HABIB UNIVERSITY

CS 113 Discrete Mathematics

"Computer science is no more about computers than astronomy is about telescopes." – Edsger Dijkstra

Spring 2018

Instructors:	Waqar Saleem, Shahid Hussain, Muhammad Imtiaz
Assistant:	Abdullah Zafar
TA's:	See LMS
Course Website:	LMS, WorkPlace
Contact, Logistics:	On LMS
Course Prerequisites:	None
Content Area:	This course is part of CS Foundation. It is required for a CS major and fulfills the requirements of a CS minor. For other students, it can be counted as either a Free Elective, University Elective, SSE Elective, CS Elective, or CS requirement.

I. Rationale:

Computer Science is the study of computation performed inevitably on discrete machines. Modeling and analysis of these computations require formal methods to reason about them as well as a mathematics that deals with discrete events and entities.

This course equips students with essential mathematical tools that they will encounter in future Computer Science courses. It develops a capacity for formal mathematical manipulation and abstract thought, both of which are essential for the successful pursuit of Computer Science.

II. Course Aims and Outcomes:

This course aims to:

- impart proficiency in essential mathematical tools required in future study of Computer Science,
- develop a capacity for mathematical modeling, analysis, and application,
- develop a capacity for abstract thought necessary for the study of Computer Science.

On successful completion of this course, a student will:

- be able to understand logic and logical arguments.
- be able to read and write simple mathematical proofs for basic concepts in computer science
- know combinatorics and will be able to apply combinatorial arguments to prove many computational results

- gain knowledge about graphs and some graph algorithms

III. Format and Procedures:

This is a highly theoretical course. You are encouraged to attend–physically and mentally–all lectures and do the assignments and readings in a timely manner. The instructors will make all efforts to closely follow the course textbook so that you have a ready reference.

You should be prepared to spend on average 3 to 4 hours of work outside class for every hour of lecture. This may vary based on your comfort with mathematics and capacity to absorb and apply new ideas.

You are expected to stay up to date with all relevant course communication shared with you over email and through the course websites. Assignments are to be submitted on time - there is no late policy. If running late, submit your partial work till the deadline so as to get some points.

Following are some ground rules for the course.

Punctuality Please respect deadlines. Submit your work by the indicated time. Incomplete work will receive partial credit. Late work will not be accepted or graded.

Contesting marks Concerns regarding a score will be entertained by the head RA up to a week after its release. Concerns raised later will not be entertained.

Grace marks Requests for grace marks for whatever reason will not be entertained and each such request will result in a penalty of 1% from the overall score.

Behavior You are expected to maintain a behavior befitting *Yohsin* and acknowledging the classroom as a place of learning, exploration, and experimentation. Please extend the course assistants the same respect and consideration that you do to the faculty.

The University's standard policies on attendance, inclusivity, office hours, and academic integrity apply in this course. These are described below.

IV. Course Requirements:

Required texts

Discrete Mathematics and Its Applications (7th edition), Kenneth H. Rosen.

Reference texts

1. *Mathematics for Computer Science*, Eric Lehman, F Thomson Leighton, and Albert R Meyer.
2. *Discrete Math for Computer Science Students*, Ken Bogart, Scot Drysdale, and Cliff Stein.
3. *Discrete and Combinatorial Mathematics: An Applied Introduction*, Ralph Grimaldi.
4. *Concrete Mathematics: A Foundation for Computer Science*, Ronald Graham, Donald Knuth, and Oren Patashnik.

V. Grading Procedures:

Grades will be computed as follows.

Homework	35%
Midterm	25%
Final	35%
Class Participation	5%
Recitation (Bonus)	5%

GRADING SCALE		
LETTER GRADE	GPA POINTS	PERCENTAGE
A+	4.00	[95, 100]
A	4.00	[90, 95)
A-	3.67	[85, 90)
B+	3.33	[80, 85)
B	3.00	[75, 80)
B-	2.67	[70, 75)
C+	2.33	[67, 70)
C	2.00	[63, 67)
C-	1.67	[60, 63)
F	0.00	[0, 60)

VI. Attendance Policy:

Habib University requires that all freshmen and sophomores must maintain at least 85% attendance and all juniors and seniors must maintain at least 75% attendance for each class in which they are registered. Non-compliance with minimum attendance requirements will result in automatic failure of the course and may require the student to repeat the course when next offered. This policy is at a minimum. Departments, schools, and individual faculty members may alter this policy to include stronger attendance requirements and/or implement them for all levels of students. It is the responsibility of the student to keep track of their own attendance and speak with their faculty member or the Office of the Registrar for any clarification.

In this course, a student can miss up to 6 lectures.

VII. Accommodations for students with disabilities:

In compliance with the Habib University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the Office of Academic Performance to verify their eligibility for appropriate accommodations.

