
جامعة الزيتونة الأردنية
Al-Zaytoonah University of Jordan



Course Syllabus

***According to JORDAN National Qualification
Framework (JNQF)***

Course Name: Algorithms

Course Number: 0130322

General Course Information:

Course Title	Algorithms
Course Number	0130322
Credit Hours	3 credit hours
Education Type	Traditional learning
Prerequisites/Co-requisites	Data Structures (0130221)
Academic Program	Computer Science
Program Code	130
Faculty	Faculty of Information Technology
Department	Computer Science
Level of Course	2
Academic Year /Semester	2024/2025 2 nd Semester
Awarded Qualification	BSc
Other Department(s) Involved in Teaching the Course	-
Language of Instruction	English
Date of Production	October 2024
Date of Revision	October 2025

Course Coordinator:

Coordinator's Name	
Office No.	
Office Phone Extension Number	
Office Hours	
E-mail	

Other Instructors:

Instructor Name	
Office No.	
Office Phone Extension Number	
Office Hours	
Email	

Course Description (English/Arabic):

English	<p>This course delves into algorithms, starting with techniques for solving summations and recurrences, and exploring the divide and conquer approach for problem-solving. We will assess algorithm efficiency and complexity, delving into tree structures, including binary trees, and their associated algorithms. The course also covers hashing methods, addressing collision resolution strategies. We will explore various sorting algorithms, including heaps and heap sort, insertion sort, merge sort, and quicksort. Additionally, the course offers an in-depth study of graph terminology, representation, and key algorithms like those of Prim, Kruskal, Dijkstra, and Floyd, alongside breadth-first and depth-first search techniques. Finally, we will examine advanced problem-solving methods, including greedy and dynamic programming techniques.</p>
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Arabic	<p>تغوص هذه الدورة في الخوارزميات، بدءًا من تقنيات حل المجاميع والتكرارات، واستكشاف منهجية تقسيم وغزو لحل المشكلات. سنقيم كفاءة الخوارزميات وتعقيدها، مع التعمق في هياكل الشجرة، بما في ذلك الأشجار الثنائية وخوارزمياتها المرتبطة. تغطي الدورة أيضًا طرق التجزئة، مع التعامل مع استراتيجيات حل التصادمات. سنستكشف مختلف خوارزميات الفرز، بما في ذلك الكومات وفرز الكومة، فرز الإدراج، فرز الدمج، والفرز السريع. بالإضافة إلى ذلك، تقدم الدورة دراسة متعمقة لمصطلحات الرسم البياني وتمثيلها، والخوارزميات الرئيسية مثل خوارزميات بريم وكروسكال وديكسترا وفلويد، إلى جانب تقنيات البحث عن العمق الأول والعرض الأول. وأخيرًا، سنفحص طرق حل المشكلات المتقدمة، بما في ذلك تقنيات البرمجة الجشعة والديناميكية.</p>
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Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

Cormen, Leiserson, Rivest and Stein Introduction to Algorithms, 4th Ed, 2022.

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

1. Steven S. Skiena, The Algorithm Design Manual (Texts in Computer Science), 3rd Ed, 2020.
2. Jay Wengrow, A Common-Sense Guide to Data Structures and Algorithms, Second Edition: Level Up Your Core Programming Skills, 2nd Ed, 2020.
3. A.F. Ossyka and A.J. Mghawish, Algorithms: Design, Analysis and Implementation, 1st Ed., 2010.
4. Lucien Sina, Algorithms and Data Structures, 2025.

Course Educational Objectives (CEOs):

CEO1	Analyzing efficiency of algorithms and comparing time and memory efficiency of different algorithms.
CEO2	Applying basic searching and sorting algorithms.
CEO3	Designing and applying basic algorithms for solving graph problems.
CEO4	Identifying the main classes of computational complexity.

Intended Learning Outcomes (ILO's):

Intended learning outcomes (ILOs)	Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	JNQF Descriptors**	
K	Knowledge and Understanding				
ILO1-K	Using Big-O, Ω , and Θ to represent efficiency levels of algorithms.	CEO1	PL02	Understanding	K
ILO2-K	Ability to recognize the main classes of computational complexity.	CEO1	PL02	Remembering	K
S	Intellectual skills				
ILO3-S	Ability to apply hashing methods for data storage and retrieval.	CEO1	PL04	Applying	S
ILO4-S	Ability to design, analyze, and applying basic algorithms for solving graph problems.	CEO3	PL03	Analyzing	S
ILO5-S	Applying basic searching and sorting algorithms.	CEO4	PL04	Applying	S

