

DTSC 5565/ DTSC 4565

**SOFTWARE ENGINEERING FOR DATA
SCIENTISTS**

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COURSE INFORMATION

- **DTSC 5565/DTSC 4565:** 3 Credit Hours
- **Title:** Software Engineering for Data Scientists
- **Course schedule:** See Table 1
- **Face-to-face classes:**
 - **Time:** Thursday 10:00 AM to 12:50 PM (CT)
 - **Location:** Room number - NTDP B185

Instructor Contact Information

- **Dr. Sharad Sharma**, Professor, Department of Information Science, College of Information, University of North Texas.
- **Office:** E292C
- **Phone:** 940 565-2605
- **Email address:** sharad.sharma@unt.edu
- **Office hours (Dr. Sharma):**
 - Thursday 12:50 PM - 2:30 PM or Other Times by Appointment
 - Office: E292C
- **TA (Teaching Assistant):**
 1. Mr. Alwin Prabhu (alwinprabu@my.unt.edu)
 2. TBD
- **Course Website:** <https://ssharma.ci.unt.edu/dtsc5565-fall2024>

Communicating with Your Instructor

This course will have a website in UNT Canvas (<https://unt.instructure.com/login/canvas>) for online discussion, assignment submissions, and sharing of reading materials. Students are welcome to make an appointment with the instructor and/or the teaching assistant (TA) to discuss course-related questions. If you need to schedule an individual meeting with the instructor or the TA, please send her/him an email via the course website in Canvas Course Messages. We will also use a discussion forum in Canvas where you can ask questions and get answers from the instructor, TA, and other students.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

- **Pre-requisite:** DTSC 5501 or DTSC 3020
- Students are recommended to prepare their own laptops. If anyone does not have a laptop, she/he can borrow one from UNT library (<https://library.unt.edu/services/laptop-checkout/>).

Course Format

DTSC 5565/ DTSC 4565 will hold face-to-face lectures by the instructor. This will be supplemented by lecture demonstrations for Junit testing. The course uses Canvas, UNT's learning management system. ALL course materials will be available at the course site on Canvas that is accessible to all students. Students will submit all assignments through the tools available on Canvas. Attending classes is mandatory.

Course Description

This course introduces the student to major topics in software engineering for data scientists such as: requirements specification, analysis and design, testing, project management, and implementation. Additional topics such as software life cycle models, the Unified Modeling Language (UML), agile software development techniques, configuration management, change control and version control tools, object oriented design, and project documentation will be discussed.

Learning Outcomes

1. Illustrate proficiency in developing and producing software process artifacts, most importantly the code and user documentation.
2. Describe the software life cycle, roles, artifacts, and activities.
3. Demonstrate and acquire skills that help you work effectively as a member of a software development team.
4. Identify and understand the concepts of software "best practices" and when they apply.
5. Demonstrate that you are able to adapt a process to your needs and select an appropriate set of best practices that will guide you in completing a software development project.

Materials

Textbook information (required):

- Somerville, Ian, Addison-Wesley Software Engineering 10th Edition, Massachusetts: Addison Wesley, ISBN:0133943038, ISBN-13:9780133943030

Supplementary materials and/or readings (recommended):

- Bruegge, B., and Dutoit, A. H. (2004). Object-Oriented Software Engineering: Using UML, Patterns and Java, Second Edition, Prentice Hall, ISBN 0-13-0471100
- Braude, Eric J. (2001). Software Engineering an Object-Oriented Perspective, John Wiley & Sons, Inc., ISBN 0-471-32208-3

Teaching Philosophy

The instructor will take a problem-solving approach and work with students to challenge software engineering problems focused on data science. Learning by doing is another teaching philosophy in this course. Students are expected to study 10-15 hours per week and submit their projects and assignments on time to achieve satisfactory class performance. Interactions with the instructor and TA are strongly encouraged.

