STOR 455-002

METHODS OF DATA ANALYSIS

Fall 2023

# **Course Description**

# *This course is a review of basic inference; two-sample comparisons, correlation; simple and multiple regression (including significance tests, diagnostics, variable selection); analysis of variance; and the use of statistical software.*

# **Course Goals**

***This course will enable you to:***

* understand the context for linear regression to evaluate models and estimate and predict likely values;
* transform data to deal with problems identified in the regression model;
* perform methods for building multiple regression models;
* include categorical predictors into a regression model;
* distinguish between outliers and influential data points and how to deal with these; and
* become competent using the R and RStudio to construct and evaluate regression models

***As part of the General Education curriculum, this course will satisfy the following focus capacities:***

# Quantitative Reasoning

Students learn to comprehend and apply mathematical concepts in authentic contexts, developing tools for reasoning with data, logic, and quantitative methods.

# **Course Details**

|  |  |
| --- | --- |
| Number | STOR 455-002 |
| Title | Methods of Data Analysis |
| Credit hours | 3 |
| Course Format | The course format will include 2 lectures per week. Lectures will be supplemented with in-class programming and practical discussion. |
| Prerequisites | STOR 120 or STOR 155 or Exemption |
| Target Audience | 1st or 2nd year undergraduates seeking a quantitative reasoning (QR) course and interested in building a strong mathematical foundation in linear regression and other related topics. |
| Instructor | Dr. Mario Giacomazzo  Office: Hanes 134  Phone: 480-489-1398 (Cell)  Email: [mgiacoma@email.unc.edu](mailto:mgiacoma@email.unc.edu)  Office Hours: W, 9AM – 11 AM / 12PM – 2PM |
| Graduate TA | Coleman Ferrell  Office:  Email:  Office Hours: |
| Course Website | <https://supermariogiacomazzo.github.io/STOR455_WEBSITE/> |
| Class Days, Times, Location | TTh, 2PM – 3:15PM, Gardner 105 |
| Course Texts |  |

# **Course Assessments**

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| --- | --- |
| **Assignments** | **Percentages** |
| Attendance | 25% |
| Homework | 10% |
| Analyses | 25% |
| Final Project | 30% |
| Group Involvement | 10% |

## Grading Scale

Your final grade is based on a weighted average according to the previously addressed breakdown. Curving on individual/group assessments should not be expected. A curve may be applied to the final grades depending upon the class average. Conversion to a letter grade will be based on the table below:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A | 93 to 100 | B | 83 to 86.99 | C | 73 to 76.99 | D | 60 to 66.99 |
| A- | 90 to 92.99 | B- | 80 to 82.99 | C- | 70 to 72.99 | F | 0 to 59.99 |
| B+ | 87 to 89.99 | C+ | 77 to 79.99 | D+ | 67 to 69.99 |  |  |

## Assignment Descriptions

**Labs:**

Attendance to all labs is mandatory. Every week, your lab instructor will take attendance. If you are there for the entire class, you will receive 10 points. During this period, students are required to work on a lab assignment. Each lab assignment will be based on the topics discussed in lecture or related to your final project. Students are responsible to turn in their own labs, but are encouraged to work in teams. These assignments are to be completed using RMarkdown and submitted as an HTML file on Canvas by 11:59PM the same day. A lab instructor will be provided to help students in the completion of the lab and to facilitate group work. Every lab is worth 20 points and no late lab assignments will be accepted. You will need to get a university approved absence and notify your lab instructor to prevent a loss of points in these weekly labs if you miss class. No late lab assignments will be accepted.

**Homework:**

Homework will be based on problems from the course textbook, *R for Data Science*. You can work with each other on this assignment, but the work you submit should be your own. Any copying of solutions will result in a 0 if caught cheating. Each homework assignment will be worth 10 points. These assignments are to be completed using RMarkdown and submitted as an HTML file on Canvas. No late homework assignments will be accepted.

