

CSC 105 - Data, Computing, and Quantitative Reasoning Syllabus

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CSC 105: Data, Computing, and Quantitative Reasoning

*(3 credit hours, Lecture)**Fall 2021: Monday/Wednesday/Friday*

<i>Section</i>	<i>Meeting Time</i>		<i>Location</i>
<i>01</i>	<i>1:00 pm</i>	<i>1:50 pm</i>	<i>Sullivan Science Building (SULV) 201</i>

Instructor Information

Name: Bryan (Todd) Dobbs, MS, PhD Candidate

Office Location: Petty Science Building (PETT) 156

Office Phone: None

Email: btdobbs@uncg.edu

Office Hours: M/W/F 10 am - 10:50 am, 12 pm - 12:50 pm

Pronouns: He/Him/His/Himself

UNCG is located on the traditional lands of the Catawba, Keyauwee and Saura. Let us venture to honor them with our work together.

Communication Response

I will respond to emails within 24 hours on Monday through Thursday. I will respond to Emails received Friday through Sunday by the following Monday.

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learning assignments. I believe positive participation fosters success.

Catalog Course Description

Problem-based introduction to quantitative reasoning, including computational methods; formulation of quantitative arguments; algorithmic understanding, selection, and utilization; data modeling, interpretation, and summarization of results, on real world datasets.

Course Description

- Data and Computational Methods: (Week 1-4)
 - Introduction to logic and programming
 - Basics of data-structures
 - What are algorithms
 - How to use algorithms efficiently
 - Merging data with algorithms
 - Reading data from storage
- Mathematical Modeling (Weeks 5-9)
 - Different types of data
 - Basics of describing data (statistical properties)
 - Probability and Sampling
 - Basics of simple distributions
 - Using computational methods to model distributions
- Visualizing data distributions (Week 10-14)
 - Inferencing
 - How to develop a hypothesis
 - Hypothesis testing
 - Understanding p-values and domains of use
 - Confidence intervals
 - Estimating from data
 - Linear versus exponential growth
 - Developing statistical tests

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For Whom Planned

The course is designed for students who have an interest in quantitative reasoning with computing. The course will explore fundamental computing techniques, algorithms, and strategies to infer and reason from data. The course is ideally suited for Freshman or Sophomore level students, but higher level (Junior and Senior) level students can also participate.

Student Learning Outcomes (SLOs)

Upon successful completion of this course students should be able to perform the following activities.

SLO1, Interrelate real-world information with mathematical forms.	<ul style="list-style-type: none"> ● Understand different types of data, storage, programming, and computational techniques. ● Recognize the need for algorithmic efficiency in large datasets.
SLO2, Justify conclusions based on quantitative arguments.	<ul style="list-style-type: none"> ● Apply mathematical / statistical models to data. ● Evaluate and interpret the results of models.
SLO3, Communicate the quantitative evidence of the argument.	<ul style="list-style-type: none"> ● Summarize and explain the results obtained from the analysis.

The formative and summative assessments of the course are as follows:

SLO 1: Interrelate real-world information with mathematical forms.

- Understand different types of data, storage, programming, and computational techniques.

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methods.

- **Data-Programming Assignments:** 2 guided programming assignments. The first will evaluate the student's ability to create identifiers, to create mathematical expressions, to format output, and to use built-in functions. Second, evaluates programming for input – output of data to a program and utilization of a simple data structure.

SLO 2: Justify conclusions based on quantitative arguments.

- Apply mathematical / statistical models to data.
- Evaluate and interpret the results of models.

Formative Assessment:

- **Quizzes:** 2 quizzes to test the recall of students in statistical concepts, such as, understanding the center of data variables (mean, median, mode), hypothesis formulation, testing, and interpretation (p-values), and estimating data.
- **Programming Assignment:** 2 guided programming assignments. First, provide a simple toy dataset to understand the statistical properties. Second, utilizes the same dataset to develop hypothesis tests on it. Students will submit results as code to be evaluated.

Summative Assessment:

- **Team Mini Project:** Mini projects will form teams into groups, where they will be working real-world datasets. There will be 2 mini-project progress presentations. First, students present an exploratory analysis of the data (evaluate statistical properties). Second presentation evaluates hypothesis formulation and testing. Peer-evaluation (on hackathons and project progress) will also be requested to assess individual student, team communication, and overall project performance.

