Course Outline

ULAB UNIVERSITY OF LIBERAL ARTS BANGLADESH

Basic Information

Term	**Spring 2021**
Course Title	Algorithms
Course Code	CSE 305
Section	2
Credit Hours	3.0
CIE Marks	75
SEE Marks	25
Class Schedule	Sunday & Tuesday: 10:00 AM to 11:30 AM
Pre-requisite Course	CSE 207
Department Offering the Course	CSE
Faculty	Tangila Islam Tanni, Lecturer, Dept. of CSE
Contact Email	Tangila.islam@ulab.edu.bd
Contact Number	
Office and Location	Room - PC 310, ULAB Permanent Campus
Counseling/Office Hour	Online via Google Meet/Telegram
Google Classroom Link	
Number of Lectures	24

1.0 Course Description (from syllabus)/Rational:

This course is an introductory undergraduate course on the design and analysis of algorithms. It introduces several important algorithm design techniques and basic algorithms that are interesting both in theory and practice. The basic algorithm design techniques will include divide-and-conquer, dynamic programming, and greedy techniques for optimization. Techniques for asymptotic analysis of algorithm time bounds by the solution of recurrence equations will also be covered. We will apply these design and analysis techniques to derive algorithms for a variety of tasks such as sorting, searching, graph problems, string matching, computational geometry. The course will also cover the relationship between feasible (polynomial-time) computations and infeasible computations. This will include discussion of the famous P vs. NP question.

1.1 Course Objectives:

1. To provide a thorough understanding of a variety of algorithms with real-life applications and the resource requirements;
2. To introduce several important algorithm design techniques as well as basic algorithms that are interesting both from a theoretical and also practical point of view;
3. To enable students to analyze time and space complexities of algorithms;
4. To emphasize on efficient algorithm designing, solving practical problems through algorithmic techniques and data structures to be used in the implementations of algorithms;

5. To expose the students to a variety of techniques that have practical applications, while conducting detailed analysis of the requirements required by the algorithms.

1.2 Course Learning Outcome/ILO: (at the end of the course, students will be able to do:)

CLO1	Describe the objective of design and analysis of algorithms
CLO2	Explain terms related to important algorithm design techniques and basic algorithms
CLO3	Understand a practical problem, apply techniques and appropriate data structures to design algorithms to solve the problem
CLO4	Analyze performance and resource requirements of various algorithms

1.3 Mapping of Course Learning Outcomes to Program Learning Outcomes [attainment level used for CLOs from 1(weak)-3(strong) correlation]

PLO's / CLO's	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	**3**											
CLO2	**3**											
CLO3	**3**	**3**									**1**	
CLO4	**3**	**3**									**1**	

1.4 Teaching and Learning Activities (TLA)

TLA1	Interactive discussion using Online/multimedia or whiteboard.
TLA2	Interactive video and/or scenario based presentation
TLA3	Case Study and group discussion
TLA4	Real-life project in a team to apply knowledge on Algorithms

1.5 Course Delivery Plan (include Lab if any)

Week/Lesson (hour)	Discussion Topic & Book Reference	Student Activities during Online and Onsite and TLA	Assessment and Mapping CLO/ILO
Wk 1 (Feb 22-Feb 25) Lesson 1 & 2 (1.5x2 = 3.0)	**Lesson-1**: Introduction to Algorithms, applications, complexity; Text Ref. ; **Lesson-2**: Introduction to Algorithms: Methods of Proof: Proof By Induction; Text Ref:*;*	Lesson-1 & 2: Online/Onsite discussion; Interactive content e.g. Voice over PPT, etc; **TLA1, TLA2**	**CLO1**
Wk 2 (Feb 28-Mar 4) Lesson 3 & 4 (1.5x2 = 3.0)	**Lesson-3**: Methods of Proof: Proof by Contradiction, Proof by Counterexample, Proof By Induction;	Lesson-3 & 4: Online/Onsite discussion; Review Feedback online; Interactive content e.g. Voice over PPT, Video etc;	**CLO1, CLO2**