TECHNICAL REQUIREMENTS/ASSISTANCE

UIT Help Desk: <http://www.unt.edu/helpdesk/index.htm>

The University of North Texas provides student technical support in the use of Canvas and supported resources. The student help desk may be reached at:

Email: helpdesk@unt.edu

Phone: 940.565-2324

In Person: Sage Hall, Room 330

Hours are:

- Monday-Thursday 8am-midnight
- Friday 8am-8pm
- Saturday 9am-5pm
- Sunday 8am-midnight
- Canvas technical requirements: <https://clear.unt.edu/supported-technologies/canvas/requirements>

Minimum Technical Skills Needed

Using the Internet and the learning management system Canvas, using email with attachments, creating and submitting files in commonly used word processing program formats, downloading and installing software are necessary. Students will be taught how to use vizard toolkit that uses python programming.

Student Academic Support Services

- Code of Student Conduct: provides Code of Student Conduct along with other useful links
- Office of Disability Access: exists to prevent discrimination based on disability and to help students reach a higher level of independence
- Counseling and Testing Services: provides counseling services to the UNT community, as well as testing services; such as admissions testing, computer-based testing, career testing, and other tests
- UNT Libraries
- UNT Learning Center: provides a variety of services, including tutoring, to enhance the student academic experience
- UNT Writing Center: offers free writing tutoring to all UNT students, undergraduate and graduate, including online tutoring
- Succeed at UNT: information regarding how to be a successful student at UNT

ASSESSMENT & GRADING

Assessments

A student's grade is composed of the following:

- | | |
|--------------------|-----|
| 1. Two Assignments | 20% |
| 2. Quizzes (2) | 10% |
| 3. Mid-Term Exam | 20% |
| 4. Final Exam | 20% |
| 5. Final Project | 30% |

Grading

Midterm Exam and Final Exam (40%). Exams are given in the class room during class time. Exams are closed notes, closed book, open mind. There will be no make-ups for Mid-Term Exam and Final Exam.

Assignments (20%). The class will have **two assignments**. These assignments are designed to help students understand important concepts and gain hands-on experience in Agile software development, Software processes, UML Modeling & Object Oriented Design. First assignment will be focused on software development life cycle, agile software development, and UML Modeling. Second assignment will be focus on Junit testing. Assignments will be due at 11:59 pm on the due date. If students have any questions, they could ask the instructor for help.

Final Project (30%)

A major part of this course is the **group project**. The purpose of the course project is to provide the students with the knowledge of software engineering methodology for data scientists and the skills to apply it. The project consists of **two iterations**, both focused around the *same* software product. The first iteration is *exploratory* and represents the first attempt at developing the proposed software product. The second *iteration* is development and also includes revision of the project goals. The deliverables for the **first and second iteration** are reports and demos. The project report guidelines will be provided to the students and it will be based on Requirements Analysis Document (RAD). The first report iteration should include at least Customer Statement of Requirements, Functional & Non-functional Requirements Specification, System Sequence Diagrams, Domain Analysis and Domain Model, User Interface Design, Class Diagram and Interface Specification. The second report iteration should be a continuation of report 1 and include Domain Analysis, Interaction Diagrams, Class Diagram and Interface Specification (revised if required), System Architecture and System Design, Algorithms and Data Structures, User Interface Design and Implementation, Conclusions and Future Work, References.

The goal of the project is developing software. Key components that the project must include are:

1. Data Input
 - a. Mechanism of input, manual or read a dataset from a file, or from a web site
2. Archiving
 - a. Examples include: SQL database (e.g., MySQL), flat file, or an online data storage (search the Web)
3. Analysis
 - a. Such as data search (discovering specific services/products among those available), sorting, regression analysis, other statistical analysis, etc. (Explain what kind of data processing/analysis you will do?)
4. Display
 - a. Visualization of the analysis results using graphs and charts
5. Unique Capability
 - a. Security, privacy, data encryption, Algorithm implementation, data mining, predicting, etc.

The project will also include submitting a *1-page product brochure*. The project grade for each group member may be modified by taking into account a member's contribution to the project.

Projects, Mid-term and Final exams are mandatory.

