**Syllabus**

# Data Structures & Algorithms

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| **1. GENERAL INFORMATION** | |
| Faculty | Faculty of Computers and Information |
| Major code and title | CS201 Computer Science |
| Year, semester | 2nd year, |
| Subject category | Required |
| Number of Credits | 3 |
| Language of Delivery | English |
| Prerequisites | Mathematics |
| Postrequisites | Object-Oriented Programming |
| Lecturer | Prof. Marghny Hassan Mohamed  e-mail: marghny@aun.edu.eg |
| Instructors |  |
| **2. GOAL AND OBJECTIVES OF THE COURSE**  The goal of the course is learning the basics of algorithms, data structures and programming to solve practical problems using the language C++.    The objectives of the course are:   * studying of the rules of formulating and solving practical problems on a computer * introduction to the basics of the theory of algorithms * to study how to present the program and methods of data processing in the computer  to study the structure of programming systems and rules for using in applications development * mastering skills of programming using high-level language C++ to solve practical problems on a computer * development of programs with use of standard modules, style of programming, methods of testing * to use the algorithms for solving typical practical tasks     **Learning outcomes of the course** Students successfully completing the course will be able to:   * To develop block diagrams of various algorithms * To organize depending on task requirements necessary structures of the data * To develop programs on C++ with use of means of language * To write programs in good style * To debug and test programs * To constitute the qualitative program documentation | |
| **3. COURSE DESCRIPTION**  The course "Data Structures & Algorithms" is designed for studying of development of algorithms and programs for solutions of different problems. For this purpose, subjects of this course are considered, such as program structure, principles of construction of algorithms and program, methods of solving, algorithmization, programming, debugging and implementation of programs, using the language C++. | |
| **4. COURSE POLICY** | |
| **Students should always**   * be appropriately dressed (formal/semi- formal styles are acceptable); - show consideration for and mutual support of teachers and other students; * let the teacher know of any problems arising in connection with their studies. | |
| **5. Literature** Basic literature:  Fourth Edition, Data Structures and Algorithm Analysis in C++ Mark Allen Weiss Florida International University | |

# Course Content

## Lecture, practical/seminar/laboratory session plans

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| --- | --- | --- | --- | --- | --- | --- |
| **Week No** | **Course Topic** | **Reference**  **Materials** | **Lectures**    **(1**  **)**  **h/w** | **Practic**  **al**  **classe**    **(1**  **)**  **h/w** | **TSIS**    **(1**  **)**  **h/w** | **SIS**    **(3**  **)**  **h/w** |
| 1 | **History of C++.**  **Variables and Types. Flowcharts. Building blocks.** Supported paradigms. The Features of C++ as a Language. Visual Studio. Support for C++. Console Appication. Structure of a program. Comments. Using namespase std. Variables and Types. Identifiers. Fundamental data types. Character types. Numerical integer types. Floating-point types. Boolean type. Basic mathematical functions in the C++ mathematics library | Basic [1]-[3] | L 1 | PA 1 | TSIS 1 | SIS 1 |

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| --- | --- | --- | --- | --- | --- | --- |
| 2 | **Declaration of variables.** **Operators.** Initialization of variables. Type deduction: auto and decltype. Introduction to strings. Literals. Integer Numerals. Floating Point Numerals. Character and string literals. Other literals. Typed constant expressions. Preprocessor definitions. Operators. Assignment operator. Arithmetic operators. Compound assignment. Increment and decrement. Relational and comparison operators. Logical operators. Conditional ternary operator. Comma operator. Bitwise operators. Explicit type casting operator. Other operators. Basic Input/Output. Standard output. Standard input. | Basic [1]-[3] | L 2 | PA 2 | TSIS 2 | SIS 2 |
| 3 | **Iteration statements (loops).** The standard header [<sstream>.](http://www.cplusplus.com/%3Csstream%3E) Statements and flow control. Selection statements: if and else. Iteration statements (loops). Iteration statements (loops). The do-while loop. The for loop. Range-based for loop. Jump statements. The break statement. The continue statement. The goto statement. The switch statement. | Basic [1]-[3] | L 3 | PA 3 | TSIS 3 | SIS 3 |
| 4 | **Arrays.** Initializing arrays. Accessing the values of an array. | Basic [1]-[3] | L 4 | PA 4 | TSIS 4 | SIS 4 |
| 5 | **Multidimensional arrays**. Arrays as parameters. Library arrays. | Basic [1]-[3] | L 5 | PA 5 | TSIS 5 | SIS 5 |
| 6 | **Multidimensional arrays**. Sum of the elements of all matrix. Product of the elements. Number of the elements.  Sum of every row and every column. | Basic [1]-[3] | L 6 | PA 6 | TSIS 6 | SIS 6 |
| 7 | **Character sequences.** Initialization of null-terminated character sequences. Strings and null-terminated character sequences. | Basic [1]-[3] | L 7 | PA 7 | TSIS 7 | SIS 7 |
| 8 | **Functions.** Functions with no type. The use of void. The return value of main. Arguments passed by value and by reference.. | Basic [1]-[3] | L 8 | PA 8 | Mid-  term |  |
| 9 | **Functions.** Efficiency considerations and const references. Inline functions. Default values in parameters. Declaring functions | Basic [1]-[3] | L 9 | PA 9 | TSIS 8 | SIS 8 |
| 10 | **Recursion. Recursive function.** | Basic [1]-[3] | L 10 | PA 10 | TSIS 9 | SIS 9 |
| 11 | **Data structures.** Nesting structures. | Basic [1]-[3] | L 11 | PA 11 | TSIS 10 | SIS 10 |
| 12 | **Pointers.** Address-of operator. Dereference operator. Declaring pointers. Pointers and arrays. Pointer initialization. Pointer arithmetics. Pointers and const. Pointers and string literals. Pointers to pointers. void pointers. Invalid pointers and null pointers. Pointers to functions. | Basic [1]-[3] | L 12 | PA 12 | TSIS 11 | SIS 11 |
| 13 | **Files.** Input/output with files. Open a file Closing a file. | Basic [1]-[3] | L 13 | PA 13 | TSIS 12 | SIS 12 |
| 94 | **Pointers and arrays. Sorting.** | Basic [1]-[3] | L 14 | PA 14 | TSIS 13 | SIS 13 |
| 15 | **Sorting.** | Basic [1]-[3] | L 15 | PA 15 | End of term |  |
|  | **Total hours** | **90** | **15** | **15** | **15** | **45** |

