

CSC475 Distributed and Cloud Computing
4 cr.
Pre- or Co-requisite: CSC280

Instructor: TBA

Office: location

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Office Hours: days and times

Section	Time	Room	Final Exam
nn	Days and times	location	Date and time

Catalog description:

This course introduces the design principles, system architectures and innovative applications of parallel, distributed, and cloud computing systems. It aims to acquaint students with supercomputers, distributed and cloud computing systems for high-performance computing, research, e-commerce, social networking, and web-scale Internet applications. Topics include clustering, virtualization, cloud platform architecture, service-oriented architecture, cloud programming, security in distributed and cloud computing, and the Internet of Things. Software development platforms and tools from several leading distributed and cloud computing vendors are used to gain hands-on experiences. Three lecture hours and three hours of scheduled laboratory per week, plus programming work outside of class.

Prerequisite: CSC 381 or CSC 280.
Goals:

The goals of this course are:

- CG01: To introduce students to the main concepts and techniques of distributed and cloud systems.
- CG02: To foster an understanding of the fundamental issues among various parallel, distributed and cloud applications.
- CG03: To provide information in sufficient depth to allow students to evaluate existing distributed and cloud systems or design new ones.

Objectives:

Upon successful completion of this course a student will have:

- CO01: mastered terminology and basic concepts of general characteristics of parallel, distributed and cloud systems
- CO02: extended his/her previously-learned basic knowledge in the subject areas of Object-Oriented Programming, Operating Systems and elementary Computer Architecture into those aspects of computer networks relevant to distributed and cloud computing systems.
- CO03: gained hands-on experience in development of distributed algorithms, security and interfaces.
- CO04: chosen a course project in one of the subfields of distributed and cloud computing system design, read and synopsised journal/magazine articles in the selected subfield, achieved the proposed learning goals of the project, and given a formal presentation of the completed projects

Program Outcome vs. Course Objectives matrix

Program Outcome (condensed form)	CO01	CO02	CO03	CO04
PO-A: apply knowledge of computing and math	✓	✓	✓	✓
PO-B: analyze a problem and define its computing requirements		✓	✓	✓
PO-C: design, implement and evaluate applications		✓	✓	✓
PO-D: function effectively in teams to accomplish a common goal				✓
PO-E: professional, ethical, and social responsibilities		✓		✓
PO-F: communicate effectively with a range of audiences				✓

Program Outcome (condensed form)	CO01	CO02	CO03	CO04
PO-G: local and global impact of computing on people and society				✓
PO-H: need for continuing professional development			✓	✓
PO-I: use current techniques, skills, and tools	✓	✓	✓	✓
PO-J: apply theory and principles to model and design systems		✓	✓	✓
PO-K: apply design and development principles in constructing software		✓	✓	✓

Topics:

Systems Modeling, Clustering, and Virtualization

- Distributed System Models and Enabling Technologies
 - Scalable Computing over the Internet
 - Technologies for Network-Based Systems
 - System Models for Distributed and Cloud Computing
 - Software Environments for Distributed Systems and Clouds
 - Performance, Security, and Energy Efficiency
- Computer Clusters for Scalable Parallel Computing
 - Clustering for Massive Parallelism
 - Computer Clusters and MPP Architectures
 - Design Principles of Computer Clusters
 - Cluster Job and Resource Management
- Virtual Machines and Virtualization of Clusters and Data Centers
 - Implementation Levels of Virtualization
 - Virtualization Structures/Tools and Mechanisms
 - Virtualization of CPU, Memory, and I/O Devices
 - Virtual Clusters and Resource Management
 - Virtualization for Data-Center automation

Computing Clouds, Service-Oriented Architecture, and Programming

- Cloud Platform Architecture over Virtualized Data Centers
 - Cloud Computing and Service Models
 - Data-Center Design and Interconnection Networks
 - Architectural Design of Compute and Storage Clouds
 - Public Cloud Platforms: GAE, AWS, and Azure
 - Inter-cloud Resource Management
 - Cloud Security and Trust Management
- Service-Oriented Architectures for Distributed Computing
 - Services and Service-Oriented Architecture
 - Message-Oriented Middleware
 - Portal and Science Gateways
 - Discovery, Registries, Metadata, and Databases
 - Workflow in Service-Oriented Architectures
- Cloud Programming and Software Environments
 - Features of Cloud and Grid Platforms
 - Parallel and Distributed Programming Paradigms
 - Programming Support of Google App Engine
 - Programming on Amazon AWS and Microsoft Azure
 - Emerging Cloud Software Environments

