Syllabus of CTIS 264 - Computer Algorithms
Department of Information Systems and Technologies
2023-2024 Spring

Credits: Bilkent 3, ECTS 5
Contact Hours: 3 hours of lecture per week, 2 hours of lab.work per week
Prerequisite(s): CTIS152 and CTIS163
Course Coordinator: Erkan Uçar

Instructor: Erkan Uçar, room C210A, eucar@bilkent.edu.tr office hours: Wed. 09:30-10:30, 14:30-15:30
Lab Instructor: Leyla Sezer, room CE116, loksuz@bilkent.edu.tr

Textbooks:
Required: "Introduction to the Design and Analysis of Algorithms", Levitin, 3rd Edition, ©Pearson, 2012.
Reference: "Introduction to Algorithms", Cormen et.al., ©The MIT Press, 2001 or later editions.

Catalog Description
The analysis of algorithms and problem solving techniques. Major concepts including; sorting, searching, divide and conquer algorithms, dynamic programming, greedy algorithms, graph algorithms and string matching algorithms. Weekly hands-on practice for the application of these algorithms using a contemporary high-level language.

Assessment Methods:

Method	Count	%	
Midterm 1	1	20	In-class written exam, closed notes.
Lab Quiz	1	10	In-lab exam.
Midterm 2	1	20	In-class written exam, closed notes.
Lab Final	1	25	In-lab exam.
Final	1	25	In-class written exam, closed notes.

Minimum Requirements to Qualify for the Final Exam:
Collect minimum 15% of total points of the course. **AND**
Attend minimum 50% of the lectures and laboratory sessions.

Course Learning Outcomes:

Outcome	Assessment	Program Outcome
Analyze both efficiency and complexity of algorithms and algorithm design techniques.	Midterm 1 Midterm 2 Final	(a)
Construct an algorithm under given memory and space constraints.	Midterm 1 Midterm 2 Final	(b)
Apply different design techniques for algorithms by using one of the programming languages.	Lab Quiz Midterm 2 Lab Final, Final	(b)

Weekly Syllabus:

Week	Lecture	Lab
1	**Introduction-1:** Syllabus, design & analysis, algorithmic problem solving, important problem types, fundamental data structures.	No labs.
2	**Introduction-2:** Different approaches on solving greatest common divisor (GCD), pseudocode examples.	**Lab Guide 1:** Python basics; installation, packages, strings, expressions, built-in and user-defined functions.
3	**Fundamentals of the Analysis of Algorithm Efficiency-1:** Input size, measuring run time, empirical and theoretical analysis of time efficiency, best-, worst-, average-case.	**Lab Guide 2:** Python basics; collections, lists, tuples, dictionary, for loops, selection, random numbers, timing.
4	**Fundamentals of the Analysis of Algorithm Efficiency-2:** Asymptotic notations, useful formulas, mathematical analysis of non-recursive algorithms.	**Lab Guide 3:** GCD; Euclid's, consecutive integer checking, analysis.
5	**Brute Force and Exhaustive Search-1:** Sequential search, selection sort, bubble sort.	**Lab Guide 4:** Numpy module, 2-dim arrays with multiplication table, timing.
6	String matching, polynomial evaluation, closest pair problem. No classes on Mar.7,8	No labs.
7	**Brute Force and Exhaustive Search-2:** Exhaustive search, traveling salesman, knapsack, and assignment problems, breadth first and depth first search.	**Lab Guide 5:** Examining efficiency classes of brute force algorithms.
8	**Decrease-and-Conquer:** Insertion sort, topological sort, binary search, quick search with Lomuto's partitioning. MIDTERM1: Mar.24, Sun., 10:00	**Lab Guide 6:** Pandas module, series, data frames, examples with World Bank data sets.
9	**Divide-and-Conquer:** Mergesort, quicksort (Hoare's partitioning algorithm), binary tree construction & traversal.	**Lab Guide 7:** DFS and BFS with dictionaries, object instances, methods, inheritance, topological sort.
10	**Transform-and-Conquer:** Balanced search trees (AVL trees), presorting heaps and heapsort.	**Lab Guide 8:** Empirical analysis of mergesort, insertion-sort, quicksort and Lomuto's partitioning.
No classes bet.Apr.8-12		
11	**Space and Time Trade-Offs-1:** String search, Horspool algorithm, Boyer-Moore algorithm.	No labs. LAB QUIZ: Apr.18, Thu., 18:30
12	No classes on Apr.22,23 **Space and Time Trade-Offs-2:** Hashing, open/closed, B-trees. MIDTERM2: Apr. 27, Sat., 13:30	No labs.
13	**Dynamic Programming:** Coin-row problem, coin-collecting by robot.	**Lab Guide 9:** Binary tree creation, post-, pre-, in-order traversals (oop), heap-tree (bottom-up, top-down).
14	**Greedy Technique-1:** Minimum spanning tree (MST), Prim's algorithm for MST.	**Lab Guide 10:** Python MatPlotLib module, morse code decision tree: binary heap tree. LAB EXAM: May 11, Sun., 10:00
15	**Greedy Technique-2:** Kruskal's algorithm for MST, Dijkstra's shortest path algorithm.	**Lab Guide 11:** Horspool algorithm, Prim's MST. (exercise: Dijkstra's shortest path algorithm)

