جـامعـة الـزيتـونــة الأردنيــة
**Al–Zaytoonah University of Jordan**
كلية العلوم وتكنولوجيا المعلومات
**Faculty of Science and Information Technology**

" عراقة وجودة"
"Tradition and Quality"

| QF01/0408-4.0E | **Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Cyber Security Department** |
|---|---|

| Study plan No. | 2024/2025 | | University Specialization | | Cybersecurity | |
|---|---|---|---|---|---|---|
| Course No. | 0133212 | | Course name | | Data Structure and Algorithm | |
| Credit Hours | 3 | | Prerequisite Co-requisite | | البرمجه التطبيقيه | |
| Course type | ☐ MANDATORY UNIVERSITY REQUIREMENT | ☐ UNIVERSITY ELECTIVE REQUIREMENTS | ☐ FACULTY MANDATORY REQUIREMENT | ☐ Support course family requirements | ☐ ✔ Mandatory requirements | ☐ Elective requirements |
| Teaching style | ☐ Full online learning | | ☐ Blended learning | | ☐ ✔Traditional learning | |
| Teaching model | ☐ 2Synchronous: 1asynchronous | | ☐ 2 face to face : 1synchronous | | ☐ 3 Traditional | |

**Faculty member and study divisions information (to be filled in each semester by the subject instructor)**

| Name | Academic rank | Office No. | Phone No. | E-mail | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

| Division number | Time | Place | Number of students | Teaching style | Approved model |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

**Brief description**

This Data Structure and Algorithm course provides students with knowledge about abstract data types and the basic operations to manipulate them, as well as the skills to apply them to solve problems. The following topics included in this course: Lists, Stacks, Queues, Recursion. Introduction to algorithm analysis. Introduction of search and sort algorithms including Trees and Binary Search Trees. In a high-level language (usually Java) the student should implement the user-defined data structures. Student can compare performance-related alternative implementations of data structures. Write programs that use the arrays, records, strings, linked lists, stacks and queues of each data structures.

**Learning resources**

| Course book information (Title, author, date of issue, publisher ... etc) | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
|---|---|
| Supportive learning resources (Books, databases, periodicals, software, applications, others) | 1. Introduction to Algorithms, fourth edition 4th Edition by Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest (Author) 2. Nell Dale, Daniel T. Joyce, Chip Weems ,Object-oriented data structures using Java,2016Data Structures and Algorithms in Java 6th Edition by Michael T. Goodrich, Roberto Tamassia |
| Supporting websites | |

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| The physical environment for teaching | ☐ **Class room** | ☐ labs | ☐ **Virtual educational platform** | ☐ Others |
|---|---|---|---|---|
| Necessary equipment and software | | | | |
| Supporting people with special needs | | | | |
| For technical support | **E-learning and Open Educational Center. Computer Center** | | | |

## Course learning outcomes (S= Skills, C= Competences K= Knowledge,)

| No. | Course learning outcomes | The associated program learning output code |
|---|---|---|
| **Knowledge** | | |
| K1 | Recognize the concept of an Abstract Data Type (ADT) | K1 |
| K2 | Determine how an ADT is designed and implemented as a class of some object-oriented programming language | K2 |
| K3 | Understanding the concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation | K3 |
| K4 | Understanding a wide range of searching and sorting algorithms | K4 |
| **Skills** | | |
| S1 | Improve the programming skills of students, especially in Java. | S1 |
| S2 | Enable students to design and implement some user-defined data structures (lists, stacks, queues, linked lists, binary trees, etc.) as Java generic classes. | S2 |
| **Competences** | | |
| C1 | Give students some practice in the application of new user-defined data structures | C1 |

## Mechanisms for direct evaluation of learning outcomes

| Type of assessment / learning style | Fully electronic learning | Blended learning | Traditional Learning (Theory Learning) | Traditional Learning (Practical Learning) |
|---|---|---|---|---|
| First exam | 0 | **0** | 0 | 0 |
| Second / midterm exam | %30 | **%30** | %30 | %30 |
| Participation / practical applications | 0 | **0** | 0 | 0 |
| Asynchronous interactive activities | %30 | **%30** | %30 | %30 |
| final exam | %40 | **%40** | %40 | %40 |

**Note:** Asynchronous interactive activities are activities, tasks, projects, assignments, research, studies, projects, work within student groups ... etc, which the student carries out on his own, through the virtual platform without a direct encounter with the subject teacher.

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## Schedule of simultaneous / face-to-face encounters and their topics

| Week | Subject | learning style* | Reference ** |
|---|---|---|---|
| 1 | Introduction to data structures: What is a data structure? Concept of an ADT: Definition of an Abstract Data Type (ADT), representation of objects, implementation of operations. | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| 2 | Introduction to Linked Lists: Array vs. Linked Lists, operations on Linked Lists. Stack ADT: Stack ADT definition and its array implementation | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| 3 | Stack ADT: Linked stack implementation, applications of stacks (Evaluating Postfix Expressions). Recursion: recursive definitions, how recursion works, classic examples | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| 4 | Queue ADT: Queue ADT definition | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| 5 | Queue ADT: implementation, Queue implementation as a linked structure, applications of queues | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| 6 | List Abstract Data Type ADT | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| 7 | List implementation as a linked: Comparing Objects, varieties of lists | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |

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|---|---|---|---|
| **8** | Midterm Exam | Traditional Learning | |
| **9** | Big-O Analysis. Binary Search algorithm, | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **10** | Binary Search Trees: Binary search tree specification, binary search tree implementation. | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **11** | Algorithms for sorting: insertion sort | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **12** | Divide and conquer Sort Algorithm | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **13** | Merge Sort Algorithm | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **14** | Quicksort Algorithm | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **15** | Project | Traditional Learning | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. |
| **16** | Final Exam | Traditional Learning | |

* **Learning styles: Lecture, flipped learning, learning through projects, learning through problem solving, participatory learning ... etc.**

** **Reference: Pages in a book, database, recorded lecture, content on the e-learning platform, video, website ... etc.**

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## Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

| Week | Task / activity | Reference | Expected results |
|---|---|---|---|
| 1 | Activity on Object oriented Programming | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019 | |
| 2 | Activity on Abstract Data Type (ADT) | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. | |
| 3 | Activity on Stack ADT And stack implementation | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019 | |
| 4 | Activity on queue | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. | |
| 5 | Activity on queue implementation | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019 | |
| 6 | Activity on List Abstract Data Type ADT | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. | |
| 7 | Activity on algorithms | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, | |
| 8 | Activity on Binary search tree | F. M. Carrano and T. M. Henry: Data Structures and Abstractions with Java, 5th edition, Pearson, 2019. | |