third Edition, Jones & Bartlett Publishers.

ASSESSMENTS:

Type of Assessment	Description	ILOs	Weighting
In-Lab Exercises	They consist mainly of implementing different data structures.	B3	Formative
In-Class Exercises	They cover problem solving and analysis questions and help students in differentiating between the various data structures.	B1, B2	Formative
Assignments	Two assignments, each one covers a number of data structures used for solving a problem and will worth ten marks. The students have to analyze the performance of each data structure.	B1, B2, B3, C1, D1, D3	20 %
Major Test	One written test to be given to students. The major test is a written, in-class 90 minutes test. It will cover topics studied in the first 10 weeks. The majority of questions are problem solving and analysis questions.	A1, B1, B2, C1	20 %
Lab Test	A practical comprehensive test of two hours. It consists of questions to implement data structures appropriate to solve given problems.	B1, B3	20%

Final Exam	The final exam is a comprehensive, written exam and will be of two hours. It consists of problem solving and analysis questions.	A1, B1, B2, C1	40%
Overall			100%

Admissions	
Minimum number of students	**5**
Maximum number of students	**25**

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