Total Points Possible for Semester/Grading Scale = 100

| | |
|-------------------|-------------|
| 1000-900 = A | 899-800 = B |
| 799-700 = C | 699-600 = D |
| 599 and below = F | |

Grading Table

| Assignment | Points Possible | Percentage of Final Grade |
|------------------------------------|------------------------|----------------------------------|
| Assignment 1: | 100 points | 10% |
| Assignment 2: Junit testing | 100 points | 10% |
| Quiz 1 | 100 points | 5% |
| Quiz 2 | 100 points | 5% |
| Midterm exam | 100 points | 20% |
| Final Group Project | 100 points | 30% |
| Final Exam: | 100 points | 20% |
| Total Points Possible | 700 points | 100% |

COURSE CALENDAR

The contents of the course are organized into 16 weeks. Please refer to Table 1 for topics, readings materials, and assignments due dates. Assignments will due on **11:59 pm of the day** of the specified week.

Course Topics

Week 1. Introduction: Ethics, ACM/IEEE code of ethics, professional software development.

Week 2. Software processes: Process models, process activities, software design activities, prototyping, RUP

Week 3. Agile software development: Plan-driven and agile development, extreme programming, refactoring, scrum, scaling up and scaling out

Week 4. Requirements engineering: requirement types, functional and non-functional requirements, requirements engineering processes and specification, elicitation and analysis, requirement document and management

Week 5 & 6. System modeling: UML diagram types, aggregation, inheritance, aggregation, composition, multiplicity, composition, generalization, association, context models, interaction models, structural models, behavioral models, model-driven engineering

Week 7. Architectural design: design decisions, abstraction, views, architectural patterns, system quality attribute, and application

Week 8 & 9. Design and Implementation: Object-oriented design using the UML, design patterns, implementation issues, open source development and licensing, object-oriented design process, configuration management

Week 10 & 11. Software testing & Unit Testing: Test types, development testing, test-driven development, release testing, user testing

Week 12 & 13. Software Evolution, Dependability and Security: Evolution processes, program evolution dynamics, software maintenance, reengineering, legacy system management, security, risk management, software management.

Week 15 & Week 16. Object Oriented Design: objects, cohesion, coupling, data encapsulation, abstraction, information hiding, polymorphism, dynamic binding.

Table 1. Study Schedule and Due Dates

| Date | Topics | Chapters | Assignments |
|--------|---|---------------------------------|--|
| 22-Aug | Introduction | Chapter 1 | |
| 29-Aug | Software processes | Chapter 2 | |
| 5-Sep | Agile software development. | Chapter 3 | Assignment 1 |
| 12-Sep | UML Modeling & Object Oriented Design | | Quiz 1 |
| 19-Sep | Requirements engineering. | Chapter 4 | Project Proposal |
| 26-Sep | System modeling | Chapter 5 | |
| 3-Oct | Architectural design | Chapter 6 | |
| 10-Oct | Design and Implementation | Chapter 7 | |
| 17-Oct | Mid Term Exam | | |
| 24-Oct | Software Testing | Chapter 8 | Project Demo 1 & Report 1 |
| 31-Oct | Unit Testing (<u>Lab 1</u>) , (<u>Lab 2</u>) (<u>Lab 3</u>) | Chapter 8 | Quiz 2, Assignment 2 |
| 07-Nov | Software Evolution | Chapter 9 | |
| 14-Nov | Software Management, Safety Engineering | Chapter 12, 22 | Assignment 2 due (Submit on Canvas)-no extension |
| 21-Nov | Thanks Giving Break | No Class | |
| 28-Nov | Security Engineering | Chapter 13 | |
| 05-Dec | Final project presentation | Project Demo 2, Report 2 | |
| 12-Dec | Final Exam | | |

Assignment Related Materials

- To get help:
 - ✓ J Unit Testing: <https://www.vogella.com/tutorials/JUnit/article.html>
 - ✓ J Unit Testing: <https://www.slideshare.net/tom.zimmermann/unit-testing-with-junit>
 - ✓ Assert API: <https://junit.sourceforge.net/javadoc/org/junit/Assert.html>

COURSE EVALUATION

Student Evaluation Administration Dates

Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13, 14 and 15 of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website at <http://spot.unt.edu/> or email spot@unt.edu.

