

King Fahd University of Petroleum and Minerals

Department of Information and Computer Science

ICS 353 - Design and Analysis of Algorithms

Sections: 01 & 02 – Term: 191



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COURSE SITE: almuhammadi.com/sultan/ics353 and Blackboard

DESCRIPTION

Algorithms and Problem solving; Basic Algorithmic Analysis; Advanced algorithmic analysis; Advanced Data Structures; Algorithmic strategies & Analysis of fundamental computing algorithms; Basic computability; the complexity classes P and NP.

PREREQUISITES ICS 202: Data Structures and ICS 253: Discrete Structures I

COURSE OBJECTIVES

To provide the students:

1. The importance of studying the complexity of a given algorithm.
2. Various algorithmic design techniques.
3. Utilization of data structures and/or algorithmic design techniques in solving new problems.
4. Basic computability concepts and the complexity classes P, NP, and NP-Complete.
5. Some techniques to deal with hard problems.

COURSE LEARNING OUTCOMES

After completion of this course, the student shall be able to:

1. Analyze the complexity of a given algorithm. [Student Outcome a]
2. Apply classical sorting, searching, optimization and graph algorithms. [Student Outcome j].
3. Compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem. [Student Outcome j]
4. Explain NP-Completeness and deal with some NP-complete problems. [Student Outcome j]

TEXTBOOK

M. Alsuwaiyel, *Introduction to Algorithms: Design Techniques and Analysis*, World Scientific Publishing Co., Inc. 2016.

EVALUATION

Coursework and homework assignments	25%
Major Exam I	20%
Major Exam II	25%
Final Exam	30%

CONTENTS

The following schedule is tentative and subjected to changes. Any change will be announced in the class and course website/ Blackboard. Material is mainly covered in the textbook. (* Supplementary material will be provided as needed).

1. Basic Concepts in Algorithmic Analysis (Chapter 1) (2 weeks)
2. Heaps and Disjoint-Sets Data Structures (Chapter 4) (1 week)
3. Solving Recurrence Relations: Expanding the recurrence, Change of Variable, and the Master Method (Chapter 2*: Sections 2.8.3.1, 2.8.3.3) (1 week)
4. Induction: Recursive Selection/Insertion Sort, Radix Sort, Integer Exponentiation, and Evaluating Polynomials using Horner's Rule (Chapter 5: Sections 1-5) (1 week)
5. Divide and Conquer (Chapter 6: Sections 1-8) (2 weeks)
6. Dynamic Programming (Chapter 7) (2 weeks)
7. The Greedy Approach: Fractional Knapsack Problem, Activity Selection Problem, Money Change Problem, (Chapter 8*: Sections 1-4) (2 weeks)
8. NP-Complete Problems (Chapter 10: Sections 1-4) (2 weeks)
9. Basic Computability: Turing Machines, Universal Turing Machines, Undecidability, Reducibility and the Halting problem (Chapter 11*) (1 week)
10. Backtracking: The 3-coloring problem, General Backtracking Method, Branch and Bound(Chapter 13: Sections 1, 2, 4, 5) (if time permits)

Course Policies

- **Coursework includes** participation, online/in-class discussions and activities, attendance, homework assignments, and quizzes. Active learning is implemented in this class. Students are expected to be positively engaged in the learning process.
- **Course Website & Participation:** Students are required to periodically check the course website and download course material as needed.
 - Several resources will be posted through the website as well.
 - [Blackboard](#) will be used for communication and interaction, posting and submitting assignments, posting grades, posting sample exams, etc.
 - It is expected that you get benefit of the discussion board by raising questions or answering questions put by others.
- **Attendance:** Regular attendance is a university requirement.
 - Attendance will be checked at each lecture.
 - Missing 20% of the classes will result in an automatic DN grade (without warning).
 - Late arrivals will disrupt the class session, and may be counted as a miss if repeated.
 - If you find yourself unable to attend a class, email the instructor ahead of time for better planning and management of the class. If you fail to do so, send your email as soon as you get a chance and provide your excuses if any.
 - Every unexcused absence may lead to a loss of 0.5% of total grade.

- ***Late assignments:*** are subjected to late-penalty. See late submission policy on the course website/ Blackboard under the Assignments page.
- ***Re-grading policy:*** If you have a complaint about any of your grades, discuss it with the instructor no later than 3 days of distributing the grades (except for the final). Only legitimate concerns on grading should be discussed.
- ***Office Hours:***
 - Students are encouraged to use the office hours to clarify any part of the material that is not clear. Use the Blackboard (Bb) for quick points and homework questions.
 - For urgent issues, use emails instead of Bb-mails, please indicate ICS353 in the "Subject" field of your email (e.g. ICS353: Quiz1 score is missing).
- ***Academic honesty:***
 - Students are expected to abide by all the university regulations on academic honesty.
 - Cheating will be reported to the department's chairman.
 - Although collaboration and sharing knowledge is highly encouraged, copying others' work without proper citation, either in part or full, is considered plagiarism. Whenever in doubt, review the university guidelines or consult the instructor.
- ***Courtesy:***
 - Students are expected to be courteous toward their classmates and the instructor throughout the duration of this course (in-class and online).
 - Side-talks and text-messages during the class are prohibited.