



CSYE 7374 Special Topics in Computer Systems Engineering Software Quality Assurance, Verification, and Validation Course Syllabus

Course Information

Course Title: Software Quality Assurance, Verification, and Validation

Course Number (CRN): TBD

Term and Year: Spring 2024

Credit Hours: 4.0

Course Format: In Classroom.

Meeting times: Thursdays, noon to 3:00 PM.

Instructor Information:

Name: Omar Badreddin

NEU Email Address: o.badreddin@northeastern.edu

Office Hours: Friday (in person) 3:00 PM to 4:00 PM, Wednesday (virtual) 4:30 PM to 5:30 PM,

Teaching Assistant:

Name: TBD

NEU Email: TBD

Prerequisites: INFO 5100.

For advising questions please contact: coe-toronto-gradadvising@northeastern.edu

Course Description:

This course covers the principles and processes of validation, verification, and integration for software, and software-intensive systems, including cyber-physical systems. The topics include test automation, testing metrics, test coverage, integration testing, state space exploration for cyber physical systems, software assurance, and software reliability. Students in this course will learn the principles, tools, applications, and processes that efficiently integrate software elements to meet customer requirements and needs. The course includes individual assignments and group project.

Course Learning Outcomes

LO 1) Understand current limitations in software testing.

LO 2) Apply software test automation techniques and tools to automate the processes of test execution.

LO 3) Assess test coverage using testing metrics such as line coverage, graph coverage, node and edge coverage, logic-based coverage, and input space coverage.

- LO 4) Apply the category partitioning method to systematically automate the process of generating test data and test cases.
- LO 5) Understand various integration testing techniques, including bottom-up, top-down, big bang, and sandwich integration testing techniques.
- LO 6) Use appropriate tools to develop mock objects to facilitate integration testing.
- LO 7) Understand basic state space exploration testing approach.
- LO 8) Develop metrics and use tools to assess an application performance characteristic.

Course Outline:

This course is organized into three largely independent parts. Part I provides some background and motivation for the course topics. We also review unit testing in this part. Part II focuses on testing metrics and coverage criteria. In this part, we learn how to measure how much of testing we have covered. This part introduces several different testing metrics. Part III shifts focus to practical considerations in testing.

Topic		Description	Readings
Part 1 – Overview and Background			
A	Why Do We Test Software?	What is automated verification and validation, when is it feasible (and not feasible)? Types of testing, and the impact on tools.	Chapter 1
B	Test Automation	Software testability, Test Automation Framework, Junit, Beyond Automation.	Lecture Notes
Part 2 – Coverage Criteria			
C	Graph Coverage	Graph Coverage criteria, graph coverage for source code, graph coverage for specifications, graph coverage for use cases.	Chapter 2
D	Logic Coverage	Overview of predicates and clauses, logic expressions coverage criteria, specification-based logic coverage.	Chapter 3
E	Input Space Partitioning	Input domain modeling, combination strategies criteria, handling constraints among criteria.	Chapter 4
F	Syntax Based Testing	Syntax based coverage criteria, Program based grammars, Input Space Grammars.	Chapter 5.1 and 5.5
Part 3 – Applying Criteria in Practice			
G	Integration Testing	Introduction to Integration Testing, System Integration, Top-Down Integration, Bottom-Up Integration, Sandwich Integration, Big Bang Integration, Mock Objects, Automated Mock Object Generation, Factory Design Pattern.	Chapter 6.1 and 6.2
H	State Space Exploration & Model Checking	State space exploration, deadlocks, exploration algorithm, Temporal Logic Model Checking, Linear Time Logic, State Explosion Problem,	Lecture notes

		Model Checking Systems, Promela language.	
I	Database testing, Web Integration and Performance Testing	Data Base Management Systems, Relational database, Database connections. Testing web-based applications, testing the client, HTTP Commands, Testing Application Server, Cactus testing tool, performance testing, JMeter	Chapter 7
J	Putting Testing First	Continuous integration, testing in agile projects, testing legacy systems.	Lecture notes
K	Selected Topics	Selected topics in technology specific testing tools and methodologies.	Chapter 7

Policy on late work: late submissions of course work will not be graded or considered without a documented and approved excuse.