FINAL: May 20 - Jun. 1 (date t.b.a.)

Grading Scale

A : 90.00 – 100.0	B+ : 75.00 – 79.99	C+ : 60.00 – 64.99	D+ : 45.00 – 49.99
A- : 80.00 – 89.99	B : 70.00 – 74.99	C : 55.00 – 59.99	D : 40.00 – 44.99
	B- : 65.00 – 69.99	C- : 50.00 – 54.99	F : 0 – 39.99

Online Course Evaluation

Course evaluation is a valuable source of feedback from the students to the department and the university which can greatly help improve teaching and learning. The greater the level of participation by the students, the more useful and statistically reliable observations and conclusions can be drawn from the evaluation results. Your honest and impartial comments about what works and what doesn't work in the course can help CTIS build on the parts of the course that are strong and improve those that are weak for the next group of students. The course evaluation also provides you the exclusive opportunity to make your opinion count on an important issue – the quality of teaching at CTIS. Please don't forget to complete the online course evaluation form for this course towards the end of the semester.

Academic Dishonesty

In light of its commitment to academic integrity, Bilkent University prohibits acts of misconduct and academic dishonesty. These include, but are not limited to, acts of cheating, plagiarism, and falsification of data, as defined below.

- *Cheating* occurs when an individual uses dishonesty or deception to receive or help others receive professional or academic credit for work she or he did not perform. Cheating includes, among other acts, misappropriation and / or development of the ideas, concepts, designs, or methodology of others without consent; use of materials or devices not permitted by the instructor during exams; taking an exam for another person; resubmitting work previously submitted elsewhere; copying previously published solutions to problems.
- *Plagiarism* is representing the work or ideas of another person as one's own. It frequently involves quoting, cutting / pasting or closely paraphrasing written language without appropriately citing the source of the material through the use of quotation marks, reference notes, or other methods of acknowledgement. An act of plagiarism may be unintentional, and to avoid unintentional plagiarism standard practices of citation should be followed. For detailed instructions regarding standard citation practices, see http://www.plagiarism.org
- *Falsification* is a deliberate misrepresentation in which information, whether in the form of data, written language, images or other media, is either altered or fabricated.

Ref: https://w3.bilkent.edu.tr/bilkent/policy-on-conflicts-of-interest-and-commitment-academic-integrity

Students' Responsibilities

- Come to class on time and prepared.
- Attend lectures & labs and participate in class discussions.
- Ask whatever you do not understand immediately (do not postpone) and make use of office hours.
- Submit all your work thru Moodle on time and with the required format.
- Do not be distracting in-class and keep your mobile devices in silent (no vibrating) mode.
- Read and apply the Academic Integrity Policy of the university.
- Study all course materials and instructor messages carefully.
- Do not use aliases in your emails, put your signature instead.

Instructor's Responsibilities:

- Come to class on time and prepared.
- Find effective ways to communicate course content to the students.
- Be responsive to student questions and encourage participation.
- Communicate all requirements to students very clearly and on time.
- Grade all exams as soon as possible and give clear feedback.
- Enforce the Academic Integrity Policy of the university.
- Treat all students respectfully and equally.