

University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
CISB463 – Logic for Computer Science
Syllabus
2nd Semester 2014/2015
Part A – Course Outline

Elective course in Computer Science

Course description:

(2-2) 3 credits. Introduction to logic, propositional calculus and predicate calculus, resolution and logic programming, temporal logic and formalization of programs, also computability will be introduced.

Course type:

Theoretical

Prerequisites:

- CISB353 Formal Languages and Automata

Textbook(s) and other required material:

- M. Ben-Ari. (2001) Mathematical Logic for Computer Science, 2nd ed., Springer.

References:

- E. Mevdelson. (1987) Introduction to Mathematical Logic. 3rd ed., Wadsworth & Brooks/Cle.
- C. C. Leary. (2000) A Friendly Introduction to Mathematical Logic. Prentice Hall.
- M. Huth, M. Ryan. (2004) Logic in Computer Science: Modelling and Reasoning about Systems, 2nd ed., Cambridge University Press.

Major prerequisites by topic:

- 1. Basic concepts of propositional logic.
- 2. Discrete mathematics.
- 3. Elements of theory of computation.
- 4. Methods for constructing mathematical proofs.

Course objectives:

- 1. Introduce formal system (propositional and predicate logic) which mathematical reasoning is based on [a]
- 2. Develop an understanding of how to read and construct valid mathematical arguments (proofs) [a]
- 3. Understand mathematical statements (theorems), including inductive proofs [a]
- 4. Introduce and work with various problem solving strategies and techniques [a, c]

Topics covered:

1. Basic Concepts: Logic and Reasoning. (3 hours)
2. Formal Systems: Propositional Logic and Predicate Logic. (3 hours)
3. Propositional Calculus: Syntax, Semantics, Tableaux, Equivalence, Satisfiability, Validity and Consequence, Deductive Proofs and Resolution. (12 hours)
4. Predicate Calculus: Syntax, Semantics, Tableaux, Interpretations, Satisfiability, Deduction and Resolution. (15 hours)
5. Propositional Temporal Logic: Syntax, Semantics, Tableaux, Soundness and Completeness. (3-4.5 hours)
6. Formalization of Programs: Axiomatization of Language, Formal Specification, Formal Methods and Formal Verification of Programs (3-4.5 hours)

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	Tutorial	Lab				
2	2	0	14	56	3.0	1 / 3 hours

Student study effort required:

Class contact:	
Lecture	42 hours
Tutorial	28 hours
Lab	0 hours
Other study effort	
Self-study	21 hours
Homework assignment	28 hours
Project / Case study	0 hours
Total student study effort	119 hours

Student assessment:

Final assessment will be determined on the basis of:

Homework 20% (in which attendance and quizzes around 10%)

1st Mid-term 35% Final exam 45%

Course assessment:

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

- Homework and exams
- Course evaluation

Course outline:

Weeks	Topic	Course work
1	Introduction Logic and Reasoning	
2	Propositional calculus, Introduction Boolean operators, propositional formulas, Boolean interpretations	
3-4	Propositional calculus Logic equivalence and substitution, satisfiability, validity and consequence, semantic tableaux	Assignment#1
5-6	Advanced Propositional calculus Deductive proofs, Gentzen systems, Hilbert systems, resolution	Assignment#2
7	Predicate calculus, Introduction Relations and predicates, predicate formulas, Interpretations	Midterm
8-9	Predicate calculus Logical equivalence and substitution, Semantic tableaux	
10-11	Advanced predicate calculus Deduction and Resolution	Assignment#3
12-14	Temporal logic and Formalization of programs Brief introduction of temporal logic and formalization of programs, computability will be introduced if time permits	Assignment #4

Contribution of course to meet the professional component:

This course prepares students with fundamental knowledge of mathematical logic for computer science.

Relationship to CS 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;

The course secondarily contributes to Computer Science program outcomes that develop student abilities to:

(c) An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution.

Relationship to CS program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)	1		2										4	

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
50%	50%	0%	100%

Coordinator:

Wong Fai, Assistant Professor of Computer Science

Persons who prepared this description:

Wong Fai, Li Yi Ping, July 25, 2010.

Long Chen, Nov 30, 2014 (revised)

Part B – General Course Information and Policies

2st Semester 2014/2015

Instructor: Dr. Long Chen
Office hour: *by appointment*
Email: longchen@umac.mo

Office: E11-4014
Phone: 8822-8459

Time/Venue: *Thursday 11:00-12:45 E11-1009(LA)*
Wednesday 11:00-12:45 E11-1028(L)

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 read the assignments prior to the lecture and should work all homework and project assignments. You are encouraged to look at other sources (other texts, etc.) to complement the lectures and text.