Grids, P2P, and The Future Internet

- Grid Computing Systems and Resource Management
 - Grid Architecture and Service Modeling
 - Grid Projects and Grid Systems Built
 - Grid Resource Management and Brokering
 - Software and Middleware for Grid Computing
 - Grid Application Trends and Security Measures
- Peer-to-Peer Computing and Overlay Networks
 - Peer-to-Peer Computing Systems
 - P2P Overlay Networks and Properties
 - Routing, Proximity, and Fault Tolerance
 - Trust, Reputation, and Security Management
 - P2P File Sharing and Copyright Protection
- Ubiquitous Clouds and the Internet of Things
 - Cloud Trends in Supporting Ubiquitous Computing
 - Performance of Distributed Systems and the Cloud
 - Enabling Technologies for the Internet of Things
 - Innovative Applications of the Internet of Things
 - Online Social and Professional Networking

Course Requirements:

- Examinations:
There will be a midterm examination and a final examination, counting 20% and 25%, respectively.
- Homework Assignments:
There will be a set of homework assignments given by the instructor.
- Lab Exercises:
There will be in-lab assignments given during the three hours of scheduled laboratory per week by the instructor.
- Programming Projects:
There will be a set of programming assignments given by the instructor. Students are responsible for completing these assignments outside class.
- Course Project:
There will be a single course project given by the instructor. The detailed requirements will be given early in the semester so that students can start planning early. The project may take a number of different formats defined by either the instructor or initiated by a student with the approval of the instructor.

Grading:

Homework Assignments	10%
Programming Projects	15%
Lab Exercises	15%
Course Project	15%
Midterm Examination	20%
Final Examination	25%

Course objectives will be assessed as specified by the following table:

	Homework Assignments	Programming Projects	Lab Exercises	Course Project	Midterm Examination	Final Examination
CO01	✓				✓	✓
CO02	✓	✓	✓	✓	✓	✓
CO03		✓	✓	✓		

	Homework Assignments	Programming Projects	Lab Exercises	Course Project	Midterm Examination	Final Examination
CO04				✓		

Bibliography:

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John Wiley, 2004 ISBN 0-471-45324-2

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Cambridge University Press, 1994 ISBN 0 521 47069 2

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Prentice Hall, 1995 (Second edition 1998) ISBN 0-13-437625-0

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Third edition, McGraw Hill, 2004 ISBN 0-07-251584-8

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Prentice Hall PTR, 1993

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Addison Wesley, 2003 ISBN 0 321 11789 1

Academic Integrity Statement:

“Salem State University assumes that all students come to the University with serious educational intent and expects them to be mature, responsible individuals who will exhibit high standards of honesty and personal conduct in their academic life. All forms of academic dishonesty are considered to be serious offences against the University community. The University will apply sanctions when student conduct interferes with the University primary responsibility of ensuring its educational objectives.” Consult the University catalog for further details on Academic Integrity Regulations and, in particular, the University definition of academic dishonesty.

Academic Integrity Policy and Regulations can be found in the College Catalog and on the College's website (http://catalog.salemstate.edu/content.php?catoid=13&navoid=1295#Academic_Integrity). The formal regulations are extensive and detailed - familiarize yourself with them if you have not previously done so. A concise summary of and direct quote from the regulations: "Materials (written or otherwise) submitted to fulfill academic requirements must represent a student's own efforts". *Submission of other's work as one's own without proper attribution is in direct violation of the College's Policy and will be dealt with according to the College's formal Procedures. Copying without attribution is considered cheating in an academic environment - simply put, **do not do it!***

Equal Access Statement:

"Salem State University is committed to providing equal access to the educational experience for all students in compliance with Section 504 of The Rehabilitation Act and The Americans with Disabilities Act and to providing all reasonable academic accommodations, aids and adjustments. **Any student who has a documented disability requiring an accommodation, aid or adjustment should speak with the instructor immediately.** Students with Disabilities who have not previously done so should provide documentation to and schedule an appointment with the Office for Students with Disabilities and obtain appropriate services."

University-Declared Critical Emergency Statement:

In the event of a university-declared emergency, Salem State University reserves the right to alter this course plan. Students should refer to www.salemstate.edu for further information and updates. The course attendance policy stays in effect until there is a university-declared critical emergency.

In the event of an emergency, please refer to the alternative educational plans for this course, which will be distributed via standing class communication protocols. Students should review the plans and act accordingly. Any required material that may be necessary will have been previously distributed to students electronically or will be made available as needed via email and/or Internet access.

Note: This syllabus represents the intended structure of the course for the semester. If changes are necessary, students will be notified in writing and via all regular class communication mechanisms – email and the class website.