	Text Ref: **Lesson-4**: Analysis of Algorithms, Asymptotic Notation, Divide and Conquer; Text Ref:	**TLA1, TLA2**	
Wk 3 (Mar 7-Mar 11) Lesson 5 & 6 (1.5x2=3.0)	**Lesson-5**: Recurrences, Recursion-tree, Master Theorem; Text Ref: ; **Lesson-6**: Discussion on Greedy Algorithms, Fractional Knapsack Problem, Activity-Selection Problem; Text Ref:;	Lesson-5 & 6: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, H5P etc; **TLA1, TLA2,**	**CLO1, CLO2, CLO3**
Wk 4 (Mar 14-Mar 18) 1st CT Week Lesson 7 & 8 (1.5x2=3.0)	**Lesson-7:** Example on Fractional Knapsack Problem Review discussion on Lesson 1-Lesson 6; **Lesson-8:** Review discussion on 1st Quiz	Lesson-7 & 8: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Video, etc; **TLA1, TLA2, TLA3**	**CLO1**, **CLO2** **Quiz # 1** (Either online or onsite based on Lesson-1-Lesson-6 discussion) based on CLO1 and CLO2
Wk 5 (Mar 21-Mar 25) Lesson 9 & 10 (1.5x2=3.0)	**Lesson-9**: Discussion on Data Compression: Huffman Code Problem, Huffman's algorithm; Text Ref: **Lesson-10**: Discussion on Direct-Addressing, Hash Tables, Issues with Hashing;	Lesson-9 & 10: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, etc; **TLA1, TLA2**	**CLO1**, **CLO2** **Assignment 1:** (will be due by Wk 6)
Wk 6 (Mar 28-Apr 1) Lesson 11 & 12 (1.5x2=3.0)	**Lesson 11:** Methods of Resolving Collisions: chaining, open addressing; Text Ref: **Lesson 12:** Review discussion for Mid Exam;	Lesson-11 & 12: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, H5P etc; **TLA1, TLA2, TLA3** **Student Submit Assigment-1 in LMS or BLC (online)**	**CLO1**, **CLO2, CLO3, CLO4**
Wk 7 (Apr 4-Apr 8)	**Midterm Exam Week** **Topics covered in Wk 1 – Wk 6**		
Wk 8 (Apr 11-Apr 15) Lesson 13 & 14 (1.5x2=3.0)	**Lesson 13:** Discussion on Dynamic Programming, Longest Common Subsequence Algorithm; Text Ref: **Lesson 14:** Matrix chain multiplication problem and its solution, Rod cutting; Text Ref:	Lesson-13 & 14: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, etc; **TLA1, TLA2**	**CLO1**, **CLO2, CLO3**
Wk 9 (Apr 18-Apr 22)	**Lesson 15**: Discussion on Graph Algorithms: Graph Searching, BFS	Lesson-15 & 16: Online/Onsite discussion; Review Feedback	**CLO1**, **CLO2**