SLO 3: Communicate the quantitative evidence of the argument.

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Summative Assessment:

- **Team Mini Project Presentation:** Evaluation of mini-projects based on final presentation. Students will be evaluated on oral presentation skills, formation of quantitative arguments, and summarization of results.
- **Term paper:** Term paper will evaluate the writing capability of students to present the quantitative observations in their mini projects.
- Both the presentation and paper will have a peer evaluation component.

Teaching Methods

The course is divided into three core sections: 1) Data and Computational Methods, 2) Mathematical Modeling, and 3) Inferencing. The first section will explore the programmatic and computational techniques to deal with large and complex data. Students will learn about programming, data-structures, efficient algorithms, and storage models in order to query, wrangle, and transform datasets. This will help students prepare the dataset for the second section, Mathematical Modeling. In this section, the topics will include description of the data (data types, categories, dimensionality), elementary probability, sampling, statistical properties (mean, variance, standard deviation), growth and decay of the data, and simple distributions. Students will learn how to formulate problems into mathematical functions and explore them in graphical visualizations. This section is geared towards SLO 1.

In the Inferencing section, students will dive deeper by learning about statistical approaches towards gaining insights from data. The topics will include, hypothesis development and testing, understanding and interpreting p-value, statistical tests, and estimation. Students will learn how to formulate mathematical tests for the questions posed to the

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comprehension of the analytical challenge, and development of quantitative methods (exploratory data analytics, mathematical modeling, and statistical tests). The students will present their work on the project in the class. This will enable honing of student's communication skills and their capacity to convey results based on analytical / quantitative approaches (SLO3).

The plan is to start each class with a brief discussion of the student learning outcomes and how they are relevant. Class will continue with individual and group active learning activities on problems that support the discussed learning outcomes. Class will conclude with each student posting their electronic notebook from class activities. It's possible for some active learning activities to span multiple classes if needed. Exams on each module are planned to measure student learning outcomes. This plan may change due to student feedback.

Legal Notice For Zoom And Course Recordings

This course will not be recorded.

Assignments And Assessments For Achieving Learning Outcomes

- Reading assignments, projects, and participation in active learning assignments are considered as practice and appropriately graded as pass/fail.
- Quizzes measure a student's mastery of learning outcomes and are graded by awarding points for each correct answer. Partial credit will be given for positive attempts at a problem.

Evaluation And Grading

Grades are kept up to date on canvas so a student should always know how they are performing.

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Mini Projects	50%
Project Presentations	30%
Term paper	20%

Letter Grade	% Points Accumulated
A	≥ 93.0
A-	90.0-92.9
B+	87.0-89.9
B	83.0-86.9
B-	80.0-82.9
C+	77.0-79.9
C	73.0-76.9
C-	70.0-72.9
D	60.0-69.9
F	<60.0

Required Texts/Readings/References

None required. Lecture notes and supplementary materials will be provided by the instructor for student reference.

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- [Python Tutor](#)
- [Project Jupyter](#)

Math Resources:

- [*Math in Society, David Lippman, Open Source Book](#)
- [American Institute of Mathematics](#)
- [*Introductory Statistics, Douglas Shafer and Zhiyi Zhang, Open source book](#)

Data Resources:

- [Kaggle](#)

Assignment Submission And Format

Assignments, projects and quizzes should be submitted before the end of class. Reading assignments should be completed before each class. Canvas assignments should be submitted in PDF format or notebook download.

Academic Integrity Policy

By submitting an assignment, each student is acknowledging their understanding and commitment to the Academic Integrity Policy on all major work for the course. Refer to the following URL:
<https://osrr.uncg.edu/academic-integrity/>.