Grade Breakdown*:

Assignments (~7, best of 6)	25%
Labs and Project	30%
Midterm	15%
Final Exam (comprehensive)	30%

* Subject to change.

Grading: Graduate Programs Final Grading Scale

95-100%	A	87-89.9%	B+	77-79.9%	C+	69.9% or below	F
		84-86.9%	B	74-76.9%	C		
90-94.9%	A-	80-83.9%	B-	70-73.9%	C-		

Academic Integrity:

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to <http://www.northeastern.edu/osccr/academic-integrity-policy/> to access the full academic integrity policy.

CPS expects independent and original work. Dishonesty and/or carelessness violates fundamental values of an intellectual and professional community and will be reported to the Office of Student Conduct and Conflict

Resolution (OSCCR) as a violation of the Academic Integrity Policy. To safeguard the integrity of assignments and programs, your course may use systems such as TurnItIn, which checks written work, and Examity, an online exam proctoring system. Work that contains academic integrity violations (AIV) will be graded on a case by case basis. Work displaying AIV may earn a failing grade, a zero, or even result in the instructor assigning the student a failing grade for the class. Students may not withdraw from a class to avoid the grade penalty for serious academic integrity violations.

For additional information or for answers to frequently asked questions, please visit:

<https://cps.northeastern.edu/academic-resources/academic-integrity>

You may also email CPS-AcademicIntegrity@northeastern.edu.

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Student Well-Being:

All students have access to We Care – 617-373-7591 wecare@northeastern.edu for health concerns, referrals for mental health and assistance with leaves of absence. Additionally we have FIND@ Northeastern - Available 24/7/365 1-877-233-9477 (domestic) 1-781-457-7777 (international) <https://www.northeastern.edu/uhrs/find-at-northeastern/>

Library Services:

The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals. For more information, visit <http://library.northeastern.edu/>.

Wyzant Tutoring Services:

Northeastern University's College of Professional Studies is covering the cost of twenty-five hours per academic year of tutoring from Wyzant to help ensure your success in challenging courses. Tutors on Wyzant have helped thousands of students in 300+ subjects ranging from College Algebra to Academic Writing, Statistical Analysis to Microbiology. To access your free Wyzant Tutoring for students in the College of Professional Studies, please complete the following steps:

- Login to Northeastern University's **Canvas** platform and click on your active course.
- Once you are logged in your class, scroll to the bottom red link on the left side of the course navigation that says "Wyzant Tutoring".

- After clicking this link, you will be prompted to access your free tutoring using your Northeastern login credentials. Indicate your program, time zone, the course you'd like support in, and the specific topics or materials you'd like help with.
- You'll receive an activation email from Wyzant for Higher Ed. (If you don't see it, check your spam or junk folders.) From the email, click on the activation button.
- Potential tutors will begin reaching out to you. Their messages will be sent to your Northeastern email inbox and will be accessible via your Wyzant account dashboard.
- Respond back to the tutors you believe might be a good fit to schedule an online session when it's convenient for you — even late at night!

Technical Help:

For immediate technical support for Canvas, call 1-833-450-3937. You can chat and report an issue to Canvas technical support right from within Canvas through the Help icon located in the Canvas global navigation.

myNortheastern, e-mail, and basic technical support

Visit the [Information Technology Services \(ITS\) Support Portal](#)

Email: help@northeastern.edu

ITS Customer Service Desk: 617-373-4357 (help)

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If you or someone you know has experienced a Prohibited Offense, **confidential** support and guidance can be found through (<https://www.northeastern.edu/ouec/resources/main-campus-resources/>), **University Health and Counseling Services (UHCS)** staff (<http://www.northeastern.edu/uhrs/>) and the **Center for Spiritual Dialogue and Service (CSDS) clergy members** (<http://www.northeastern.edu/spirituallife/>). Employees within

the VRC, UHCS, and CSDS are not required to report allegations of Prohibited Offenses to the Office for University Equity and Compliance.

In case of an emergency, please call 911 OR NUPD'S Emergencyline: 617-373-3333.

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