2nd CT Week Lesson 15 & 16 (1.5x2=3.0)	Text Ref: ; Review discussion on Lesson 13 and Lesson 14; **Lesson 16**: Discussion on Graph Algorithms: Graph Searching, DFS, Single Source Shortest Path Text Ref: ;	online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, H5P etc; **TLA1, TLA2**, **TLA3**	**Class Test# 2** (either online or onsite based on Lesson 13 - Lesson 15 discussion) based on CLO1, CLO2
Wk 10 (Apr 25-Apr 29) Lesson 17 & 18 (1.5x2=3.0)	**Lesson 17:** Discussion on Single Source Shortest Path - BellmanFord & Dijkstra's Algorithm; Text Ref.: **Lesson 18:** Discussion on Single Source Shortest Path - Directed Acyclic Graph; Text Ref.:	Lesson-17 & 18: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, H5P etc; **TLA1, TLA2, TLA3**	**CLO1**, **CLO2, CLO3** **Assignment 2:** (will be due by Wk 11)
Wk 11 (May 2-May 6) 3rd CT Week Lesson 19 & 20 (1.5x2=3.0)	**Lesson 19:** Discussion on Computational Geometry, Convexity, Graham Scan; Text Ref.: Review discussion on Lesson 16 and Lesson 18; **Lesson 20:**; Discussion on String Matching, Rabin-Karp Algorithm; Text Ref.: ;	Lesson-19 & 20: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, H5P etc; **TLA1, TLA2, TLA3** **Student Submit Assigment-2 in LMS or BLC (online)**	**CLO1**, **CLO2, CLO3** **Class Test# 3** (either online or onsite based on Lesson 16 – Lesson 19 discussion) based on CLO1 and CLO4
Wk 12 (May 9-May 12) Presentation Lesson 21 & 22 (1.5x2=3.0)	**Lesson 21:** Discussion on NP-completeness; **Lesson 22:** Presentation on course project – group wise	Lesson-21 & 22: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, H5P etc; **TLA1, TLA2, TLA4** Hands-on: Course project presentation by team lead	**CLO1**, **CLO3, CLO4** **Presentation** on course project - group wise **Project Implementation Presentation by Team (using Google meet team record their presentation and upload the Google meet link in BLC)**
Wk 13 (May 16-May 19)	**Holiday Week – Eid ul-Fitr**		
Wk 13 (May 23-May 27) Study Week Lesson 23 & 24 (1.5x2=3.0)	**Lesson 23:** Discussion on Research article writing, review and publishing **Lesson 24:** Review class on topics discussed of Wk 8 - Wk 12	Lesson-21 & 22: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, Weekly Forum, PPT, Video, H5P etc; **TLA1, TLA2**, **TLA3**	**CLO1**, **CLO2**, **CLO4**
Wk 14 Jun 1-Jun 10	**Final Exam Week** Topics: Comprehensive		

1.6 Text and Reference Materials

Text Book(s): Introduction to Algorithms, 3rd edition. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein

Reference Material/Book(s):

(1) The Art of Computer Programming (Vol-1): Fundamental Algorithms, 3rd edition. Donald E. Knuth
(2) Schlar.google.com and Google search engine

1.7 Distribution of Marks for Assessment

CIE – Breakup (Theory) [60 marks]

Bloom's Criteria	Attendance & Performance (15)	Quiz (20)	Assignment & Presentation (15)	Mid Exam (25)
Remember		05		05
Understand		05	05	05
Apply		10	05	05
Analyze			05	05
Evaluate				05

SEE – Semester End Examination [25 marks] {Theory}

Bloom Criteria	Score for the Test
Remember	05
Understand	05
Apply	05
Analyze	05
Evaluate	05

C. Grading Policy

Policy	Letter Grade	Grade Point	Assessments
95% and above	A+	4.00	Outstanding
85% to 94%	A	4.00	Superlative
80% to 84%	A-	3.80	Excellent
75% to 79%	B+	3.30	Very Good
70% to 74%	B	3.00	Good
65% to 69%	B-	2.80	Average
60% to 64%	C+	2.50	Below Average
55% to 59%	C	2.20	Passing
50% to 54%	D	1.50	Probationary
below 50%	F	0.00	Fail
--	I	0.00	Incomplete
--	W	0.00	Withdrawn
--	AW	0.00	Administrative Withdrawal

Tangila Islam Tanni

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Course Coordinator/ Teacher	*Head of the Department*
Date: 22/02/2021	Date:

Appendix-1: Program outcomes

POs	Category	Program Outcomes
PO1	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis**	Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.
PO3	**Design/Development of Solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
PO4	**Investigations**	Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
PO5	**Modern tool usage**	Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.
PO9	**Individual work and teamwork**	Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.
PO10	**Communication**	Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.
PO12	**Life Long Learning**	Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.