## List of assignments for Student Independent Study

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| --- | --- | --- | --- | --- |
| № | Assignments (topics) for Independent study | Hours | Recommended literature and other sources (links) | Form of submission |
| 1 | Fundamental data types.  Boolean type. Basic mathematical functions in the C++ mathematics library. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 2 | Operators.  Assignment operator. Arithmetic operators.  Basic Input/Output. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 3 | Iteration statements (loops).  The do-while loop. The for loop.  Range-based for loop.  Jump statements.  The break statement.  The continue statement.  The goto statement.  The switch statement. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 4 | One-dimensional arrays. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 5 | Multidimensional arrays. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 6 | Tasks with Multidimensional arrays. Sum of the elements of all matrix. Product of the elements.  Number of the elements. Sum of every row and every column. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 7 | Character sequences. String. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 8 | Function. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 9 | Recursivity. | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 10 | Function. Arguments passed by | 1 | Basic [1]-[3] | Discussion |
|  | value and by reference |  | Supplementary [1][2] |  |
| 11 | Data structures | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 12 | Pointers | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |
| 13 | Files | 1 | Basic [1]-[3]  Supplementary [1][2] | Discussion |

# Student performance evaluation system for the course

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| --- | --- | --- | --- |
| **Period** | **Assignments** | **Number of points** | **Total** |
| 1st attestation | **Class work:**  Regular attendance\Active participation  Quiz # 1  Quiz # 2  **Student Independent Study:**  Home Work  Assignments  **Mid term** | **20**  10  5  5  **30**  15  15  **50** | 100 |
| 2nd attestation | **Class work:**  Regular attendance\Active participation  Quiz # 1  Quiz # 2  **Student Independent Study:**  Home Work  Assignments  **End of term** | **20**  10  5  5  **30**  15  15  **50** | 100 |
| Final exam | **Exam** | **100** | 100 |
| **Total** | **0,3\*1stAtt+0,3\*2ndAtt+0,4\*Final** |  | **100** |

\*If the number of absences exceeds 20%, student will be automatically scheduled for a Retake (summer semester)

Achievement level as per course curriculum shall be assessed according to the evaluation chart adopted by the academic credit system:

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| --- | --- | --- | --- |
| Letter Grade | Numerical equivalent | Percentage | Grade according to the traditional system |
| А | 4,0 | 95-100 | Excellent |
| А- | 3,67 | 90-94 |
| В+ | 3,33 | 85-89 | Good |
| В | 3,0 | 80-84 |
| В- | 2,67 | 75-79 |
| С+ | 2,33 | 70-74 | Satisfactory |
| С | 2,0 | 65-69 |
| С- | 1,67 | 60-64 |
| D+ | 1,33 | 55-59 |
| D | 1,0 | 50-54 |
| F | 0 | 0-49 | Fail |

# METHODOLOGICAL GUIDELINES

Assessment is administered continuously throughout the course. The students are rated against their performance in **continuous rating** administered throughout the semester (credited 60%) and **summative rating** done during the examination session(credited 40%), total **100%.** **Continuous rating** is students’ on-going performance in class and independent work. Class work is assessed for attendance and active participation (problem solving).

**Teaching methodology** Theory classes:

* lectures developing the theoretical aspects of the subject - practical classes aimed at applying theory to problems.

Workshop classes:

* practical classes in which students solve problems in groups or individually.

**SIS (Student Independent Study**) comprises topics related problems to be done by students independently and checked in class.

**TSIS (Teacher Supervised Student Independent Study)** comprises individual homework assignments to be done by students independently and checked by teacher.

**Mid-term** examination is held in the 8th week of the semester and includes topics 1-7 of the course.  **End-of-term** examination is held in the last week of the semester and includes topics 8-15 of the course.

**Final examination** is a computer-based test that consists of multiple choice questions covering all topics of the course.