Course unit title:	Data Structures and Algorithms
Course unit code:	CSC205
Type of course unit: **(Compulsory/optional)**	Compulsory (Foundation)
Level of course unit: **(First, second or third cycle)**	Bachelor (1st cycle)
Year of study:	2
Semester when the unit is delivered:	3
Number of ECTS credits allocated:	6
Name of lecturer(s):	TBA

Learning outcomes of the course unit:

Upon succesful completion of this course students should be able to:

- Analyze program time complexity and express it in big-Oh, Omega and Theta notation.
- Classify and evaluate different data structures, both linear and non-linear.
- Generate programs that use abstract data structures to solve computational problems.
- Apply different algorithms to solve computational problems.

Mode of delivery:	Face- to- face
Prerequisites and co-requisites:	CSC120, CSC132
Recommended optional program components:	None

Course Contents:

Objective:

The course will introduce students to the basic concepts of data structures, and their usefulness in various computer operations. Structures like arrays, stacks, queues, linked lists, trees and graphs will be discussed and analyzed. Algorithms will be developed that operate and manipulate these structures efficiently. Analysis of time-space complexity of algorithms.

Description:

Introduction and basic concepts of data structures:
Definition of a data structure, implementation of a data structure, definition of an algorithm, distinguishing between an algorithm and a program, how to create and analyze programs. Asymptotic notation and arithmetic, O-notation. Complexity of searching and sorting algorithms. Recursive mathematical function, recursively defined problem, relation of mathematical induction and recursion, comparison of iterative and recursive solutions, divide-and-conquer strategies, recursive backtracking.

Linked Lists:
Cursor-implementation of a linked list, pointer implementation of a Linked list, the INSERT and DELETE operations on Linked lists, the efficiency of these operations on Linked lists compared to sequential storage structures, algorithms for Deletion and Addition with Linked lists; doubly linked lists and their advantages versus singly linked lists.

STACKS and QUEUES:
Definitions of these two data structures, operations associated with stacks, CREATE a stack DELETE a stack, return the TOP element of a stack, ADD an element to the stack algorithms for ADDING to and DELETING elements from a stack; operations performed on Queues, Create a queue, DELETE the FRONT element of a queue, ADD an element to the REAR of a queue, algorithms for Deletion and Addition routines on Queues.

Sorting and Searching:
$O(n^2)$ and O(nlogn) sorting techniques, Linear and Binary Search, Greedy and Divide and Conquer algorithmic techniques, Hashing.

Trees:
Definition of a Tree, a rooted tree, the height of a rooted tree, level numbers of any vertex, a balanced tree, theorems concerning a Tree graph, an n-ary tree, traversing a tree, Inorder, Postorder Preorder and Level-Order traversals; implementation of trees, representation of trees by Lists of children using linked lists; BINARY trees, representing binary trees Advanced set representation methods: definition of a SET BINARY SEARCH Trees, the Binary Search Tree property, operations supported by such structures (INSERT, DELETE, MEMBER, MIN) algorithms to implement these operations, time-analysis of these operations;
INSERTION into a BALANCED Tree, DELETION in a Balanced Tree

Graph Theory:
What a graph, what a PATH and a CIRCUIT are, directed and undirected graphs, networks, breadth- and depth-first search in graphs, representation of graphs as abstract data structures.

Recent developments and contemporary issues pertaining to the subject-matter of the course.

Recommended or required reading:	Lewis, J. & Chase J., JAVA SOFTWARE STRUCTURES: DESIGNING & USING DATA STRUCTURES, Addison Wesley Goodrich, M. & Tamassia, R., DATA STRUCTURES AND ALGORITHMS IN JAVA, Wiley Sartaj Sahni, DATA STRUCTURES, ALGORITHMS AND APPLICATIONS IN JAVA, McGraw-Hill Mark Allen Weiss, DATA STRUCTURES AND ALGORITHM ANALYSIS, Addisson Wesley Drozdek, DATA STRUCTURES & ALGORITHMS IN JAVA, Thompson Course Technology Clifford, A., PRACTICAL INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS, Prentice Hall Bailey, JAVA STRUCTURES: DATA STRUCTURES IN JAVA FOR THE PRINCIPLED ROGRAMMER" , McGraw-Hill
Planned learning activities and teaching methods:	Class Instruction 42 Hours Consultation/Computer Lab 15 Hours
Assessment methods and criteria:	Examinations 75% Assignments/ Class Participation 25% 100%
Language of instruction:	English
Work placement(s):	No
Place of Teaching:	Theoretical Part: Regular Classroom European University Cyprus, Nicosia Practical Part: Computer Laboratory European University Cyprus, Nicosia