Accommodations

The University of North Carolina at Greensboro respects and welcomes students of all backgrounds and abilities. If you feel you will encounter any barriers to full participation in this course due to the impact of a disability, please contact the Office of Accessibility Resources and Services (OARS). The OARS staff can discuss the barriers you are

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Contrapower Statement

As your instructor, I am committed to creating a productive and non-discriminatory learning environment of mutual respect. Title IX and UNCG's school policy prohibit gender-based harassment, sexual harassment, and sex discrimination for all members of the University community. Harassment can come in many forms - both direct and indirect - and can occur in subtle or overt ways. Traditionally, harassment is seen from a formal power-over structure. However, harassment can occur without a formal power structure. Contrapower, when a student harasses an instructor or peer, is a type of behavior that can create an intimidating environment in and outside of the classroom. Either form of harassment can include direct or indirect comments, physical intimidation, emails, anonymous notes, and course evaluations. **Both Contrapower and traditional forms of harassment are prohibited and subject to the same kinds of accountability applied to offenses against protected categories, such as race, national origin, religion, sexual orientation, etc.**

If you experience or witness such instances of harassment, please seek out the following resources:

- UNCG Counseling Center (non-reporting agency/confidential): 336.334.5874
- Murphie Chappell, Title IX Coordinator (reporting agent): 336.256.0362 or mechappe@uncg.edu
- University Police (reporting agent): 336.334.4444

For more information on UNCG's policies regarding harassment, visit [UNCG Sexual Harassment Policy](#)

Health And Wellness

Health and well-being impact learning, access, and academic success. Throughout your time in the university, you may experience a range of concerns that can cause barriers to your academic success. These might include illnesses, strained relationships, anxiety, high levels of stress, alcohol or drug dependency, crime victimization, feeling down, loss of motivation, or death of a loved one. Seeking support confidentially- Student Health Services (SHS), The Counseling Center, and the Campus

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recovery program (SRP) offers recovery support services. You can learn more about recovery and recovery support services by visiting <https://shs.uncg.edu/srp> or reaching out to recovery@uncg.edu.

Title IX

UNCG is committed to fostering a safe, productive, learning environment. Title IX and our school's policy prohibit discrimination on the basis of sex. Sexual harassment, which includes gender-based harassment, domestic and dating violence, sexual assault, and stalking, is prohibited. We encourage anyone who has experienced sexual harassment to speak with someone and get the support and resources they need. I, because of my role with the University, am not required to share information with the University's Title IX Coordinator. Please be aware that if you share a situation related to interpersonal violence with an Official with Authority, they are required to share that information with the University's Title IX Coordinator. For a list of Officials with Authority, please visit: titleix.uncg.edu/employee-reporting-obligations.

UNCG has confidential staff members trained to support students in navigating campus life, understanding reporting options, accessing health and counseling services, and more. Confidential support services include; Campus Violence Response Center (CVRC) located on the ground floor of Gove Student Health Center <http://cvrc.uncg.edu> or UNCG's Medical Clinic, Wellness Center, and Counseling Center located in the Gove Student Health Center <https://shs.uncg.edu/>.

If you wish to report sexual harassment or have questions about school policies and procedures regarding sexual harassment, please contact our school's Title IX Coordinator, Murphie Chappell at (336) 256-0362 or visit <http://titleix.uncg.edu>.

Classroom Conduct

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Attendance Policy

Class attendance is taken by collecting each student's active learning work at the end of class. Regular class attendance is a responsibility and a privilege of university education. It is fundamental to the orderly acquisition of knowledge. Students should recognize the advantages of regular class attendance, accept it as a personal responsibility, and apprise themselves of the consequences of poor attendance. **Student athletes** must make prior arrangements in advance for any conflicts with their schedule and due dates for this course.

Please see [UNCG Attendance Policy](#) for more information.

Religious Holidays

It is expected that instructors will make reasonable accommodations for students who have conflicts due to religious obligations. Please make arrangements with the instructor in advance of any conflict. For more information on UNCG's Religious Obligations policy, visit: [UNCG's Religious Obligations Policy](#).

Final Examination

The final examination period will be used for make up work and extra credit if required.

Additional Requirements

Students are expected to be prepared for class by reading assigned book chapters and bringing paper, pencil, and laptop to each class. If you

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Policy On Late Work & Extra Credit

Since active learning assignments depend on class attendance, missing a class results in late work. If you miss a class, you are encouraged to review the content with a classmate if necessary and turn in your work. Your work will be noted as late but you will still receive a passing grade. The abuse of this policy will be self-evident via poor exam performance. If the decision to offer extra credit is made, it will be offered to everyone as an activity during the final examination period.

Communication

Communication includes Announcements in Canvas, individual emails, and discussion board forums in Canvas.