COURSE POLICIES

Assignment Policy

Some of the assignments (Java, Junit) are coding work. Students should write their codes either in Eclipse IDE. Any kind of copy is forbidden. If it is found, this assignment will get 0 points. Students are required to sign an Academic Honesty Statement. The Final project is a group project and should be your group's work.

Instructor Responsibilities and Feedback

- Helping students grow and learn
- Providing clear instructions for assessments
- Answering questions about assignments
- Identifying additional resources as necessary
- Providing grading rubrics
- Reviewing and updating course content
- The instructor and TA will respond to students' emails and questions posted to the discussion boards within two or three days except for the weekends
- Assignments grades and feedbacks will be returned to the students within one week after the submission deadline.

Late Work and Missed Work

Students are expected to submit assignments on time by Canvas. **The due are 11:59 pm of the due date specified in Table 1.** If an extenuating circumstance such as a medically diagnosed illness or family emergency arises, which prevents you from submitting your assignments, you should contact the instructor as soon as possible before the due date. Late assignments will not be accepted in this course. All work turned in after the deadline will receive a grade of zero unless the student has a university-excused absence and provides documentation with 48 hours of the missed deadline. A student who is having trouble with assignments is strongly encouraged to contact the instructor and the TA as early as possible for personal advising.

Syllabus Change Policy

The instructor(s) may, at his/her/their discretion, change any part of the course before or during the term, including assignments, grade breakdowns, due dates, and schedule. Such changes will be communicated to students via either email or Canvas announcement.

Course Incomplete Grade

The UNT Graduate Catalog (<http://catalog.unt.edu/index.php?catoid=16>) describes and explains grading policies. A grade of Incomplete (I) will be given only for a justifiable reason and only if the student is passing the course. The student is responsible for meeting with the instructor to request an incomplete and discuss requirements for completing the course. If an incomplete is not removed within the time frame agreed to by instructor and student, the instructor may assign a grade of F.

Withdrawal

The UNT Graduate Catalog (<http://catalog.unt.edu/index.php?catoid=16>) describes and explains withdrawal policies and deadlines. The UNT semester course schedule lists specific deadlines regarding withdrawal. A grade of Withdraw (W) or Withdraw-Failing (WF) will be given depending on a student's attendance record and grade earned. Please note that a student who simply stops attending class and does not file a withdrawal form may receive an F.

Attendance Policy

Students are required to attend all classes and to abide by the attendance policy established for the course. Prior to the meeting, please read pre-assigned chapters for the class and prepare your questions for discussion. Research has shown that students who attend class are more likely to be successful. You should attend every class unless you have a university excused absence such as active military service, a religious holy day, or an official university function as stated in the Student Attendance and Authorized Absences Policy (PDF) (https://policy.unt.edu/sites/default/files/06.039_StudAttnandAuthAbsence.Pub2_19.pdf). If you cannot attend a class due to an emergency, please let me know. Your safety and well-being are important to me.

Face Coverings

UNT encourages everyone to wear a face covering when indoors, regardless of vaccination status, to protect yourself and others from COVID infection, as recommended by current CDC guidelines. Face covering guidelines could change based on community health conditions.

COVID-19 Impact on Attendance

While attendance is expected as outlined above, it is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community. If you are experiencing any symptoms of COVID (<https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.

Students' Responsibility for Their Learning

The students are required to follow course schedule and finish the class work, assignments, and exams. Students are expected to study 10-15 hours per week to achieve satisfactory class performance. Students do not have programming experience are encouraged to find extra materials to study.

