



COURSE SYLLABUS

I-Course Information :

Title of the course	Discrete Mathematics
Department	Data Science
Specialization	
Academic Year	2020-2021
Semester Duration	3 months
Credit Number	4
Number of Hours	40
Course Instructor	Rabih Assaf
Email	rabih_assaf@hotmail.com / rabih.assaf@ul.edu.lb
Office Hours	Friday 8:00 to 12:00

II- Course Description

This course covers elementary discrete mathematics for data science science and engineering. It emphasizes mathematical definitions and proofs as well as applicable methods. Topics include formal logic notation, proof methods; induction, recurrence, well-ordering; sets, relations; elementary graph theory; integer congruences; asymptotic notation and growth of functions; permutations and combinations and counting principles.

III-Course Objectives

This course aims to provide students with/allows students to:

- ❖ Use correctly the classical notions of logic: implications, equivalence, negation, proof by contradiction, proof by induction, qualifiers.
- ❖ Use set theory: union, intersection, complementary, maps.
- ❖ Employ functions between set properties, bijection, injection, surjection.
- ❖ Know the Relations, basic definitions and properties, representations of a relation, special types of relations, Combining relations, Equivalence Relation and partial ordering
- ❖ Know the main formulas in combinatorics: enumerations of subsets, enumerations of injections, surjections, bijections of functions.
- ❖ Have the basic concepts of graph theory and

In order to achieve the objectives of the course, the following requirements must be met by the student:

- Scientific activities
- Academic regulations
- Academic work and perseverance
- 70% attendance and participation



IV- Course Outline and Calendar

Learning Objective	Session(s)	Learning Content	Pedagogical Strategy& Tools
Chapter 1 - The Foundations: Logic and Proofs	1-2-3-4-5-6	• Equivalence and Implication • Equivalence of statements • Truth tables • DE Morgan's Laws • Implication : Important Concepts, Formula and Theorems • Variables and Quantifiers • Variables and universes • Standard notation for quantification • Statements about variables • Proving quantified statements true or false • Negation of quantified statements • Implicit quantification • Direct Inference (Modus Ponens) and Proofs • Rules of inference for direct proofs • Contrapositive rule of inference • Proof by contradiction • Important Concepts, Formula and Theorems	Explanations of definitions, theorems and methods with direct applications, then solving a work sheet of exercises at the end of the course + extra exercises as assignments.
Chapter 2 - Basic Structures: Sets, Functions, Sequences and Sums	7-8-9-10-11-12	• Sets: Subset, Size of a Set • Power Sets, Cartesian Products • Set Operations: Set Identities, Generalized Unions and Intersections. • Functions: One-to-One	Explanations of definitions, theorems and methods with direct applications, then solving a work sheet of exercises at the end of the course + extra exercises as assignments.



		and Onto Functions, Inverse Function and Compositions Functions, The Graph of Functions, Injections, Bijections and Inverse Functions. • Cardinality and Countability • Sequences and Summations: Recurrence Relations, Properties of Summations • Cardinality of Sets • Matrices: Matrix Arithmetic, Transposes and Powers of Matrices, Zero-One Matrices.	
Chapter 3 – Number Theory	13-14-15-16-17	• Divisibility and Modular Arithmetic • The Integers and Division • Representations of Integers. • Primes and Greatest Common Divisors and Least Common Multiples. • Solving Congruences • Linear Congruences • Fermat Theorem • Applications of Congruences	Explanations of definitions, theorems and methods with direct applications, then solving a work sheet of exercises at the end of the course + extra exercises as assignments.
Chapter 4 - Relations	18-19-20-21-22-23	• Relations and their properties • Principle of recurrence • Representing Relations • Equivalence Relations: Equivalence Classes and their properties • Partial Orderings	Explanations of definitions, theorems and methods with direct applications, then solving a work sheet of exercises at the end of the course + extra exercises as assignments.
Chapter 5 – Graph Theory	24-25-26	• The Basics of graph theory. • Minimum Spanning tree • Graph theory with	Explanations of definitions, theorems and methods with direct applications, then solving a work sheet of exercises at the



		applications	end of the course + extra exercises as assignments.
Final Exam			

P.S.: The course outline above may be modified during the semester.

V- Teaching approach & methods

The goal in my classroom is to have a lively, open, and educational environment. Therefore, the use of many methods and strategies of modern learning will be concentrated in class:

- Emphasizing class participation.
- Encouraging discussion and interaction
- Bringing excitement and a storyline to classes, using energy and enthusiasm to teach ideas while guiding students along a path where each new concept is a natural consequence of the previous and a natural precursor to the following.
- Focusing on higher order thinking skills and promoting students' critical thinking in self-directed and safe learning environments.
- Providing active learning: showing problem-solving techniques, and making mistakes, getting stuck, and trying different strategies.
- Combination of theoretical and practical parts of the course
- Active learning outside the class room providing homeworks and online resources.
- Focusing on the importance of the course in the major and its relation with other courses.
- Showing real life and practical examples of the development of linear algebra tools in the world of Data Science.
- Continuous assessments thought the learning schedule.

VI- Assessment Methods

The success of the student in this course is based on:

- 1- His/her active participation in class.
- 2- His/her scientific contribution through research done outside the classroom.
- 3- His/her reading notes, research reports and practical applications as requested by course instructor.

The assessment of the student is carried out according to the following grid:

Assessment Type	Final Grade Weighting (%)	Dates/Deadlines
Participation (graded assignments, projects, research paper, , etc.)	40%	During the semester
Final exam	60%	July 2020
Total	100%	

VII- Specific Course Requirements

1- Regulations concerning deadlines for written and applied work submissions



The teacher has the right to:

- Refuse to receive written applied work outside the deadlines.
- Give the student additional time after omitting up to 25% of the mark awarded to the concerned activity.

2- Academic measures in case of plagiarism

The student shall be liable to the following penalties in case of any attempt of illicit scientific citation:

- Cancellation of the student's contribution, activity or scientific article and reduction of the final mark.
- If the same offense is reported in other courses, cancellation of the final exam and failure in the relevant course(s).

VIII- Reference Book

- Discrete Mathematics and its Applications (Seventh Edition) by Kenneth H. Rosen (McGraw-Hill, Inc., New York, 2012).
- Susanna Epp, Discrete mathematics with applications, Cengage Learning, 2019

IX- Bibliography& Additional Sources

- Discrete Mathematics second edition by Biggs, Oxford University Press, 2013.
- Discrete Mathematics for Computer Science (Mathematics Across the Curriculum) Hardcover – 8 February 2006.
- Discrete Mathematics with applications by Koshy Thomas, Elsevier, 2014.
- Schaum's Outline of Discrete Mathematics, Revised Third Edition 3rd Edition.
- Discrete Mathematics by Wross and Wright: 4th edition.