



East West University

Department of Computer Science and Engineering

Course Outline -- CSE 245: Algorithms

Course Information

Course Code: CSE 245

Course Title: Algorithms

Credit: 4 Credits

Pre-requisite: CSE 207 Data Structures

Class Times:

- Theory**

Section 1: 10:10 am – 11:40 am (ST), Room: 108

Section 2: 11:50 am – 01:20 pm (ST), Room: 112

Section 3: 10:10 am – 11:40 am (MW), Room: 114

- Lab**

Section 1: 04:50 pm – 06:50 pm (W), Room: 530

Section 2: 04:50 pm – 06:50 pm (R), Room: 529

Section 3: 04:50 pm – 06:50 pm (T), Room: 529

Instructor Information

Instructor: Md. Shamsujjoha

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Course Files: http://groups.yahoo.com/group/cse_msj/files

❖ CSE-245

Teaching Assistant: Ariful Islam

Office Hour

Day	Time
Sunday	08:00am – 10:00am
Monday	08:00am – 10:00am
Tuesday	08:00am – 10:00am
Wednesday	08:00am – 10:00am
Thursday	11:50am – 01:20pm, 02:20pm – 04:50pm

Course Outcome (CO)

The objective of this course is to provide a solid foundation in algorithm design and analysis. At the end of the course, students are able to:

1. Determine the computational complexities of algorithms.
2. Explain different techniques of algorithm analysis and designs.
3. Apply algorithmic techniques for graph problems.
4. Analyze algorithmic techniques for solving complex combinatorial problems.

Course Contents and Teaching Schedule:

Week	Lecture/lab/assignment topic	References/teaching materials/equipment
1	Lecture: Introduction to algorithms, complexity analysis, asymptotic notation, typical running time functions, classifying functions by their asymptotic growth rates etc.	Text: Cormen Chap. 3; Ref.:Lec. Notes 1
2	Lecture: Graphs, graph based algorithm (breadth-first search (BFS), depth-first search (DFS), edge identification. Lab: Graph.	Text: Cormen Chap. 22; Ref.:Lec. Notes 2, 3; Ex.: 22.1-5, 22.1-6, 22.2-6, 22.2-7, 22.2-8
3	Lecture: Modification of DFS to find the Topological sort, Strongly connected component, articulation points, bridges and bi-connected components. Lab: BFS.	Text: Cormen Chap. 22 and Weiss (AP); Ref.:Lec. Notes 4, 5, 6; Ex.: 22.4-5, 22.5-1, 22.5-6; Assignment 1: DFS
4	Lecture: Sorting algorithms: selection sort, bubble sort, insertion sort, merge-sort, quick-sort. Minimal spanning tree: basic terminology, applications and algorithms Lab: DFS.	Text: Cormen Chap. 2, 7 & 23; Ref.:Lec. Notes 7, 8.
5	Lecture: Single source shortest path algorithms: Dijkstra's algorithm, Bellman ford algorithm, shortest path in DAG. Lab: Topological sort, Strongly connected component.	Text: Cormen Chap. 24; Ref.:Lec. Notes 9, 10; Ex.: 24.1-6, 24.2-4, 24.3-6, 24.6.
6	Lecture: Floyd-Warshall algorithm, Transitive closure. Algorithm strategy, structure and problem types. Lab: Dijkstra's and Modified Dijkstra's algorithms	Text: Cormen Chap. 25; Ref.:Lec. Notes 11, 12; Assignment 2: Shortest Path
7	Lecture: Divide and Conquer algorithms: Binary search (review), Closest pair of points, Counting inversion. Greedy algorithms: Coin changing, Knapsack (fractional), Huffman codes, Optimal codes, Activity selection. Suitability of all these algorithms in greedy approach. Lab: Floyd-Warshall algorithm and Transitive closure	Text: Cormen Chap. 16; Ref.:Lec. Notes 13, 14
8	Lecture: Dynamic programming (DP) and Memoized algorithms: Longest increasing subsequence (LIS), 0-1 Knapsack, Longest common subsequence (LCS), Rock climbing. Lab: Greedy- Knapsack (fractional) and Huffman codes	Text: Cormen Chap. 15 & 16; Shani Chap. 5; Ref.:Lec. Notes 15, 16;
9	Lecture: Network Flow, Max Flow, MinCut, Residual Network, Augmenting paths, Ford-Fulkerson and Edmonds-Karp algorithms. Lab: DP- Knapsack, LCS, LIS	Text: Cormen Chap. 26; Ref.:Lec. Notes 17; Ex.: r1-to-r6 (ref.); Assignments 3: TSP, OBST
10	Lecture: Number theoretic algorithms: Euclid's algorithm (GCD), Extended Euclid's algorithm. Pattern matching and String matching algorithms: Rabin-Karp algorithm, Computing the transition function and diagram for String. Lab: Max Flow	Text: Cormen Chap. 31 & 32; Ref.:Lec. Notes 18, 19, 20;
11	Lecture: Asymptotic notation part-II, Recurrence relation. Iteration, Substitution, Recursion tree and Master methods. Lab: String Matching	Text: Cormen Chap. 2 & 4; Ref.:Lec. Notes 21, 22.
12	Lecture: NP completeness and final review Lab: Project Defense	Text: Cormen Chap. 34; Ref.:Lec. Notes 23, 24.

