University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
Department of Electrical and Computer Engineering
CISB111/ECEB222 – Discrete Structures
Syllabus
1st Semester 2015/2016

Part A – Course Outline

Compulsory course in Computer Science
Compulsory course in Electrical and Computer Engineering

Catalog description:
(2-2) 3 credits. Set Theory, Logic, Counting, Relations, Graph Theory, and other topics. Students will be trained in developing skills in mathematics, such as formulating problems, abstraction and proof methods.

Course type:
Theoretical

Prerequisites:
None

Textbook(s) and other required material:
Discrete Mathematical Structures, Kolman, Busby, Ross, 6th Edition, Pearson Prentice Hall, 2009, ISBN 0-13-207845-7; 978-0-13-207845-0 (Required)

References:
Discrete Mathematics and its applications, Rosen, Kenneth H. 7th Edition, McGraw-Hill Higher Education, 2012, ISBN 978-0-07-338309-5

Major prerequisites by topic:
College algebra or pre-calculus

Course objectives:
- Develop an understanding of mathematical statements (theorems) and how to read and construct valid mathematical arguments (proofs). [a, b, i]
- Introduce various problem-solving strategies, especially thinking algorithmically. [c, i]
- Introduce important discrete data structures such as sets, relations, discrete functions, graphs and trees. [a, b]

Topics covered:
- **Introduction to Discrete Mathematical Structures (1 hour)**: An introduction to the course. It starts with the meaning of "discrete" comparing with "continuous", and the reason of taking the course in computer science. It then introduces the goals, objectives, and topics to be covered. Some warm-up questions are also raised.
- **Sets and Sequences (2 hours)**: Concept of sets and subsets, operations on sets, algebraic properties of set operations, the addition principle; sequences, characteristic function, strings and regular expressions.
- **Integers and Matrices (1 hours)**: Properties of integers, division in the integers, greatest common divisor, Euclidean algorithm, least common multiple, matrices, Boolean matrices, and Boolean matrix operations.
- **Mathematical Structures (2 hours)**: Concept of mathematical structures, closure property, commutative, associative, distributive properties, De Morgan's laws, identity element and inverse.
- **Propositions, Logical Operations, and Conditional Statements (3 hours)**: Definition of proposition, propositional variables, compound statements, negation, conjunction, disjunction, truth table, predicate, universal and existential quantification, conditional statements, converse, contrapositive, equivalence, tautology, absurdity, and contingency.

- **Methods of Proof and Mathematical Induction (4 hours)**: Introduce the rules of inference. Determine if an argument is valid or not. Introduce indirect method of proof, proof by contradiction, and disproof. Review the principle of mathematical induction, and introduce the strong form of mathematical induction. Study the use of mathematical induction to prove a loop invariant in programs.
- **Counting, Pigeonhole Principle, and Recurrence Relations (1 hours)**: Pigeonhole principle and its use in existence proof, recurrence relations, Fibonacci sequence, finding explicit formula for linear homogenous relation of degree 2.
- **Relations and Digraphs (8 hours)**: product sets, partitions, relations, the matrix of a relation, the digraph of a relation, paths in relations and digraphs, properties of relations, equivalence relations and partitions, operations on relations, closures and composition.
- **Functions and Growth of Functions (2 hours)**: concept of functions, special types of functions, invertible functions, composition of functions, functions for computer science, growth of functions, Big-O notation, and rules for determining the growth of functions.
- **Trees and Graphs (4 hours)**: Concept of trees, labeled trees, binary tree searching, searching general trees, undirected trees, spanning trees, minimal spanning trees, Prim's algorithm and Kruskal's algorithm, graphs.