You should be ready to RECEIVE the following types of messages:

Announcements

You will receive regular communication via the Announcements in the course Canvas site that are intended for all students regardless of your group. Check these each time you access the course in Canvas to be sure you are up to date with the latest information (these are time stamped so if you know when you logged in last, you can determine if anything is new).

Individual Email from the Instructor

Individual email messages will be sent to your UNCG email account. Please check your UNCG email daily to be sure you are getting your emails (if you are having any technical issues with UNCG email you must get assistance ASAP from TECH Support—contact information under the

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your email and your issue may not get resolved in a timely manner):

To: btdobbs@uncg.edu

From: [*Student Email*] (Please use your UNCG email address here)

Subject: CSC 250-[XX] (Class Section) [*Student*] (Type Your name in place of Student)

Dear Todd:

I am [*Student A*] (use your full name, first and last) and I wanted to speak to you about an upcoming deadline (or whatever the issue/question/etc.). I will be at my sister's wedding February 12 and would like to request to submit my class assignment on Monday, February 15, rather than Friday, the 12th. I can answer any additional questions you might have about my trip and send you appropriate documentation. Please let me know if you would like to meet to discuss my request further.

Thank you.

[*Student A*] (Type your name)

Technical Support

Students with technical issues with the course and email should contact 6-TECH for support either by email or phone or chat ([6TECH Help](#)). Please also make your instructor aware of the issue and if there will be any delays in resolving the issue.

Group Roles And Group Assignments

In this course, we will be using groups or teams to complete active learning assignments. Students are asked to familiarize themselves with the various roles needed for effective group work. We will be using the roles established using the POGIL Method:

- **Manager or Facilitator:** Manages the group – keeping the group on task, scheduling meetings (if needed), and making sure everyone has an opportunity to participate.

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• **Fact checker:** Double-checks the group's findings with course materials and other resources.

If there are not enough students in the group for each role, students may need to perform more than one role.

Elasticity Statement

It is the intention of the instructor that this syllabus and course calendar will be followed as outlined; however, as the need arises, there may be adjustments to the syllabus and calendar. In such cases, the instructor will notify the students in class and via email with an updated syllabus and calendar within a reasonable timeframe to allow students to adjust as needed.

Adverse Weather

In cases of inclement weather that impact this course and course schedule, details can be found:

- In your University email: UNCG sends out Adverse Weather updates.
- In the UNCG Mobile App: You can set it to provide you alerts.
- Via television announcements: UNCG makes weather announcements available on five local stations (WFMY-2, WGHP-V, WXII-TV, WXLV-TV, and Spectrum News).
- Visit Spartanalert.uncg.edu or the UNCG homepage: UNCG posts up-to-date information on the main University website (uncg.edu) and on the main Spartan Alert page (spartanalert.uncg.edu).

COVID-19 Statement

As UNCG returns to face-to-face course offerings, the campus community must recognize and address concerns about physical and emotional safety. As such, all students, faculty, and staff are required to

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- [Self-monitoring for symptoms of COVID-19](#)
- Staying home if you are ill
- Complying with directions from health care providers or public health officials to quarantine or isolate if ill or exposed to someone who is ill.

Instructors will have seating charts for their classes. These are important for maintaining appropriate social distance during class and facilitating contact tracing should there be a confirmed case of COVID-19. Students must sit in their assigned seat at every class meeting and must not move furniture. Students should not eat or drink during class time.

A limited number of disposable masks will be available in classrooms for students who have forgotten theirs. Face coverings will also be available for purchase in the UNCG Campus Bookstore. Students who do not follow masking and social distancing requirements will be asked to put on a face covering or leave the classroom to retrieve one and only return when they follow these basic requirements to uphold standards of safety and care for the UNCG community. Once students have a face covering, they are permitted to re-enter a class already in progress. Repeated issues may result in conduct action. The course policies regarding attendance and academics remain in effect for partial or full absence from class due to lack of adherence with face covering and social distancing requirements.

For instances where the Office of Accessibility Resources and Services (OARS) has granted accommodations regarding wearing face coverings, students should contact their instructors to develop appropriate alternatives to class participation and/or activities as needed. Instructors or the student may also contact [OARS](#) (336.334.5440) who, in consultation with Student Health Services, will review requests for accommodations.

