University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
CISB352 Computer Based Simulation
Syllabus
1st Semester 2014/2015
Part A – Course Outline

Elective course in Computer Science

Catalog description:
(2-1) 3 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:
- CISB 122

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,b]
- Introduce to students the basic knowledge of statistical models in simulation. [a]
- Introduce the analysis approaches of simulation data. [b,c]
- Learn the application areas of the simulation systems. [c,d]

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 (6 hours):** including queueing systems, inventory and supply-chain systems, reliability and maintainability, and discrete distribution.
- **Analysis of simulation data (6 hours):** Input modeling, verification, calibration, and validation of simulation models, estimation of absolute performance, and estimation of relative performance.
- **Simulation applications (10 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				
2	1	1	14	58	3	3

Student study effort required:

Class contact:	
Lecture	28 hours
Tutorial	14 hours
Practice	14 hours
Other study effort	
Self-study	14 hours
Assignment and projects	28 hours
Total student study effort	98 hours

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

Assignment	20%	Lab exercises and reports	10%
Project	20%	Mid-term	20%
Final Exam	30%.		

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

- Assignments, lab exercises and reports, 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 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**	

Weeks	Topic	Course work
	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 contributes to the 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;

(d) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, social and environmental considerations;

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

1st Semester 2014/2015

Instructor: Dr. Liming Zhang Office: E11-4016
Office hour: Wed 2:30 pm – 5:30 pm, or by appointment Phone: 8822 8467
Email: lmzhang@umac.mo

Time/Venue: Mon 11:00 pm – 12:45 pm, (lectures)
Thu 1:30 pm – 3:30 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 and class exercises. 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 and 1 project.
- 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.

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.

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