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	**Tutorial**	**Practice**				
2	**2**	**Nil**	**14**	**56**	**3**	**1 / 2 hours**

Student study effort required:

Class contact:	
Lecture	28 hours
Tutorial	28 hours
Other study effort	
Self-study	20 hours
Homework	14 hours
Total student study effort	90 hours

Student assessment:

Final assessment will be determined on the basis of:

Homework	20%
Midterm Test	30%
Final Exam	50%

Course assessment:

The assessment of course objectives will be determined on the basis of:

- Homework, test and exam
- Course evaluation

Course outline:

Weeks	Topic	Course work
1	Introduction to Discrete Mathematical Structures	
2, 3	Sets and Sequences, Integers and Matrices	Homework#1
4	Mathematical Structures	
5	Propositions, Logical Operations, and Conditional Statements	Homework#2
6, 7	Methods of Proof and Mathematical Induction	Homework#3

8, 9	Counting, Pigeonhole Principle, and Recurrence Relations	Midterm Test
10	Binary Relation, Geometric and Algebraic Representation Method	
11	Properties, Equivalence Relations, Operations on Relations	Homework#4
12	Functions and Growth of Functions	Homework#5
13	Trees and Graphs	
14	Conclusion & Review	

Contribution of course to meet the professional component:

This course presents the foundations of many basic computer related concepts, such as set theory, logic, graph theory, and counting.

Relationship to Computer Science program objectives and outcomes:

This course primarily contributes to Computer Science program outcomes that develop student abilities to:
(a) An ability to apply knowledge of computing and mathematics appropriate to the programme outcomes and to the discipline.
(b) An ability to apply knowledge of a computing specialisation, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models.
(c) An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution.
(i) Recognition of the need for and an ability to engage in continuing professional development.

Relationship to Computer Science program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)	1													

Discrete Structures (DS), Programming Fundamentals (PF), Algorithms and Complexity (AL), Architecture and Organization (AR), Operating Systems (OS), Net-Centric Computing (NC), Programming Languages (PL), Human-Computer Interaction (HC), Graphics and Visual Computing (GV), Intelligent Systems (IS), Information Management (IM), Social and Professional Issues (SP), Software Engineering (SE), Computational Science (CN).

Course content distribution:

Percentage content for			
Mathematics	Science and engineering subjects	Complementary electives	**Total**
100%	0%	0%	100%

Persons who prepared this description:

Dr. Yan Zhuang

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Part B General Course Information and Policies

1st Semester 2015/2016

Instructor:	Dr. Yan Zhuang	Office: E11-4091
Office Hour:	10:00 ~ 11:00, Tuesday, Thursday	Phone: 8822-4464
Email:	syz@umac.mo	

Teaching Assistants: TBA

Time/Venue

Lecture:	14:00 – 15:45 Thursday	E22-G010
Tutorial:	9:30 – 11:15 Friday	E22-G010

Grading Distribution:

Percentage Grade	Final Grade	Percentage Grade	Final Grade
100 - 93	A	92 - 88	A–
87 - 83	B+	82 - 78	B
77 - 73	B–	72 - 68	C+
67 - 63	C	62 - 58	C–
57 - 53	D+	52 - 50	D
below 50	F		

Comment:
The objectives of the lectures are to explain and to supplement the text material. Students are responsible for the assigned material whether or not it is covered in the lecture. Students who wish to succeed in this course should work all homework and exercises given in tutorial classes. You are encouraged to look at other sources (other texts, etc.) to complement the lectures and text.

Homework Policy:
Doing exercises is of vital importance to help the students to master the concepts covered, therefore:

- There will be approximately 5 homework assignments.
- Homework is due one week after assignment unless otherwise noted, no late homework is accepted.

Test and Exam:
One midterm test and one final exam will be held during the semester. Both are 2-hour and closed book.

Note

- Attendance at both lectures and tutorial classes is strongly recommended.
- Check UMMoodle (http://ummoodle.umac.mo) for announcement, homework and lectures.
- No make-up test is given except for clear medical proof.
- Cheating is absolutely prohibited by the university.

Student Disabilities Support Service:

The University of Macau is committed to providing an equal opportunity in education to persons with disabilities. If you are a student with a physical, visual, hearing, speech, learning or psychological impairment(s) which substantially limit your learning and/or activities of daily living, you are encouraged to communicate with your instructors about your impairment(s) and the accommodations you need in your studies. You are also encouraged to contact the Student Disability Support Service of the Student Counselling and Development Section (SCD), which provides appropriate resources and accommodations to allow each student with a disability to have an equal opportunity in education, university life activities and services at the University of Macau. To learn more about the service, please contact SCD at scd.disability@umac.mo, or 8397 4901 or visit the following website: http://www.umac.mo/sao/scd/sds/aboutus/en/scd_mission.php