DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE OUTLINE FOR CSE 230: DISCRETE MATHEMATICS
SEMESTER: SPRING 2019

In this course we learn about the mathematical foundations of Computer Science, essential knowledge for anyone who wants to work at the frontiers of modern day Computer Science

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I. Rationale:

Discrete Mathematics is a field of Pure Mathematics, out of which the entire field of Computer Science as we know it today was born. Computer Science is not just about programming languages, software and hardware. The true abilities and limitations of computers cannot be appreciated until we look at mathematical roots behind these machines, and learn to mathematically analyze and even predict the performance of computer programs using knowledge of logic, set theory, counting and statistics. This course serves as a starting point where we look at all the different domains of mathematics that come together to enrich Computer Science.

II. Course Aims and Outcomes:

Aims
Students will learn the mathematical tools needed to analyze computer programs, understand logic, basic mathematical proof techniques, understand and verify different computational techniques. These skills will be further developed in more advanced courses like Algorithms and Theory of Computation.

Outcomes
Students will develop the basic Mathematical foundation required for the study of Computer Science and Engineering. After completion of the course, their mathematical maturity will be sufficient to solve basic CS computational problems.

III. Specific Learning Outcomes:

By the end of this course, students will be able to:

a) Follow steps of logical reasoning and be able to communicate using Formal Logic

b) Explore the world of propositional and predicate logic

c) Understand how to construct mathematical proofs and learn an arsenal of different proof techniques

d) Understand fundamentals of Set Theory and be able to solve problems using the theories of Set

e) Understand fundamentals of Functions and different types of functions

f) Understand the basics of combinatorics and be able to apply those in real world problems

g) Understand the basics of discrete probability theory, conditional probability and probabilistic reasoning

h) Getting familiar with the basic ideas of Graph theory

i) Understand different representations of graphs and explore basic concepts of connectivity and traversals

j) Explore Dijkstra's Algorithms

k) Getting familiar with the introductory ideas of trees and different tree traversal algorithms

l) Explore Kruskal's and Prim's Minimum Spanning Trees algorithm

m) Understand the representation, evaluation and calculation of prefix, postfix and infix notations

IV. Format and Procedures:

The course is structured as two lectures per week, each of duration 80 minutes. There is no separate lab or tutorial component.
Students are expected to be punctual in class, and participate actively through questions and discussion. Bear in mind that participation will be a big portion of your final grade, and simply attending the lectures without any visible engagement will not be of much help. All students are expected to be civil and ensure an environment where everyone feels safe to voice their questions and comments.

V. Teaching/Learning methods to be used

Given the densely mathematical nature of the course, most of the classes will be modeled as lectures given by the instructor, juxtaposed with questions and clarifications from the students. Students will be required to do a significant amount of reading.
For best results, students should participate actively in the lecture, and revise the topics once they go back from class. A list of topics to be covered, along with an expected timeline, will be provided in class in order to facilitate this..

VI. Course Requirements:

1. Class attendance and participation policy: While attending lectures and being punctual is mandatory, just passively sitting in class will not be conductive to learning. Students are expected to ask questions and are encouraged to have discussions in class about the material being covered. This will be done a lot more productively if students read the textbook prior to coming to class, and also review material already covered in class once they are back home.

2. Course readings:

(a) Discrete Mathematics and Its Applications – Kenneth H. Rosen, McGraw Hill, 6th International Edition

(b) There is a full online course with videos available on YouTube, at
https://www.youtube.com/watch?v=pKjrK-yEYFI&list=PLYx-Huwyr19hDr9_9eZ4RJVEUlqvgfWBj
Students who have difficulty reading and comprehending English text are especially encouraged to peruse these lectures as a supplementary resource. It should be emphasized that these video lectures are not a substitute for coming to class, merely an additional resource.

VII. Grading Procedures:

a) Final – 40%-50%

b) Midterm – 20%-25%

c) Quiz – 10%-15%

d) Assignments – 5%-10%%

e) Attendance – 5%

VIII. Important Dates

Midterm and final exam of CSE 230 course of all the sections will be taken together with a standard question paper prepared and moderated by all the course instructors. Special care will be given to ensure complete coverage of the syllabus. The exam schedules are as follows:

a) Midterm Examination: Sunday, February 24, 2019 (Tentative)
b) Final Examination: Monday, April 15, 2019 [2.00-5.00 PM] (Day-1)

IX. Course Materials

Course materials for this course can be found in the TSR. Important course materials include:

a) All lecture slides (For Reference Only)
b) Assignments
c) Midterm questions of previous semester
d) Final exam questions of previous semester
e) Practice problems
f) Summed up formulas

X. Academic Integrity

Each student in this course is expected to abide by the BRAC University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work.

