**SAN FRANCISCO UNIVERSITY OF QUITO**

**COLLEGE: SCIENCE AND ENGINEERING**

**Semester:** 202120 - Second Semester 2021/2022  **Schedule:**  MJ 10:00 - 11:20 (Classroom N-219)

**TEACHER DETAILS:**

**Professor:** Noel Perez Perez

**Email:** nperez@usfq.edu.ec  **Office:**  **H340 & ZOOM.**

**Office hours: LMIJ – 15:00-16:00.**

**COURSE DETAILS:**

**COURSE: CMP-3002 - DATA STRUCTURES**

**NRC:** 3647

**Credits:** 3

**Prerequisites:** Verify prerequisites in BANNER academic system. **Co-requirements:**  The course has no co-requirements

**COURSE DESCRIPTION:**

The course introduces the student to the fundamentals of the main traditional data structures, both their implementation and the use of generic libraries and collections. The technique of algorithm analysis for the design of efficient programs that optimally use computer resources.

Part of this course is also the teaching of conceptual programming techniques that allow students to propose and develop solutions independent of the programming language.

**COURSE-SPECIFIC LEARNING OUTCOMES:**

|  |  |  |
| --- | --- | --- |
| **#** | **Learning**  **Outcomes** | **Level** |
| 1 | Implement and use the main traditional data structures | Middle |
| 2 | Develop algorithm analysis techniques in general | Middle |
| 3 | Evaluate programming techniques in classification, search and sorting | Middle |
| 4 | Identify and analyze traditional algorithms | Middle |
| 5 | Develop advanced programming techniques for computer memory management | Middle |
| 6 | Understand professional programming concepts and features | Middle |

**COURSE CONTENTS:**

Abstract Data Types

Linear Structures : Stacks, Queues, Priority Queues, Collections

Trees, Binary Trees, Search Binary Trees, Multivia Trees, Tree Balancing

Generic Libraries

Complexity Analysis, Big O Notation, Search Algorithms and Sorting

Dispersion Tables, Collisions

**METHODOLOGY FOR THE INTEGRATION BETWEEN THEORETICAL AND PRACTICAL CONTENTS:**

The teaching methodologies used to teach USFQ courses, following the philosophy of the Liberal Arts, encourage dialogue and facilitate the construction of knowledge through the constant exchange of ideas and experiences between teachers and students. It is expected that in all courses the theoretical contents will be linked to the professional practice and work context where the students will work in the future, trying to integrate activities and simulations of various kinds that promote the understanding of the contents contextualized with practice and reality.

**COURSE EVALUATION:**

|  |  |  |
| --- | --- | --- |
| **Category** | **Description** | **Percentage of the final grade** |
| Exams (E) | * Theory. * Implementation.   (18 points each) | 54 |
| Seminar (S) | - Preparation of a topic assigned by team.  (15 points) | 15 |
| Independent Studio (EI) | * Readings. * Quizzes of questions about readings or classes in general. * Implementation of exercises in*Java.*   (5 points each) | 35 |
| Control Questions\* | - Questions related to content previously oriented in independent studies or taught in classes. | 0.5 |

THE RATING SCALE USED SHALL BE THE REGULAR ONE STIPULATED IN THE MANUAL

STUDENT AND TEACHERS

**Description of evaluation categories**

|  |  |  |  |
| --- | --- | --- | --- |
| **Category** | **Implementation and**  **Execution** | **Development, presentation**  **and**  **advocacy** | **Value** |
| E1, E2, E3 | 18 points each |  | 18% of the final grade  (c/u) |
| S1 |  | * Development and presentation of the theme with quality * Answers to questions | 15% of the final grade |
| **Category** | **Implementation and**  **solution** | | **Value** |
| EI1, EI2, EI3, EI4, EI5, EI6 and EI7 | * Upload diagrams, codes, etc. to D2L. * Questions about readings or classes in general. | | 5% of the final grade each |

**MAIN BIBLIOGRAPHY:**

* Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser. Data Structures and Algorithms in Java, 6th Edition. ISBN: 978-1-118-77133-4. Wiley, 2014.

**COMPLEMENTARY BIBLIOGRAPHY:**

* Collins, William J., Data structures :, Reading, Mass.: Addison-Wesley, 1992
* Weiss, Mark Allen., Data structures and algorithm analysis in Java /, London : Pearson, 2014.
* Sedgewick, Robert, Algorithms in C /, Boston: Addison Wesley, 1998 \* Algorithms, 4th Edition by Rober Sedgewick and Kevin Wayn https://algs4.cs.princeton.edu/home/

**POLICIES:**

All USFQ courses are governed by the standards of learning ethics, research ethics, and behavioral ethics contained in the USFQ Code of Honor and Coexistence;and by the policies and procedures detailed in the Student Handbook.