C	Subject Specific Skills					
IL06-C	Ability to design and applying basic algorithms for solving graph problems.	CE02	PL06	Creating	C	
IL07-C	Analyzing the efficiency of iterative and recursive algorithms.	CE03	PL05	Analyzing	C	
*Bloom Taxonomy Levels:						
Level #	1	2	3	4	5	6
Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Program Learning Outcome (PLOs):

(PLOs)		JNQF Descriptors**		
		K	S	C
PL01-K	Knowledge of professional ethics, social responsibility, and the regulations governing them.	X		
PL02-K	Understanding various programming techniques, the stages of software development, and the fundamental principles of security.	X		
PL03-S	Skill in applying mathematical concepts to analyze and design algorithms and verify their correctness		X	
PL04-S	Skill in using different programming languages and applying them to develop software and computer applications.		X	
PL05-C	The ability to analyze, design, and develop effective and reliable computer programs that meet user requirements and adhere to professional ethics.			X
PL06-C	The ability to keep up with continuous advancements in computer science, innovate, and work independently or as part of a team.			X
PL07-D	The ability to work collaboratively, communicate effectively, and demonstrate teamwork spirit.			X

** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)

Weekly Schedule (please choose the type of teaching)

Face to Face (F2F)

Hybrid (One - To - One)

Online

Schedule of Simultaneous and their Topics:

Week	First Lecture	Second Lecture	ILOs	PLOs	JNQF Descriptors*
1	Introduction: specifications of an algorithm, mathematical background.	Asymptotic growth rates of functions, (Big-O, Ω and Θ).	ILO1	PLO2	K
2	Analysis of iterative algorithms.	Analysis of recursive algorithms.	ILO7	PLO5	C
3	Searching unsorted and sorted lists: brute force method, linear search.	Worst- and average-case time efficiency, binary search and its analysis.	ILO5	PLO4	S

4	Hashing method: hash tables, hash functions.	Resolving collisions, searching, reading, and writing in hash tables.	ILO3	PLO4	S
5	Simple sorting algorithms: selection sort and its analysis.	Simple sorting algorithms: insertion sort and its analysis.	ILO5	PLO4	S
6	Divide and conquer technique: recursive sorting algorithms, merging of sorted lists, Mergesort algorithm.	Quicksort algorithm.	ILO5, ILO7	PLO4, PLO5	S
7	Heaps: min- and max-heaps, properties, representation.	Heapsort algorithm, tracing, and analysis.	ILO5, ILO7	PLO4, PLO5	S
Midterm Exam (30%)					
9	Graphs: graph types and their static and dynamic representations, space complexity.	Trees: tree types and their static and dynamic representations, space complexity.	ILO1	PLO2	K
10	Greedy algorithms for graph problems, shortest paths.	Dijkstra's shortest-path algorithm.	ILO4	PLO3	S
11	Minimum spanning tree: Prim's Algorithm.	Kruskal's Algorithm.	ILO4	PLO3	S
12	Depth-first search graph traversal.	Breadth-first search graph traversal.	ILO4	PLO3	S
13	Dynamic Programming.	Floyd's Algorithm.	ILO6	PLO6	C
14	Computational complexity: Classes of complexity: P, NP, NP-hard, NP-complete.	Examples of NP-complete problems.	ILO2	PLO2	K
15	Project Discussions				
16	Final Exam				

* K: Knowledge, S: Skills, C: Competency

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- Lecture.
- Learning through projects.
- Learning through problem solving.
- Participatory learning

Course Policies:

A- Attendance policies:

The maximum allowed absences is 15% of the lectures.

B- Absences from exams and handing in assignments on time:

Midterm exam can be retaken based on approval of excuse by the instructor's discretion.

Not handing assignment on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehavior:

Cheating, plagiarism, misbehavior will result in zero grade and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Activities (Course Videos, Practice labs, Homework, Quizzes) 30%
- Midterm 30%
- Final Exam 40%

F- Available university services that support achievement in the course: **E-Learning Platform.**

Required Equipment:

- PC / Laptop with webcam and mic
- Internet Connection
- Access to the ZUJ E-Learning Platform at <https://elearning.zuj.edu.jo/>
- E-learning plan
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning
- Training

Assessment Tools Implemented in the Course:

- Final Exam
- Midterm Exam
- Quizzes (Optional)
- Homework
- Programming Project

Responsible Persons and their Signatures:

Course Coordinator		Completed Date	
		Signature	
Received by (Department Head)		Received Date	
		Signature	
