



The University of Jordan

King Abdullah II School for Information Technology (KASIT)			
Computer Science Department			
Semester:	Fall	Academic Year:	2014 / 2015

Course Information		
Course Title & Number	Theory of Algorithms (CS 1901341)	
Course Level	Undergraduate – Third Year	
Prerequisite	Data Structures (CS 1901231)	
Course Website	http://elearning.ju.edu.jo	
Instructors	Dr. Basel Mahafzah, Dr. Jamal Alsakran, and Prof. Riad Jabri	
Dr. Basel	Office Location	KASIT: First Floor – CS Department
	Office Phone #	06-5355000 ext. 22579
	Office Hours	Sunday, Tuesday, & Thursday 12:00 – 1:00 PM
	e-mail	b.mahafzah@ju.edu.jo or BASEL8@hotmail.com
Dr. Jamal	Office Location	KASIT: First Floor – CS Department
	Office Phone #	06-5355000 ext. 22633
	Office Hours	Sunday, Tuesday, & Thursday 11:00 – 12:00 PM
	e-mail	j.alsakran@ju.edu.jo
Prof. Riad	Office Location	KASIT: First Floor – CS Department
	Office Phone #	06-5355000 ext. 22591
	Office Hours	Sunday & Tuesday 10:00 – 11:00 AM
	e-mail	jabri@ju.edu.jo

Text Book	
Title	Introduction to Algorithms
Author(s)	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, & Clifford Stein
Publisher	The MIT Press
Edition & Year	Third Edition 2009 Or Second Edition 2001
Book Website	http://mitpress.mit.edu/algorithms/ http://highered.mcgraw-hill.com/sites/0070131511/student_view0/



The University of Jordan

References

- Jeffrey J. McConnell, "*Analysis of Algorithms: An Active Learning Approach*", Second Edition, Jones & Bartlett, 2008.
- Richard Neopolitan and Kumarss Naimipour, "*Foundations of Algorithms*", Fourth Edition, Jones & Bartlett, 2011.
- Richard Johnsonbaugh and Marcus Schaefer, "*Algorithms*", Pearson/Prentice Hall, 2004.
- Sara Baase and Allen Van Gelder, "*Computer Algorithms: Introduction to Design and Analysis*", Third Edition, Addison-Wesley, 2000.
- Horowitz Ellis, Sahni Sartaj & Rajasekaran Sanguthevar, "*Fundamentals of Computer Algorithms*", 2008.

Assessment Policy

Assessment Type	Expected Due Date	Weight
Midterm Exam	Sunday November 9 / 2014 from 2:00 – 3:00 PM at KASIT	30%
Final Exam	Tuesday December 30 / 2014 from 2:00 – 4:00 PM at KASIT	50%
Activities (Quizzes etc.)	TBA	20%

Intended Grading Scale

Weight	Points	Grade
85 – 100	4	A
80 – 84	3.75	A-
76 – 79	3.5	B+
70 – 75	3	B
66 – 69	2.75	B-
60 – 65	2.5	C+
56 – 59	1.75	C
50 – 55	1.75	C-
46 – 49	1.5	D+
41 – 45	1	D
36 – 40	0.75	D-
0 – 35	0	F

Course Description

This course will provide a rigorous introduction to the design and analysis of algorithms. We will discuss problems (e.g., sorting, searching, travel salesman problem, etc.), classic algorithm design strategies (e.g., divide-and-conquer and greedy approaches), and data structures (e.g., graphs, hash tables, Dijkstra's algorithm, etc.). We will also analyze algorithm complexity throughout and touch on issues of "NP-Completeness".



The University of Jordan

Course Main Goals

The main goals of this course are to be able to design correct and efficient algorithms, also be able to evaluate algorithms in terms of running time and memory space.

Course Objectives

- To provide a thorough treatment of the concepts and design principles of contemporary Computer Algorithms.
- To present time and space complexity of algorithms.
- To measure the efficiency of algorithms.
- To design and analyze various sorting algorithms such as insertion, merge, quick, and heap sort.
- To design and analyze various searching algorithms such as breadth-first and depth-first search.
- To select best algorithm for a certain problem.
- To design different algorithmic approaches.

Teaching/Learning & Assessment Methods

Teaching (T) Methods:

- Class contact is 3 hours per week. The Course will be delivered using different means like lectures, presentations, and discussion.
- Class lecture is 1 hour, lecture notes, exams (midterm and final) and quizzes are designed to achieve the course goals and objectives.

Learning (L) Methods:

- You should read the assigned topics before class, and participate in class and do whatever it takes for you to grasp this material. Also, ask any question related to Computer Algorithms.
- You are responsible for all material covered in the class.
- Please communicate with me regarding any concerns or issues related to Computer Algorithms by either in class, course web page, phone or email.
- The web page (elearning.ju.edu.jo) is a primary communication vehicle. Lecture notes, presentations and syllabus are available on the web.

Assessment (A) Methods:

- There will be several assessment methods of evaluation the performance of the students such as attending and class participation, quizzes, conducting the midterm and the final exams.



The University of Jordan

Intended Learning Outcomes (ILOs)

Upon successful completion of this course, students be able to:

A- Knowledge and Understanding:

- A1) know and understand basic terms associated with algorithms; such as time and space complexities, Big O notation, Big Omega notation, Big Theta notation, etc.
- A2) know and understand basic terms associated with graphs; such as directed and undirected graphs, path, cycle, strongly and weakly connected graphs, tree and forest, etc.
- A3) know and understand sequential, divide-and-conquer and greedy approaches.
- A4) know the advantages and disadvantages of various sorting, searching, and minimum spanning tree algorithms.
- A5) understand the structure of various sorting algorithms; such as insertion sort, merge sort, heap sort, quicksort, etc.
- A6) understand the structure of various searching algorithms; such as breadth-first search, depth-first search, etc.
- A7) understand the structure of various minimum spanning tree algorithms.
- A8) know the applications of various sorting, searching, minimum spanning tree algorithms.