UNT POLICIES

Academic Integrity Policy

Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

According to the UNT catalog, the term "cheating" includes, but is not limited to: a. use of any unauthorized assistance in taking quizzes, tests, or examinations; b. dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; c. the acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university; d. dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or e. any other act designed to give a student an unfair advantage. The term "plagiarism" includes, but is not limited to: a. the knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and b. the knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

Americans with Disabilities Act Compliance Statement

UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time; however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website at disability.unt.edu.

Emergency Notification & Procedures

UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Blackboard for contingency plans for covering course materials.

Retention of Student Records

Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course completion. Course work completed via the Canvas online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student's records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational

Rights and Privacy Act (FERPA) laws and the University's policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Acceptable Student Behavior

Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student's conduct violated the Code of Student Conduct. The University's expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. The Code of Student Conduct can be found at deanofstudents.unt.edu/conduct.

Access to Information - Eagle Connect

Students' access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student's Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail: eagleconnect.unt.edu/.

Sexual Assault Prevention

UNT is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and UNT policies prohibit discrimination on the basis of sex, and therefore prohibit sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking, and/or sexual assault, there are campus resources available to provide support and assistance. UNT's Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victim's compensation applications, contacting professors for absences related to an assault, working with housing to facilitate a room change where appropriate, and connecting students to other resources available both on and off campus. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-565- 2648. Additionally, alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at oeo@unt.edu or at (940) 565 2759.

Important Notice for F-1 Students taking Distance Education Courses

Federal Regulation

To read detailed Immigration and Customs Enforcement regulations for F-1 students taking online courses, please go to the Electronic Code of Federal Regulations website at <http://www.ecfr.gov/>. The specific portion concerning distance education courses is located at Title 8 CFR 214.2 Paragraph (f)(6)(i)(G).

The paragraph reads:

(G) For F-1 students enrolled in classes for credit or classroom hours, no more than the equivalent of one class or three credits per session, term, semester, trimester, or quarter may be counted toward the full course of study requirement if the class is taken on-line or through distance education and does not require the student's physical attendance for classes, examination or other purposes integral to completion of the class. An on-line or distance education course is a course that is offered principally through the use of television, audio, or computer transmission including open broadcast, closed circuit,

cable, microwave, or satellite, audio conferencing, or computer conferencing. If the F-1 student's course of study is in a language study program, no on-line or distance education classes may be considered to count toward a student's full course of study requirement.

University of North Texas Compliance

To comply with immigration regulations, an F-1 visa holder within the United States may need to engage in an on-campus experiential component for this course. This component (which must be approved in advance by the instructor) can include activities such as taking an on-campus exam, participating in an on-campus lecture or lab activity, or other on-campus experience integral to the completion of this course.

If such an on-campus activity is required, it is the student's responsibility to do the following:

(1) Submit a written request to the instructor for an on-campus experiential component within one week of the start of the course.

(2) Ensure that the activity on campus takes place and the instructor documents it in writing with a notice sent to the International Student and Scholar Services Office. ISSS has a form available that you may use for this purpose.

Because the decision may have serious immigration consequences, if an F-1 student is unsure about his or her need to participate in an on-campus experiential component for this course, s/he should contact the UNT International Student and Scholar Services Office (telephone 940-565-2195 or email internationaladvising@unt.edu) to get clarification before the one-week deadline.

Student Verification

UNT takes measures to protect the integrity of educational credentials awarded to students enrolled in distance education courses by verifying student identity, protecting student privacy, and notifying students of any special meeting times/locations or additional charges associated with student identity verification in distance education courses.

See [UNT Policy 07-002 Student Identity Verification, Privacy, and Notification and Distance Education Courses](#).

Use of Student Work

A student owns the copyright for all work (e.g. software, photographs, reports, presentations, and email postings) he or she creates within a class and the University is not entitled to use any student work without the student's permission unless all of the following criteria are met:

- The work is used only once.
- The work is not used in its entirety.
- Use of the work does not affect any potential profits from the work.
- The student is not identified.
- The work is identified as student work.

If the use of the work does not meet all of the above criteria, then the University office or department using the work must obtain the student's written permission.