VIII. Inclusivity Statement

We understand that our members represent a rich variety of backgrounds and perspectives. Habib University is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values and beliefs

- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the Habib community

IX. Office hours:

Office hours will be shared over LMS. During these hours the course instructor will be available to answer questions or provide additional help.

X. Academic Integrity

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

Scholastic dishonesty shall be considered a serious violation of these rules and regulations and is subject to strict disciplinary action as prescribed by Habib University regulations and policies. Scholastic dishonesty includes, but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

PLAGIARISM: Plagiarism is the act of taking the work created by another person or entity and presenting it as one's own for the purpose of personal gain or of obtaining academic credit. As per University policy, plagiarism includes the submission of or incorporation of the work of others without acknowledging its provenance or giving due credit according to established academic practices. This includes the submission of material that has been appropriated, bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.

CHEATING: The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.

COLLUSION: Collusion is the act of providing unauthorized assistance to one or more person or of not taking the appropriate precautions against doing so.

All violations of academic integrity will also be immediately reported to the Student Conduct Office.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. 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, a diskette, or a hard copy.

Should copying occur, the student who copied work from another student and the student who gave material to be copied will both be in violation of the Student Code of Conduct.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, 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.

Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

XI. Tentative Course Schedule

The schedule is subject to change based on students' needs as the course progresses.

Week	Lecture		Topic	Reading	Notes
Module I: Logic and Proofs					
1	1	3 Jan 18	Logistics		
	2	4/5 Jan 18	Propositional Logic	1.1	
2	3	8 Jan 18	Propositional Logic	1.1	
	4	10 Jan 18	Applications of Propositional Logic	1.2	
	5	11/12 Jan 18	Propositional Equivalence	1.3	
3	6	15 Jan 18	Predicates and Quantifiers	1.4	Fri, 19 Jan: HW 1 out
	7	17 Jan 18	Nested Quantifiers	1.5	
	8	18/19 Jan 18	Rules of Inference	1.6	
4	9	22 Jan 18	Sets and Set Operations	2.1,2	
	10	24 Jan 18	Functions	2.3	
	11	25/26 Jan 18	Functions	2.3	
5	12	29 Jan 18	Sequences and Summations	2.4	Fri, 2 Feb: HW 1 due HW 2 out
	13	31 Jan 18	Sequences and Summations	2.4	
	14	1/2 Feb 18	Cardinality of Sets	2.5	
6	15	5 Feb 18	Holiday: Kashmir Day		
	16	7 Feb 18	Relations and Their Properties	9.1	
	17	8/9 Feb 18	Representing Relations	9.3	
7	18	12 Feb 18	Equivalence Relations	9.5	Fri, 16 Feb: HW 2 due HW 3 out
	19	14 Feb 18	Partial Orderings	9.6	
	20	15/16 Feb 18	Introduction to Proofs	1.7	
			Proof Methods and Strategies	1.8	
8	21	19 Feb 18	Proof Methods and Strategies	1.8	Sat, 24 Feb: Mid, 14–17h
	22	21 Feb 18	Mathematical Induction	5.1	
	23	22/23 Feb 18	Strong Induction and Well-Ordering	5.2	
Module II: Combinatorics and Structures					
9	24	26 Feb 18	The Basics of Counting	6.1	Fri, 2 Mar: HW 3 due HW 4 out
	25	28 Feb 18	The Pigeonhole Principle	6.2	
	26	1/2 Mar 18	Permutations and Combinations	6.3	
10	27	5 Mar 18	Binomial Coefficients and Identities	6.4	
	28	7 Mar 18	Generalized Perm. and Comb.	6.5	
	29	8/9 Mar 18	Generating Perm. and Comb.	6.6	
11	30	12 Mar 18	Graphs and Graph Models	10.1	Fri, 16 Mar: HW 4 due HW 5 out
	31	14 Mar 18	Graph Terminology and Special Types	10.2	
	32	15/16 Mar 18	Graph Isomorphism	10.3	
12	33	19 Mar 18	Graph Isomorphism	10.3	
	34	21 Mar 18	Connectivity	10.4	
	35	22/23 Mar 18	Holiday: Pakistan Day		Not for Sec 1
13	36	26 Mar 18	Euler and Hamilton Paths	10.5	Fri, 30 Mar: HW 5 due HW 6 out
	37	28 Mar 18	Planar Graphs	10.7	
	38	29/30 Mar 18	Graph Coloring	10.8	
			Introduction to Trees	11.1	
Module III: Number Theory					
14	39	2 Apr 18	Divisibility and Modular Arithmetic	4.1	

Week	Lecture		Topic	Reading	Notes
	40	4 Apr 18	Integer Representations and Algorithms	4.2	
	41	5/6 Apr 18	Primes and GCD	4.3	
15	42	9 Apr 18	Solving Congruences	4.4	Fri, 13 Apr: HW 6 due
	43	11 Apr 18	Applications of Congruences	4.5	
	44	12/13 Apr 18	Cryptography	4.6	
		16–21 Apr	– Final Exam –		