Course specifics :

* + All activities must be uploaded to D2L within the allowed period. The notes will be delivered by the same means.
  + Each exam will be submitted 10 minutes before the end time of the class.
  + For no reason will shipments of delayed activities be accepted. If necessary and not obvious any delay, the sending of the activity in question will be made to the teacher's email until a period of 24 hours after the closing of the folder in the D2L and will have a penalty of 50% of the value of the activity. After that period it is assumed not delivered and receives zerograde.
  + Students are responsible for correctly submitting their activities, any mistake in the submission does not exempt them from the general rules.
  + Participation in the exams and seminar is mandatory. Any absence will be assumed as a grade I,until the deadline for delivery of a valid (not obvious) justification that merits the realization of an extraordinary evaluation is met. The deadline for delivery of the justification will be within 48 hours after the activity has been applied. If the valid justification is not presented within this period, the rating will automatically become a zero grade (F).
  + Any academic dishonesty (plagiarism between colleagues, from the internet, inconsistent codes, etc.) detected in the activities of the course, will be penalized with grade F in this course.
  + The participation of all students in the classes is mandatory.
  + It is mandatory to turn on the webcams during classes.
  + Cell phones should be in silent mode to avoid distractions and interruptions.
  + Late arrivals will be tolerated up to 10 minutes after the start of the class. After the tolerance will not be allowed entry to the class.
  + The schedule of course activities may eventually be modified with prior notice to students during the semester.
  + The attention to students will be in the schedule of LMIJ 15:00 – 16:00 with prior appointment

(email)

Reclamos:

* + In cases of complaints regarding the class, the operational flow will be through the conversation with the teacher. If this does not satisfy your demand, you can go to the coordinator of the area and later to the Dean through a written claim.

Special cases:

* + If a enrolled student has been diagnosed with health problems that may cause some type of learning impairment they should contact the teacher to explain their situation during the first week of the course. In this way the teacher will plan their activities and exercises so that said student can be evaluated correctly. For this, it is required to prove the existence of the problem (not obvious) with appropriate medical documentation. Class objectives are the same for all enrolled students.

**SCHEDULE OF ACTIVITIES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Theme** | **Activity** |  | **Contents** | | |
| 1 | TDAs and  Algorithms | Introductory |  | • Introduction to the Syllable. | | |
| Theoretical |  | * Abstract Data Type (TOTs) * Growth and Big O functions | | |
| 2 | Lists,stacks, and queues | Theoretical |  | * Listas enlazadas (singly linked list) * Pilas (stacks) * EI1- Implementation | | |
| Practice |  | • Exercises | | |
| 3 | Theoretical |  | * Colas (tails). * Priority queues | | |
| Practice |  | • Exercises | | |
| 4 | Theoretical |  | * Doubly linked lists   list)   * Multilistas. * EI2 - Implementation | | |
| Practice |  | • Exercises | | |
| 5 | Practice |  | • Exercises | | |
| E1 |  | • Address contents of the conferences given to date. | | |
| 6 | Recursion | Theoretical |  | * Recursion * EI3 - Implementation | | |
| Practice |  | • Exercises | | |
| 7 |  | | **ACADEMIC BREAK** | | |  |
|  | | |
| 8 | Trees | Theoretical |  | * Trees. * Tours. * Binarytrees. * Representations. * EI4 - Implementation | | |
| Practice |  | • Exercises | | |
| 9 | Theoretical |  | * Ordered map. * Binary search. * Lookup tables. * Binary search trees. * Find, insert and delete nodes. | | |
| Practice |  | • Exercises | | |
| 10 | Practice |  | • Exercises | | |
| E2 |  | • Address contents of the conferences given to date. | | |
| 11 | Maps and scatter tables | Theoretical |  | * Dispersion tables. * EI5 - Implementation | | |
| Practice |  | • Exercises | | |
| 12 |  | Theoretical |  | * Graphs. * Properties. | | |
|  | Graph |  | | • | Representations. | |
| Practice | | • | Exercises | |
| 13 | Theoretical | | •  • | DFS (depth-first search) y BFS (breadthfirst search).  EI6 - Implementation | |
| Practice | | • | Exercises | |
| 14 | Theoretical | | • | Directed graphs (digraphs). | |
|  |  |  | | • | Properties. | |
|  |  |  | | • | Connectivity. | |
|  |  |  | | • | Transit closures (Floyd-Warshall). | |
|  |  |  | | • | Topological ordering | |
|  |  |  | | • | EI7 - Implementation | |
| Practice | | • | Exercises | |
| 15 | Theoretical | | • | Shorter path. | |
|  |  |  | | • | Dijkstra algorithm | |
| Practice | | • | Exercises | |
|  |  |  | | • | Orientation of the seminar | |
| 16 | E3 | | • | It will address the contents of the conferences given to date. | |
| Consolidated topics | S1 | | • | Presentation of the seminar | |

This Program of Study (Syllabus) was reviewed and approved by the coordination of the academic area or department responsible. In case it is necessary to make changes/adjustments to the study program, you must request it from the coordination of the academic area or department responsible so that the approved changes/adjustments are reflected in the Curriculum Design system.

During the 202120 semester, the teaching process designed for this course is consistent with the approved plans for the return to face-to-face attendance, so the capacity indicated for each classroom must always be respected. Some classes will be taught in synchronous virtual mode (without face-to-face) and ONLINE courses will continue to be offered for students who are studying careers in that modality. Each syllabus must be designed according to the learning modality in which the course will be taught, in all cases the use of technological, telematic and other methodologies must be integrated to facilitate learning during the transition to normality. All learning activities seek to ensure compliance with academic plans of the careers and programs and continuity of students' studies; the physical integrity of the students, preserving the quality and rigor of the academic and the right to work, to the health of the academic, support and administrative staff.