Introduction to Discrete Simulation

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Section

Topic

Topic

- Given a system, how do you evaluate its performance?
  - Three classical methods:
    - ★ **Experiments:** Use a concrete example of a system and try to measure its performance
    - ★ **Analysis:** Construct a mathematical abstraction of the system and derive equations describing the system's performance
    - ★ **Simulation:** Build a model (a representation) of the system, along with its operations, and use this model to numerically evaluate the system performance – usually with the help of computers
- **In this course, our focus is on** SIMULATIONS!

Topic ...

- Open questions
  - What is a system?
  - What is performance?
  - On what does performance depend?
  - What is a model?
  - What are operations on a system?
  - How to build a model?
  - How to numerically evaluate it?
  - How to interpret the results of such an evaluation?

Section

Objective

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- Provide a basic treatment of all the important aspects of discrete simulation.
- Familiarize with a variety of modelling and simulation techniques.
- Practical experience in composing models and running simulations under a variety of circumstances.
- Discuss results from modelling and simulation using some open source simulation libraries/packages.

Section

Description of the course

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- the fundamentals of discrete event simulation will be introduced.
- techniques for generating random numbers will be studied.
- relation between statistical distributions and how to simulate them using these relations will be studied.
- discrete event simulation methodology, development of simulation models, simulation verification and validation and the design of simulation experiments will be covered.

Description of the course · · ·

- important statistical concepts, including selection of input probability distribution, output data analysis, and variance reduction techniques (if time permits), will be developed and applied.
- simulation packages/libraries like OMNeT++ and NS2 will be explored by you to simulation queueing models and real-world applications.
- project groups will be identified during this course and tasks will be assigned to each group, based on areas of interests and programming knowledge.

Section

Prerequisite

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- Undergraduate course in probability and statistics.
- Programming knowledge in C,C++ or Java.

Section

Contents

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- Introduction
- Modelling random phenomena (random number generation)
- Statistical distributions in simulation
- Random variate generation
- Introduction to queueing models
- Progressive examples
  - Simulation of queueing models
  - Case studies
  - Analyzing some simulation packages
- Input analysis
- Output analysis

Section

Books

Books

- There is no text book as such for the course.
- Lecture slides will be distributed in electronic file format.
- Reference Books
  - A.M. Law and W.D. Kelton. *Simulation Modeling and Analysis*, Edition 3, Tata McGraw Hill, India.
  - J.S. Banks, Carson II, B.L. Nelson and D.M. Nicol. *Discrete-Event System Simulation*, Pearson education, India, 2004.
  - Sheldon M. Ross, *A Course in Simulation*, Macmillan publishing company, New York, 1991.
  - Donald Gross and Carl Harris. *Fundamentals of Queueing Theory*. Edition 3, John Wiley and Sons, 1998.
  - Giovanni Giambene. *Queueing Theory and Telecommunications, Networks and Applications*. Springer, 2005.
  - Online resource for queueing theory `http://www2.uwindsor.ca/~hlynka/queue.html`

Section

Evaluation Process

Evaluation Process

- Two in-semesters — 20% each
- One presentation – 20%
- End-semester – 40%

Project groups must be identified by August 31, 2007

Section

Homepage of the course

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`http://intranet.daiict.ac.in/~lenin/`
`http://courses.daiict.ac.in`

Check "Announcements" link regularly (almost everyday)

Section

Goal

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- know about fundamental principles of discrete-event simulation.
- build models for systems to be simulated.
- understand queueing theory (models).
- be able to identify suitable performance metrics of a given system.
- design and implement simple discrete event simulation programs.
- work with well-known, open source, OMNeT++ and NS-2.
- be familiar with basic statistical questions.
- be aware of common pitfalls.

Section

Non-Goals

Non-Goals

- Experimental approaches.
- Complete course in statistics.
- Programming course
- Computer networking
  - This course is not about the simulation of computer networks, but they will often server as examples.