University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
SFTW420 Computer Based Simulation
Syllabus
2nd Semester 2011/2012
Part A – Course Outline

Elective course in Computer Science

Course description:
(3-2) 4 credits. This course introduces fundamentals of a simulation study, including simulation modeling, simulation software, model verification and validation, input modeling, random-number generators, generating random variates and processes, statistical design and analysis of simulation experiments. The course of study should also highlight major application areas such as manufacturing, computing, and organizational systems. The simulation software ARENA is used to present the concepts and methods of simulation so as to enable students to carry out effective simulation modeling, analysis, and projects of interest using the ARENA simulation system.

Course type:
Theoretical with substantial laboratory/practice content

Prerequisites:
- SFTW210

Textbook(s) and other required material:
- Bank, J., Carson II, J.S., Nelson, B.L., & Nicol, D.M. (2010). *Discret-Event System Simulation,* 5th edition. New York: Pearson Education, Inc

References:
- Kelton, W.D., Sadowski, R.P., & Sturrock, D.T. (2007). *Simulation with Arena,* 4th edition. New York: McGraw Hill Higher Education.

Major prerequisites by topic:
- Probability & Statistics
- Algorithms and Data Structure

Course objectives:
- Introduce to students the general principles and basic concepts in discrete-event simulation. [a,e]
- Introduce to students the basic knowledge of statistical models in simulation. [a,e]
- Introduce the analysis approaches of simulation data. [a,e]
- Learn the application areas of the simulation systems. [a,e,k]
- Learning to apply course material to improve thinking, and problem solving. [k]

Topics covered:
- **Introduction to general principles and basic concepts in discrete-event simulation (6 hours):** Introduce the basic concepts of simulation, concepts in discrete-event simulation and processing, general knowledge of simulation software.
- **Mathematical and statistical models (12 hours):** including queueing systems, inventory and supply-chain systems, reliability and maintainability, and discrete distribution.

- **Analysis of simulation data (12 hours):** Input modeling, verification, calibration, and validation of simulation models, estimation of absolute performance, and estimation of relative performance.
- **Simulation applications (12 hour):** Simulation of manufacturing and material-handling systems, and simulation of networked computer systems.

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				
3	1	1	14	70	4	3 hours

4 hour lectures, including three hours tutorials every three weeks. (14 weeks)

Student study effort required:

Class contact:	
Lecture	42 hours
Tutorial	14 hours
Practice	14 hours
Other study effort	
Self-study	14 hours
Assignment and projects	28 hours
Total student study effort	112 hours

Student assessment:
Final assessment will be determined on the basis of:

Assignment	20%	Lab exercises and reports	10%
Project	30%	Exam	40%.

Course assessment:
The assessment of course objectives will be determined on the basis of:
- Assignments, lab exercises, project and examination.
- Course evaluation

Course outline:

Weeks	Topic	Course work
1-2	**Introduction to discrete-event system simulation** Fundamental concepts on simulation and modeling, general principles on discrete-event simulation, and introduction to simulation software	
3	**Statistical models in simulation** Review of terminology and concepts and useful statistical models	
4-5	**Discrete and continuous distribution** Binomial distribution, uniform distribution, exponential distribution, etc.	
6	**Poisson process** Properties of a Poisson process, non-stationary Poisson process and Empirical distribution.	Assignment 1
7	**Input modeling** Identifying the distribution with data, parameter estimation, and	

Weeks	Topic	Course work
	selecting input models without data.	
8	**Verification, calibration, and validation of simulation models** Modeling building, verification, and validation.	
9	**Estimation of absolute performance** Types of simulations with respect to output analysis.	
10	**Estimation of relative performance** Metamodeling, optimization via simulation.	Assignment 2
11-12	**Simulation of manufacturing and material-handling systems** Issues in manufacturing and material-handling simulations, case studies of the simulation of manufacturing and material-handling, and manufacturing simulation example.	
13-14	**Simulation of networked computer systems** Model input, mobility models in wireless systems, media access control, and model construction.	1. Project 2. Experiment report

Contribution of course to meet the professional component:
This course prepares students to work professionally in the area of computer based simulation.

Relationship to CS program objectives and outcomes:
This course primarily contributes to the Computer Science program outcomes that develop student abilities to:
(a) an ability to apply knowledge of computing, mathematics, science, and engineering.
(e) an ability to analyze a problem, and identify, formulate and use the appropriate application requirements for obtaining its computing solution.

The course secondarily contributes to the Computer Science program outcomes that develop student abilities to:
(k) an ability to use the techniques, skills, and modern computer tools necessary for engineering practice.

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		4									3		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**
30%	40%	30%	100%

Coordinator:
Prof. Yi Ping Li

Persons who prepared this description:
Dr. Li Ming Zhang

Part B – General Course Information and Policies

2nd Semester 2011/2012

Instructor: Dr. Liming Zhang Office: B1-B703
Office hour: Wed 2:30 pm – 5:30 pm, or by appointment Phone: 8397 8467
Email: lmzhang@umac.mo

Time/Venue: Mon 1:00 pm – 4:00 pm, (lectures)
Wed 11:30 am – 1:30 pm, (laboratory)

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, lab exercises and project. Students 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 2 homework assignments.
- Homework is due three weeks after assignment unless otherwise noted, late homework will be deducted 10% marks for each delayed day.
- Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework
- The course grade will be based on the average of the homework grades.

Exams:
One 3-hour exam will be held at the end of semester. The exam is close book examinations.

Note:
- Lab exercise sessions are important part of this course and attendance is strongly recommended.
- Check UMMoodle 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

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 (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.
Rubric for (k)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Use modern principles, skills, and tools in engineering practice	Student applies the principles, skills and tools to correctly model and analyze engineering problems, and understands the limitations.	Student applies the principles, skills and tools to analyze and implement engineering problems.	Student does not apply principles and tools correctly and/or does not correctly interpret the results.