CS 6210: Performance Evaluation of Computer Systems

Jan.-May Semester 2025
'H' Slot; SSB 134
Slots are: Mon (2 – 3.15pm); Tue (3.30 – 4.45pm); Thu (5.00pm – 5.50pm);
Thu. slot will be used for the Tutorial session and any missed lectures.
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Updated on January 21, 2025

Note: Course related communications will be on IITM Moodle site (CS6210); please regularly check the email that is linked to your email account.

1 Course objectives

The objective of this course to understand the fundamental concepts of computer system performance evaluation. This will include introduction to mathematical modeling techniques, discrete event simulation modeling, experiment design, workload characterization, measurement of performance metrics, and presentation of results.

2 Learning Outcomes

- To apply mathematical modeling methods based on queuing theory, Markov Chains, and similar techniques to model the behaviour of Computer Systems.
- To apply discrete-event simulation methods to model the behaviour of Computer Systems, with the help of suitable DES packages and tools.
- To use these models to study the performance of such computer systems.
- To design workloads and experiments for performance studies.
- To learn techniques for identifying significant factors or parameters that affect the performance of computer systems.
- To learn techniques to statistically compare the performance of different systems based on varying algorithms and system parameters.

3 Course prerequisite(s)

CS2700, CS2710, MA2040 – or equivalent for each course.

4 Classroom Mode

Traditional Lectures, with one 50-minute tutorial slot per week. Tutorial problems have to be solved in class and will be graded for credit.

5 Textbooks

RJ Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling", Wiley-Interscience, 1991.

KT K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", Wiley, 2001/2003. (An earlier edition of this book was published by Prentice Hall in 1982.)

6 Reference Books

Material from the following books will be used as necessary.

ROS Sheldon Ross, "Probability Models for Computer Science", ISBN-10: 0125980515, Academic Press, 2001.

CAD Liliana Blanco Castaneda, Viswanathan Arunachalam, Selvamuthu Dharmaraja, "Introduction to Probability and Stochastic Processes with Applications", ISBN: 978-1-1182-9440-6, Wiley-India, June 2012.

BGMT Gunter Belch, Stefan Greiner, Hermann de Meer, and Kishor S. Trivedi, "Queueing Networks and Markov Chains", Wiley, 1998.

QSP E.D. Lazowska, J. Zahorjan, G.S. Graham and K.C. Sevcik, "Quantitative System Performance", Prentice-Hall, 1984. (PDF available from: `www.cs.washington.edu/homes/lazowska/qsp/`)

LK1 L. Kleinrock, "Queueing Systems, Vol. 1: Theory", Wiley 1975.

LK2 L. Kleinrock, "Queueing Systems, Vol. 2: Applications", Wiley 1976.

LK3 Leonard Kleinrock and Richard Gail, "Queueing Systems: Problems and Solutions", Wiley-Interscience, 1996.

PJH Peter J. Haas, Stochastic Petri Nets: Modelling, Stability, Simulation, Springer, 2010, ISBN-13: 978-1441930019.

RJCourse , CSE 567-13-01A Course Overview, `https://www.youtube.com/watch?v=QsenPyqCuGQ`, 2013.

7 Course Requirements

You are *required* to attend all the lectures. If you miss any of them it is your responsibility to find out what went on during the classes and to collect any materials that may be handed out.

Class participation is strongly encouraged to demonstrate an appropriate level of understanding of the material being discussed in the class. Regular feedback from the class regarding the lectures will be very much appreciated.

8 Planned Syllabus

The following topics will be covered, but not necessarily in the order listed below:

1. Introduction, Design for performance
2. Probability, Random Variables and Stochastic Processes review
3. Markov Chains
4. Queueing theory: single server [RJ] Ch. 30, 31
5. Simulation [RJ] Ch. 24, 25, 29
6. Queueing theory: network of servers [RJ] Ch. 32
7. Mean Value Analysis [RJ] Ch. 33, 34
8. Convolution Algorithm and Hierarchical Decomposition [RJ] Ch. 35, 36
9. Data presentation, Comparing Systems, Experiment design [RJ]
10. Stochastic Petri Nets (Time permitting)
11. Case studies and applications, as appropriate

9 Tentative Grading Policy

The following allocation of points is tentative. These may change during the semester.

Quiz 1 (Date: Feb. 24, 2025):	15%
Quiz 2 (Date: Mar. 24, 2025):	15%
In-class Tutorials:	15%
2–3 Prog. Assignments (in C/C++):	15%
Final Exam (Sat., May 10, 2025, 2pm – 5pm):	40%

10 Academic Honesty

Academic honesty is expected from each student participating in the course. NO sharing (willing, unwilling, knowing, unknowing) of assignment code between students, submission of downloaded code (from the Internet, Campus LAN, or anywhere else) is allowed.

Academic violations will be handled by IITM Senate Discipline and Welfare Committee (DWC). Typically, the first violation instance will result in ZERO marks for the corresponding component of the Course Grade and a drop of one- penalty in overall course grade. The second instance of code copying will result in a 'U' Course Grade and/or other penalties. The DWC can also impose additional penalties.

Please protect your Moodle account password. Do not share it with ANYONE. Do not share your academic disk drive space on the Campus LAN.