Homework policy:

The completion and correction of homework is a powerful learning experience; therefore:

- There will be approximately 4 homework assignments.
- Homework is due one week after assignment unless otherwise noted, no late homework is accepted.
- The course grade will be based on the average of the HW grades.

Quiz:

One 2 hours mid-term exams will be held during the semester. Several quizzes will be held in class.

Note:

- **Recitation/tutorial session is important part of this course and attendance is strongly recommended**
- Check UMMoodle (<https://ummoodle.umac.mo/>) for announcement, homework and lectures. Report any mistake on your grades within one week after posting.
- No make-up exam is given except for CLEAR medical proof.
- Cheating is absolutely prohibited by the university.

Appendix:

Rubric for Program Outcomes

(a) An ability to apply knowledge of computing and mathematics appropriate to the programme outcomes and to the discipline

Measurement Dimension	Excellent (80-100%)	Average (60-79%)	Poor (<60%)
1. An ability to apply knowledge of computing to the solution of complex computing problems.	Students understand the computing principles, and their limitations in the respective applications. Use the computing principles to formulate and solve complex computing problems.	Students understand the computing principles, and their limitations in the respective applications. But they have trouble in applying these computing principles to formulate and solve complex computing problems.	Students do not understand the computing principles, and their limitations in the respective applications. Do not know how to apply the appropriate computing principles to formulate and solve complex computing problems.
2. An ability to apply knowledge of mathematics to the solution of complex computing problems.	Students understand the mathematical principles, e.g., calculus, linear algebra, probability and statistics, relevant to computer science, and their limitations in the respective applications. Use mathematical principles to formulate and solve complex computing problems.	Students understand the theoretical background and know how to choose mathematical principles relevant to computer science. But they have trouble in applying these mathematical principles to formulate and solve complex computing problems.	Students do not understand the mathematical principles and do not know how to formulate and solve complex computing problems.

(c) An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution

Measurement Dimension	Excellent (80-100%)	Average (60-79%)	Poor (<60%)
1. An ability to understand problem and identify the fundamental formulation	Students understand problem correctly and can identify the fundamental formulation	Student understand problem correctly, but have trouble in identifying the fundamental formulation	Students cannot understand problem correctly, and they do not know how to identify the fundamental formulation
2. An ability to choose and properly apply the correct techniques	Students know how to choose and properly apply the correct techniques to solve problem.	Students can choose correct techniques but have trouble in applying these techniques to solve problem.	Students have trouble in choosing the correct techniques to solve problem.

學生身心障礙支援服務

學生身心障礙支援服務澳門大學致力為身心障礙人士提供平等的學習機會，若您在肢體、視力、聽力、語言、學習或心理上的障礙，導致您在學習或日常活動中受到嚴重的限制，我們鼓勵您與老師溝通，讓他/她知道你的狀況，並作出適當的安排。此外，我們也鼓勵您與學生輔導及發展處之學生身心障礙支援服務聯繫，該服務將為有需要的學生提供相應的資源和設施，讓所有學生都能在大學裏享有同等的教育機會、大學生活及服務。如閣下對此服務有任何疑問，歡迎聯絡學生事務部---學生輔導及發展處（電郵：scd.disability@umac.mo；電話：88224901；瀏覽網頁http://www.umac.mo/sao/scd/sds/aboutus/cn/scd_mission.php）。

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) in Student Affairs Office, 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 8822 4901 or visit the following website:

http://www.umac.mo/sao/scd/sds/aboutus/en/scd_mission.php.

Serviço de Apoio aos Estudantes Portadores de Deficiência

A Universidade de Macau (UM) compromete-se a oferecer oportunidades iguais de educação para as pessoas portadoras de deficiência. Caso o aluno tenha deficiência física, visual, auditiva, mental, ou dificuldades de fala ou de aprendizagem, que afectem consideravelmente a sua aprendizagem ou actividades quotidianas, convém comunicar estas dificuldades aos professores para pedir apoio necessário. É também aconselhável contactar o Serviço de Apoio à Deficiência dos Alunos da Secção para Aconselhamento e Desenvolvimento dos Estudantes (SADE), à qual compete oferecer recursos e condições para que os alunos portadores de deficiência tenham oportunidades iguais na educação, actividades e serviços universitários na UM. Para mais informações sobre este serviço, é favor contactar a SADE via email: scd.disability@umac.mo, telefone 8822 4901 ou visitar a página electrónica http://www.umac.mo/sao/scd/sds/aboutus/en/scd_mission.php.