

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): SCI 3210 SIMULATION (3,2,1)

Course Aims: This course aims to introduce basic technique in computer simulation. Two computer software packages (one for continuous systems and one for discrete systems) will be taught. Various practical problems will be modeled, discussed, and simulated through computer simulation. Upon completion of this course, students should be able to simulate a wide range of practical problems in the daily life.

Prerequisite: MATH1111 or MATH1550 or MATH1570 or MATH1590 or MATH1140

Prepared by: Li-Zhi Liao

Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

| No. | Learning Outcomes (LOs) |
|-----|--|
| | Knowledge |
| 1 | Able to understand the basic techniques in computer simulation |
| 2 | Able to understand the basic structure and process in computer simulation |
| 3 | Able to master the continuous simulation package SIMULINK |
| 4 | Able to master the discrete simulation package GPSS World |
| | Skills |
| 5 | Able to identify and model various practical problems into the framework of SIMULINK |
| 6 | Able to identify and model various practical problems into the framework of GPSS World |
| 7 | Able to conduct simulation using SIMULINK |
| 8 | Able to conduct simulation using GPSS World |
| 9 | Able to experience some mini-project writing and presentation |
| | Attitudes |
| 10 | Confident of identifying and simulating some real world problems by themselves |
| 11 | Confident of working either independently or as a team to solve some real world problems |

Assessment:

| No. | Assessment Methods | Weighting | Remarks |
|-----|---|-----------|---|
| 1 | Continuous Assessment (assignments, test, and mini-project) | 40% | Assignments are designed to help students to master and use the two computer software packages to solve some classroom questions as well as some practical problems. The group mini-project is an essential part of self-learning as well as a test of students' understanding of the knowledge and skills learned in class. The group mini-project provides an opportunity for the students to identify and model some daily life problems and conduct computer simulation to generate some meaning results. |
| 2 | Final Examination | 60% | Final Examination of this course will be conducted in a computer lab. Students will be asked to model some real world problems into the framework of the two computer software packages learned in class. In addition, the students will be also required to simulate their models to generate some meaning results. This exam requires the students to have good skills in modeling and a solid understanding of the two computer software packages. |

Learning Outcomes and Weighting:

| Content | LO No. | Teaching (in hours) |
|-----------------------------------|---------------------|---------------------|
| I. Simulation of Random Variates | 1, 2 | 6 |
| II. Overview of System Simulation | 1, 2 | 2 |
| III. Continuous System Simulation | 1, 2, 3, 5, 7, 9-11 | 12 |
| IV. Discrete System Simulation | 1, 2, 4, 6, 8-11 | 22 |

- References:** F. Neelamkavil, Computer Simulation and Modelling, John Wiley, 1987.
 S.V. Hoover and R.F. Perry, Simulation, A Problem Solving Approach, Addison-Wesley Publishing Company, 1989.
 A.M. Law and W.D. Kelton, Simulation Modeling and Analysis, 2nd Ed., McGraw Hill Inc., 1991.
 J.A. Chisman, Introduction to Simulation Modeling Using GPSS/PC, Prentice-Hall, 1992.

Software: SIMULINK, GPSS World

Course Content in Outline:

| | <u>Topic</u> | <u>Hours</u> |
|------|--|--------------|
| I. | Simulation of Random Variates | 6 |
| | A. Generation of random numbers | |
| | B. Generation of random variates | |
| | C. Estimation of characteristics for random variates | |
| II. | Overview of System Simulation | 2 |
| | A. Objectives of simulation modeling | |
| | B. Simulation principles | |
| | C. Approaches in simulation | |
| III. | Continuous System Simulation | 12 |
| | A. Structure and behavior of continuous systems | |
| | B. A continuous system simulation package | |
| | C. Case study | |
| IV. | Discrete System Simulation | 22 |
| | A. Analysis of discrete systems | |
| | B. A discrete system simulation package | |
| | C. Case study | |
| | D. Analysis of simulation results | |