UNIVERSITY OF MACAU
FACULTY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE
CISB210 Algorithm and Data Structures II
Syllabus
1st Semester 2014/2015
Part A – Course Outline

Compulsory course in Computer Science

Catalog description:
(2-2) 3 hours credit. Advanced data structures and algorithms. Algorithm Design Techniques. Introduction to NP problem.

Course type:
Theoretical with substantial laboratory/practice content.

Prerequisites:
- CISB120

Textbook(s) and other required material:
- Mark Allen Weiss, *Data Structures and Algorithm Analysis*, 2nd Edition, Addison-Wesley 1997 (Required)

References:
- Robert L. Kruse and Alexander J. Ryba, *Data Structures and Program Design*, Prentice Hall 1998.

Major prerequisites by topic:
- Programming in high level language
- Application of mathematical principals to the analysis of computing problems.
- Discrete mathematics.
- Basic knowledge of data structures and algorithms

Course objectives:
- Introduce to students advanced data structures [a,c,e].
- Introduce to students efficient algorithms for more difficult problems [a,c,e]
- Enhance students abilities in algorithm analysis [a,c,e].
- Introduce to students advanced techniques for algorithm design [a,c,e].
- Further enhance students programming abilities [c,e]
- Introduce to students reasoning of algorithms [a] (not measured).
- Introduce to students theory of computation [a] (not measured).

Topics covered:
- Heaps (3 weeks)
- Advanced trees (AVL trees) (2 weeks)
- Sorting (3 weeks)
- Graphs (2 weeks)
- Algorithm design techniques (1 week)
- Introduction to theory of computation (1 week)

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	Nil	2	14	56	3	1 / 3 hours

Student study effort required:

Class contact:	
Lecture	28 hours
Practice	28 hours
Other study effort	
Self-study and assignment	42 hours
Total student study effort	98 hours

Student assessment:
Final assessment will be determined on the basis of:
Homework and quizzes 15%
Exams 85%

Course assessment:
The assessment of course objectives will be determined on the basis of:
- Homework, quizzes and exams
- Course evaluation

Course outline:

Weeks	Topic	Course work
1-3	**Priority Queues** Simple implementation by lists, binary heaps, D-heaps, leftist heaps.	Assignment#1
4-5	**Advanced Trees** AVL trees	Assignment#2
6	**Review and Middle Term Exam**	Middle Term Exam
7-9	**Sorting** Insertion sort, lower bound for simple sorting algorithms, shell sort, merge sort, quick sort, general lower bound for sorting based on comparison, external sorting.	Assignment#3
10-11	**Graph** Representation of graph, traversal, topological sort, shortest path, minimal spanning tree.	Assignment#4
12	**Techniques for Algorithm Design** Greedy, divide and conquer, dynamic programming, backtracking.	
13	**Introduction to Theory of Computation** Undecidable problems, tractable and untractable problems, NP problems, randomized algorithms.	
14	There are several holidays in the semester. This week will be flexible, and if there is time, will spend more time on algorithm design.	

Contribution of course to meet the professional component:
This course further prepares students to work professionally in the area of advanced programming.

Relationship to CS program objectives and outcomes:
This course primarily contributes to the Computer Science program outcomes that develop student abilities to:
(a) apply knowledge of computing, mathematics, science, and engineering
(c) design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(e) an ability to identify, formulate, and solve engineering problems

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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)	2	4	4				3						1	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**
10%	90%	0%	100%

Coordinator:
Prof. Chi Man Pun

Persons who prepared this description:
Dr. Qi Wen Xu

Part B – General Course Information and Policies

1st Semester 2014/2015

Instructor: Dr. Qi Wen Xu
Office: E11-4024
Phone: 8822 4337
Email: qwxu@umac.mo

Time/Venue: Mon 11:00-12:50, theory, E22-G015
Thur 11:00-12:50. practice, E6-3093
Fri 14:00-15:50, practice, E6-2092

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 lab assignments, and 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 two weeks after assignment unless otherwise noted, no late homework is accepted.
- Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework.

Quizzes:
There will be a 30-miniute in class quizzes (or exercise) from time to time.

Note:
- Check course web 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.
- No exam is given if you are 30 minutes late in exam. Even if you are late in the exam, you must turn in at the due time.
- Cheating is absolutely prohibited by the university.

Appendix:

Rubric for Program Outcomes

Rubric for (a)	5 (Excellent)	3 (Average)	1 (Poor)
Understand the theoretic background	Students understand theoretic background and the limitations of the respective applications.	Students have some confusion on some background or do not understand theoretic background completely.	Students do not understand the background or do not study at all.
Rubric for (c)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Design capability and design constraints	Student understands very clearly what needs to be designed and the realistic design constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Student understands what needs to be designed and the design constraints, but may not fully understand the limitations of the design constraints.	Student does not understand what needs to be designed and the design constraints.
Rubric for (e)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Identify applications in engineering systems	Students understand problem and can identify fundamental formulation.	Students understand problem but cannot apply formulation, or cannot understand problem.	Students cannot identify correct terms for engineering applications.