UNIVERSITY OF MACAU
FACULTY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE
SFTW373 Special Topics in Computer and Information Science I
(Subtitle: Advanced Techniques for Algorithm Design and Implementation)
Syllabus
1st Semester 2011/2012
Part A – Course Outline

Compulsory course in Computer Science

Catalog description:

(2-2) 4 hours credit. Advanced algorithm design and implementation. Problem solving by programming

Course type:

Theoretical with substantial laboratory/practice content.

Prerequisites:

- SFTW111

Textbook(s) and other required material:

- Steven S. Skiena and Miguel A. Revilla, *Programming Challenges*, Springer 2002 (Required).

References:

- Problem set from ACM Programming Contest.

Major prerequisites by topic:

- Good programming skills in high level language
- Application of mathematical principals to the analysis of computing problems.
- Discrete mathematics.
- Data structures and algorithms

Course objectives:

- Enhance students abilities in algorithm design [a,c,e].
- Enhance students abilities in solving problems [a,c,e].
- Enhance students abilities in programming [c,e].
- Enhance students abilities in reasoning of algorithms [a] (not measured)
- Enhance students abilities to communicate effectively [g] (not measured)

Topics covered:

- Application of sorting (1 week)
- Application of arithmetic and algebra (1 week)
- Application of number theory (1 week)
- Application of combinatorics (1 week)
- Application of graph algorithms (2 weeks)
- Application of geometry and computational geometry (2 weeks)
- Advanced algorithm design techniques (3 weeks)

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	Tutorial	Exam				
2	2	1 (average)	14	70	4	1 problem for middle term; 3 problems for

						final, up to 4 hours for one problem

Student study effort required:

Class contact:	
Lecture	28 hours
Tutorial	28 hours
Exam	14 hours
Other study effort	
Self-study	14 hours
Homework assignment	42 hours
Total student study effort	126 hours

Student assessment:
Final assessment will be determined on the basis of:
Homework and quizzes 30%
Exams 70%

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 and Application of Sorting**	Assignment#1
2	**Application of Arithmetic and Algebra** High-precision arithmetic, manipulating polynomials	Assignment#2
3	**Application of Combinatorics** Recurrence relations, binomial coefficients	Assignment#3
4	**Number Theory** Finding prime numbers, divisibility, modular arithmetic, congruence	Assignment#4
5-6	**Backtracking** Greedy, divide and conquer, dynamic programming, backtracking.	Assignment#5
7	**Middle Term Exam**	Middle Term Exam
8-9	**Graph** Applications of basic algorithms, network flow, matching problem	Assignment#6
10-11	**Dynamic Programming**	Assignment#7
12	**Grids** Rectilinear, triangular, hexagonal	Assignment#8
13	**Computational Geometry** Line, polygon, angle computations, convex hull.	
14	There are several holidays in the semester. This week will be flexible, and if there is time, will spend more time on dynamic programming.	

Contribution of course to meet the professional component:
This course enhances students' abilities 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
(g) communicate effectively

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 2011/2012

Instructor: Dr. Qi Wen Xu
Office: N327
Phone: 8397 4337
Office Hour: Immediately after lecture, and in addition one hour in a week will be arranged depending on student time table, further office hours by appointment.
Email: qwxu@umac.mo

Time/Venue: Mon 9:30 am – 11:30 am J206 (lectures)
Thur 9:30 am – 11:30 am, N201 (tutorials)
Five sessions of problem solving in computer lab, each up to 4 hours.

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 8 homework assignments.
- Homework is due one week 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.

Discussions and presentations:
There will be chances for discussions and for students presenting their ideas, student performance will be recorded in homework and presentation.

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.