Learning Outcomes

❖ Knowledge and understanding

- Understand the importance of designing efficient algorithms for complex problem
- Understand and write pseudocode for different types of algorithm.
- Understand the use of fundamental and advanced data structures for algorithms.

❖ Cognitive skills (thinking and analysis)

- Be able to develop and design efficient algorithms.
- Be able to understand and analysis difficult problems and derive its solutions.
- Be able to analyze Algorithms and calculate its effectiveness in different environments.

❖ Communication skills (personal and academic)

- Two individual assignments involve writing effective reports and designing documentation, making effective presentations, and giving and receiving clear instructions.
- A group assignment and a group presentation (defense of project to be done in a group), where students will be assessed in terms of their effectiveness as individual or leader in a team.

❖ Practical and subject specific skills (Transferable Skills)

- In addition to the continuous lab works (including pre and post lab), each group of student should be able to implement a distinct complete project based on the algorithms taught to address the depth programming skills, designing skills and complex problem solving skills.

Teaching Materials/ Online Resources/ Equipments

Main Reference (Text book)

- [1] Introduction to algorithms (3rd or later edition) - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, MIT Press (Main Text).
- [2] Introduction to algorithms (3rd or later edition) - S. Sahni, S Dasgupta, McGraw-Hill (ref. text 1).
- [3] Data Structures and Algorithms in C++ by M. T. Goodrich et al. Wiley Publications (ref. text 2).

Teaching Materials: Lecture Notes*, Lab Exercises/Notes*, Reference Book, and Computer & Software C#.

Teaching-Learning Method: Lecture Notes*, PDF Documents, Lab Exercises*, Assignments.

*Lecture and Lab Notes that are required for the course will be delivered during class.

Software to compile C/C++ programs:

IDE	Platform	Console programs
Code::blocks	Windows/Linux/MacOS	<u>Compile console programs using Code::blocks</u>
Visual Studio Express	Windows	<u>Compile console programs using VS Express 2013</u>

Assessment Weightage (Evaluation and Grading Policy)

The relative contributions of exams, assignment, and lab work are as follows[†]:

❖ Class Participation	5%	❖ Term I Exam	15%
❖ Assignments	5%	❖ Term II Term Exam	15%
❖ Quiz (Average of Best Two)	5%	❖ Final Exam	20%
❖ Project (Inc. Presentation)	10%	❖ Lab works	25%

[†]The above mark distribution can change up to $\pm 5\%$ (for each field).