You are encouraged to study together and to discuss information and concepts covered in lecture with other students. You can help out or receive help from other students in the form of consultation and guidance. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, or any form electronic or hard copy.

If copying occurs, both the student who copied work and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, and you may not compare answers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

XI. Schedule of Class Lectures

Chapter: 1, 2, 3, 5, 6, 7, 8, 9, 10.

	Topics	Readings
1	**Lecture 01**	**Introduction to Discrete Mathematics**
2	**Lecture 02** **Basics of Propositional Logic**	**Chapter 1, Sections 1.1**
3	**Lecture 03** **Propositional Equivalences**	**Chapter 1, Sections 1.2**
4	**Lecture 04** **Propositional Equivalences**	**Chapter 1, Sections 1.2**
5	**Lecture 05** **Predicates and Quantifiers**	**Chapter 1, Sections 1.3**
6	**Lecture 06**	**Quiz 1**
7	**Lecture 07** **Introduction to Proofs**	**Chapter 1, Section 1.6**
8	**Lecture 08** **Functions, Sequences and Summations**	**Chapter 2, Sections 2.1, 2.2**
9	**Lecture 09** **Functions, Sequences and Summations**	**Chapter 2, Sections 2.3, 2.4**
10	**Lecture 10** **Modular Arithmetic, Application of Congruences & Cryptology**	**Chapter 3, Sections 3.4, 3.5**
11	**Lecture 11** **The basics of Counting, The pigeonhole principle**	**Chapter 5, Section 5.1,5.2**
12	**Lecture 12** **Permutations and Combinations, Binomial Coefficients**	**Chapter 5, Section 5.3,5.4**
MID TERM EXAMINATION		
13	**Lecture 13**	**Quiz 2**
14	**Lecture 14** **An introduction to discrete probability, Probability theory**	**Chapter 6, Section 6.1,6.2**
15	**Lecture 15** **Conditional Probability and Bayes' Theorem**	**Chapter 6, Section 6.3**
16	**Lecture 16**	**Quiz3**
17	**Lecture 17** **Graphs**	**Graphs & Graphs Models, Basic Terminology, Representation of graphs**

18	**Lecture 18** **Graphs**	**Connectivity, Euler and Hamilton Path, Shortest Path Problem**
19	**Lecture 19** **Trees**	**Introduction to trees, Traversal Algorithms**
20	**Lecture 20** **Trees**	**Prefix, Postfix, Infix**
21	**Lecture 21**	**Quiz4**
22	**Lecture 22** **Trees**	**Kruskal's Algorithm**
23	**Lecture 23** **Trees**	**Prim's Algorithm**
24	**Lecture 24**	**Review Class**
SEMESTER FINAL EXAMINATION		

XII. Syllabus

1. **Basics of Propositional Logic:** Chapter 1, Sections 1.1
2. **Propositional Equivalences:** Chapter 1, Sections 1.2
3. **Predicates and Quantifiers:** Chapter 1, Sections 1.3
4. **Introduction to Proofs:** Chapter 1, Section 1.6
5. **Functions, Sequences and Summations:** Chapter 2, Sections 2.1, 2.2, 2.3, 2.4
6. **Modular Arithmetic, Application of Congruences & Cryptology:** Chapter 3, Sections 3.4, 3.5
7. **The basics of Counting, The pigeonhole principle:** Chapter 5, Section 5.1, 5.2
8. **Permutations and Combinations, Binomial Coefficients:** Chapter 5, Section 5.3, 5.4
9. **An introduction to discrete probability, Probability theory:** Chapter 6, Section 6.1, 6.2
10. **Conditional Probability :** Chapter 6, Section 6.3
11. **Graphs:** Graphs & Graphs Models, Basic Terminology, Representation of graphs, Connectivity, Euler and Hamilton Path, Shortest Path Problem
12. **Trees:** Introduction to trees, Traversal Algorithms, Minimum Spanning Trees

*Reference Books:

1. Discrete Mathematics and Its Applications – Kenneth H. Rosen, McGraw Hill, 6th International Edition
2. Elementary Probability for Applications – Rick Durrett, Cambridge University Press

***Practice the marked problems in the pdf version of the book given in TSR**