

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
Department of Computing and Mathematics
COURSE OUTLINE FOR

Course No.: MSE655
Cr Hrs: 3

Title: Performance Analysis of Real-Time Systems

Lecture Hours: 3

Laboratory Hours: 0

COURSE DESCRIPTION:

The objective of this course is to teach principles of performance analysis of real-time systems on the design and implementation levels. Performance modeling and analysis techniques are described and illustrated by examples and practical exercises. Principles and practices of software development to achieve required or optimal performance, including design analysis and assessment of the implementation, are addressed. An actual project in instrumentation of software for performance evaluation is an essential element of this course

GOALS:

This course provides students with a practical knowledge and understanding of performance analysis and the evaluation of real-time software. Students are exposed to the most important concepts of real-time performance, including program instrumentation, timing analysis, benchmarks, rate-monotonic analysis, modeling and simulation techniques. Students learn how to use modern engineering tools supporting performance evaluation.

PERFORMANCE OBJECTIVES:

Upon completion of this course, students should be able to:

1. describe the essential concepts of computer performance analysis and evaluation;
2. discuss the major problems in analyzing performance of real-time applications;
3. determine the major criteria to assess the quality of a real-time system;
4. propose and select a method, techniques, and tools to solve a particular performance analysis problem;
5. demonstrate a selected method to evaluate the design or implementation of a real-time system;
6. Apply modern software tools and environments for performance evaluation of real-time systems.

Department of Computing and Mathematics
COURSE OUTLINE FOR MSE655, Continued

TEXTBOOK:

Jain, Raj, *The Art of Computer Systems Performance Analysis*, John Wiley, 1991.

SUGGESTED SUPPLEMENTAL MATERIALS:

- a. *Software Design Methods for Concurrent and Real-Time Systems*, by Hassan Gomma, Addison Wesley, Reading, MA, 1993 ISBN 0-201-52577
- b. *POSIX.4: Programming for the Real World*, by Bill O. Gallmeister, O'Reilly & Associates, Sebastopol, CA, 1995 ISBN 1-56592-074-0
- c. *Capacity Planning and Performance Modeling*, by Daniel A. Menasce, V. Almeida, and L. Dowdy, Prentice Hall, Englewood Cliffs, NJ, 1994 ISBN 0-13-035494-5
- d. *The Practical Performance Analyst*, by Neil J. Gunther, McGraw Hill, New York, NY, 1998 ISBN 0-07-912946-3
- e. *P.S. to Operating Systems*, by Larry Dowdy and Craig Lowery, Prentice Hall, Englewood Cliffs, NJ, 1993, ISBN 0-13-011685-8
- f. *Performance Modeling with Deterministic and Stochastic Petri Nets*, by Christoph Lindemann John Wiley and Sons, Chichester, 1998 ISBN 0-471-97646-6
- g. any reasonable book on statistics

PREREQUISITE KNOWLEDGE AND TOPICS:

1. Knowledge of the probability theory and mathematical statistics.
2. Familiarity with computer systems operations.
3. Proficiency in a high level language programming.
4. Familiarity with the computer system concepts and the software engineering lifecycle.

TOPIC	CLASS HOURS	COURSE OBJECTIVES
1. Overview of Computer Performance Analysis	3	Describe the essential concepts of computer performance analysis and evaluation. Discuss the major problems in analyzing performance of real-time applications. Determine the major criteria to assess the quality of a real-time system.
2. Probability Theory and Statistics Refresher	6	Describe the essential concepts of computer performance analysis and evaluation. Discuss the major problems in analyzing performance of real-time applications.

3. RTOS Performance Issues	3	Determine the major criteria to assess the quality of a real-time system. Demonstrate a selected method to evaluate the design or implementation of a real-time system.
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TOPIC (cont.)	CLASS HOURS	COURSE OBJECTIVES (cont.)
4. Measurement Techniques and Tools (Workloads, monitors, capacity, data presentation)	9	Discuss the major problems in analyzing performance of real-time applications. Determine the major criteria to assess the quality of a real-time system. Propose and select a method, techniques, and tools to solve a particular performance analysis problem.
5. Experimental Design and Analysis	9	Propose and select a method, techniques, and tools to solve a particular performance analysis problem. Apply modern software tools and environments for performance evaluation of real-time systems.
6. Queing Models for Performance Analysis	9	Propose and select a method, techniques, and tools to solve a particular performance analysis problem. Demonstrate a selected method to evaluate the design or implementation of a real-time system.
7. Simulation for Performance Analysis	3	Propose and select a method, techniques, and tools to solve a particular performance analysis problem. Demonstrate a selected method to evaluate the design or implementation of a real-time system.
8. Rate-Monotonic Analysis of Concurrent Systems	3	Determine the major criteria to assess the quality of a real-time system. Apply modern software tools and environments for performance evaluation of real-time systems.

LABORATORY AND COMPUTER USAGE:

The access to Internet for class material and research. Access to RTOS platforms for timing analysis. Access to Performance Analysis Tools. Access to spreadsheet tools for statistical analysis of data

GRADING SYSTEM:

The final evaluation will be based on four components:

- PROJECT - system performance analysis project (individual or team), assigned in 5-6th week of class, to be delivered in a form of formal performance analysis report (additionally an executive summary of project and main results in a form of an HTML file) and presented at the end of term (30%)

- TESTS - tests, including set of problems and questions from the material discussed in class and available in your text and additional readings (open books) administered about the last week of term, not interfering with the project presentations (30%)
- RESEARCH - individual research paper with class presentation (15-25 pages, about 2,000 words, in word processing or HTML format, both hard and soft copy required) discussing selected issues of system performance analysis focused on real time system performance and related to the class material; the paper shall be based on compilation of few literature positions, not limited to the reading list to be distributed in class - this may be only a starting point (25%)
- CLASS - class attendance, initiative, class discussions in the Q&A period, pop-up short quizzes on the mathematics of the performance analysis - open books (15%)

ESTIMATED CONTENT:

Skills: 25 %
Content: 75 %