Student Learning Time (SLT)

Student Learning Time (SLT) can be divided into: Face to Face (36 hours), Guided Learning (24 hours), Independent Learning (93 hours) and Assessment (7 hours). The detailed breakdown is as follows:

No.	Teaching And Learning Activities	Student Learning Time (SLT)
1.	Lecture	36 hours (3 x 12 weeks)
2.	Lab works	22 hours (2 x 11 weeks)
3.	Review lesson after lecture (includes preparation for final exams)	54 hours (36 hours x 1.5 hour study time)
4.	Student's preparation for lab including pre lab, post lab and project work	33 hours (11 Lab x 3 hours preparation)
5.	Carry out Assignment	7.5 hours (3 Assignments x 2.5 hours)
6.	Carry out Mid Term and Final Exams	4.5 hours
7.	Carry out Lab Tests, Quiz and Project defence	3.0 hours
TOTAL SLT		160 hours
CREDIT = SLT/40		4.0

Details:

- ❖ Homework/Assignment: must be done in group not more than 3 (the same group as the lab works), **STRICTLY NO COPY-PASTING** from other groups.
- ❖ **Late assignments suffer a penalty rate of 20% per day, up to 5 days (weekends count towards the 5 days).** Assignments that are more than 5 days late are penalized by 100%.
- ❖ Submit the signed **Expectations of Originality form** with each homework assignment.
- ❖ **Failing Grade:** Plagiarism, absenteeism, lack of preparation, and lack of effort will result it.

Grading System:	Marks (%)	Letter Grade	Grade Point	Marks (%)	Letter Grade	Grade Point
	97-100	A+	4.00	73-76	C+	2.30
	90-96	A	4.00	70-72	C	2.00
	87-89	A-	3.70	67-69	C-	1.70
	83-86	B+	3.30	63-66	D+	1.30
	80-82	B	3.00	60-62	D	1.00
	77-79	B-	2.70	Below 60	F	0.00

Exam Dates:	Exam Name	Section 1, 2	Section 3	Notes
	Mid Term 1	Sunday 04 th June 2017	Wednesday 07 th June 2017	Monday, 05 th June 2017 is earmarked for Mid Term I Exams for students who will have more than two exams on a single day.
	Mid Term 2	Sunday 09 th July 2017	Wednesday 12 th July 2017	Monday, 10 th July 2017 is earmarked for Mid Term II Exams for students who will have more than two exams on a single day.
	Final	Sunday 13 th August 2017	Wednesday 16 th August 2017	Saturday, 19 th August 2017 is earmarked for Final Exams for students who will have more than two exams on a single day.



Academic Code of Conduct

Academic Integrity

Any form of cheating, plagiarism, personation, falsification of a document as well as any other form of dishonest behavior related to obtaining academic gain or the avoidance of evaluative exercises committed by a student is an academic offence under the Academic Code of Conduct and **may lead to severe penalties up to and including suspension and expulsion.**

Special Instructions

- ❖ Students **MUST WEAR dresses** in conformity with the **dress code of EWU** within the lecture/lab classes and examination hall.
- ❖ Class Lectures and Lab works are believed to be the most effective and reliable source of knowledge for this course. Therefore, students are **strongly encouraged to participate in all the classes** attentively.
- ❖ Students will not be allowed to enter into the classroom after 20 minutes of the starting time. Moreover, **You MUST have at least 80% class attendance to sit for the final exam.** All mobile phones **MUST** be turned to silent.
- ❖ There is zero tolerance for cheating at EWU. Students caught with cheat sheets in their possession, whether used or not used, &/or copying from cheat sheets, writing on the palm of hand, back of calculators, chairs or nearby walls, etc. would be treated as cheating in the exam hall. **The only penalty for cheating is expulsion from EWU.** For plagiarism, the grade will be automatically become zero for that exam/assignment.
- ❖ There will be **NO make-up examinations for Quiz & Lab Exam in any case.** Make up exam can only be considered for the midterms in case of emergency, you **MUST** either inform me or the department chairperson/your advisor/secretary within 24 hours of the exam time. Failure to do so will mean that you are trying to take **UNFAIR** advantage and you will be automatically disqualified.