B- Cognitive and Intellectual skills:

- B1) analyze and evaluate various sorting algorithms
- B2) analyze and evaluate various searching algorithms.
- B3) analyze and evaluate various minimum spanning tree algorithms.

C- Subject specific skills:

- C1) design various sorting algorithms using sequential and divide-and-conquer approaches.
- C2) design various searching algorithms.
- C3) design various minimum spanning tree algorithms using greedy approach.

D- Transferable skills:

- D1) Discuss and evaluate in class the design of various algorithms.



The University of Jordan

Course Contents, Teaching/Learning & Assessments Methods with ILOs			
Chapter & Number of Lectures	Topic Details	Teaching/Learning & Assessments Methods	ILOs
Chapter 1 (5 Lectures)	<u>Introduction</u> What is an algorithm? Algorithms as a Technology; Components of an Algorithm; Example: Greatest Common Divisor; Algorithm's Efficiency.	T: Lecture & Discussion L: Reading lecture notes and Chapter 1 A: In class questions	A1
Chapter 2 (4 Lectures)	<u>Getting Started</u> Insertion Sort; Analyzing and Designing Algorithms; Merge Sort (Divide and Conquer).	T: Lecture & Presentation L: Reading Chapter 2 A: Quiz-1 on Chap. 1 & 2	A1, A3, A4, A5, A8, B1, C1, D1
Chapter 3 (5 Lectures)	<u>Growth of Functions</u> Complexity (Worst-Case, Best-Case, and Average-Case); Example: Sequential Search; Growth Rates of Functions (Polynomials, Exponents, Logarithms, Summation, and Factorials); Optional: Proofs by Counterexample, Contradiction, and Induction.	T: Lecture & Presentation L: Reading Chapter 3 A: In class questions	A1
Chapter 4 (4 Lectures)	<u>Recurrences and Induction</u> Induction Proofs; Recurrence Equations; Recurrence Trees; Substitution Method; Iteration Method; Master Method.	T: Lecture & Presentation L: Reading Chapter 4 A: Quiz-2 on Chap. 3 & 4	A1, A3, B1
Chapter 6 (8 Lectures)	<u>Heap Sort</u> Heap Property; Build Heap; Heap Sort; Performance Comparisons (Insertion Sort, Merge Sort, and Heap Sort); Optional: Max-Priority Queues and Basic Operations on Max-Priority Queues (Max, Extract-Max, Increase-Key, and Insert).	T: Lecture & Presentation L: Reading Chapter 6 A: Midterm Exam in Chap. 1-4 and chap. 6	A1, A3, A4, A5, A8, B1, C1, D1
Chapter 7 (3 Lectures)	<u>Quick Sort</u> Advantages and Disadvantages; Partitioning (Choice of Pivot: Rightmost element, Randomly, and Median of three (first, last, and middle)); Worst, Best, and Average Case Partitioning; Randomized Quick Sort.	T: Lecture & Presentation L: Reading Chapter 7 A: Quiz-3 on Chap. 6 & 7	A1, A3, A4, A5, A8, B1, C1, D1
Chapter 22 (12 Lectures)	<u>Graphs</u> Graph Terminologies; Representations of graphs; Breadth-First Search; Depth-First Search.	T: Lecture & Presentation L: Reading Chapter 22 A: Quiz-4 on Chap. 22 Part-I Quiz-5 on Chap. 22 Part-II and Part-III	A2, A4, A6, A8, B2, C2, D1
Chapter 23 (7 Lectures)	<u>Minimum Spanning Trees</u> Finding a Minimum Spanning Tree; Algorithms by Prim and Kruskal.	T: Lecture & Presentation L: Reading Chapter 23 A: Final Exam in all chapters covered in class	A2, A3, A4, A7, A8, B3, C3, D1



The University of Jordan

Course Regulations & Ethics	
Quizzes & Assignments	<ul style="list-style-type: none">• The instructor may give quizzes or assignments or both; usually it is left up to the instructor.• Usually 4 quizzes are given in semester; it is left up to the instructor.• Each Quiz is out of 10.• No makeup quizzes.
Exams	<ul style="list-style-type: none">• The format for the exams is generally (but NOT always) as follows: General Definitions, Multiple-Choice, True/False, Analyze a Problem, Short Essay Questions, Solving Problems etc.
Makeup Exams	<ul style="list-style-type: none">• No Makeup exams.
Cheating	<ul style="list-style-type: none">• Cheating or copying on exam or quiz is an illegal and unethical activity.• Standard University of Jordan policy will be applied.• All graded assignments must be your own work (your own words).
Attendance	<ul style="list-style-type: none">• Excellent attendance is expected.• The University of Jordan policy requires the faculty member to assign ZERO grade (F) if a student misses 10% of the classes that are not excused.• Sign-in sheets will be circulated.• If you miss class, it is your responsibility to find out about any announcements or assignments you may have missed.
Workload	<ul style="list-style-type: none">• Average work-load student should expect to spend 6 hours per week.
Participation	<ul style="list-style-type: none">• Participation in and contribution to class discussions will affect your final grade positively. Raise your hand if you have any question.• Making any kind of disruption and (side talks) in the class will affect you negatively.
Concerns or Complaints	<ul style="list-style-type: none">• Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam
University Regulations	<ul style="list-style-type: none">• For more details on University regulations please visit: http://www.ju.edu.jo/rules/index.htm