**Analyses:**

Analyses are constructed using customized problems from real life data sets. These analyses allow you to practice the techniques learned from lab assignments. You cannot work with any other student on these assignments or you will receive a 0 if caught cheating. Each analysis will be worth 40 points. These analyses are to be completed using RMarkdown and submitted as an HTML file on Canvas. If you submit your analyses late, expect a 25% deduction for less than 1 day late, 50% deduction between 1 and 2 days late, and 100% deduction more than 2 days late. All late assignments must be submitted to Canvas as soon as they are completed.

**Final project:**

The final project is done in groups of 4-5 students and worth a total of 100 points. There will be 4 parts of varying point values submitted throughout the semester. The first part, the Project Proposal, is worth 10 points and will be due sometime in the beginning of the semester after groups have been designated. The second part, the Exploratory Data Analysis, is worth 20 points and will be due approximately in the middle of the semester after the Project Proposal has been completed. The third part, the Final Paper, is worth 40 points and must be submitted on Canvas by 11:59PM on Thursday, July 27. The fourth part, the Final Presentation, is worth 30 points and will take place during our designated final exam time according to the university calendar. For our class, this is 11:30AM to 2:30PM on Tuesday, August 1. Slides must be submitted by 11:30AM on August 1 to Canvas.

**Group Involvement:**

Since the final project is a group project that is worth a tremendous amount of points, it is very important that each group member fulfills their obligation to their group. Four times during the semester, there will be a survey sent out to the class, where you will score your group members on a scale from 0 (Terrible) to 5 (Excellent). In extreme circumstances, Dr. Mario has the right to remove individuals from their group and force them to submit their own project.

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# **Course Policies and Resources**

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| **Accessibility Resources** | UNC-Chapel Hill facilitates the implementation of reasonable accommodations for students with learning disabilities, physical disabilities, mental health struggles, chronic medical conditions, temporary disability, or pregnancy complications, all of which can impair student success. See the ARS website for contact and registration information: <https://ars.unc.edu/about-ars/contact-us> |
| **Attendance Policy** | No right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:   1. Authorized University activities 2. Disability/religious observance/pregnancy, as required by law and approved by [Accessibility Resources and Service](https://ars.unc.edu/) and/or the [Equal Opportunity and Compliance Office](https://eoc.unc.edu/what-we-do/accommodations/) (EOC)   Significant health condition and/or personal/family emergency as approved by the [Office of the Dean of Students](https://odos.unc.edu/), [Gender Violence Service Coordinators,](https://womenscenter.unc.edu/resources/gender-violence-services/) and/or the [Equal Opportunity and Compliance Office](https://eoc.unc.edu/what-we-do/accommodations/) (EOC). |
| **University Testing Center** | The College of Arts and Sciences provides a secure, proctored environment in which exams can be taken. The center works with instructors to proctor exams for their undergraduate students who are not registered with ARS and who do not need testing accommodations as provided by ARS. In other words, the Center provides a proctored testing environment for students who are unable to take an exam at the normally scheduled time (with pre-arrangement by your instructor). For more information, visit <http://testingcenter.web.unc.edu/>. |
| **Counseling and Psychological Services** | CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: <https://caps.unc.edu/> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more. |
| **Title IX** | Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – [Adrienne.allison@unc.edu](mailto:Adrienne.allison@unc.edu)), Report and Response Coordinators in the Equal Opportunity and Compliance Office ([reportandresponse@unc.edu](mailto:reportandresponse@unc.edu)), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators ([gvsc@unc.edu](mailto:gvsc@unc.edu); confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu. |
| **Honor Code Statement** | Students are bound by the Honor Code in taking exams and in written work. The Honor Code of the University is in effect at all times, and the submission of work signifies understanding and acceptance of those requirements. Plagiarism will not be tolerated. Please consult with me if you have any questions about the Honor Code. |
| **Technology Use** | Students are required to bring their computer to every class and lab with a working copy of R and RStudio. Directions for free downloads of this software will be provided. The professor or lab assistant will occasionally request computers to be closed for dynamic discussion and guest speakers. |
| **Legal** | Dr. Mario reserves the right to make changes to the syllabus, including all due dates. These changes will be announced as early as possible so that students can adjust their schedules. |

# **SYLLABUS**

* [Course Overview](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#overview)
* [Required Materials](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#materials)
* [Assignments and Exams](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#assignments)
* [Grading](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#grading)
* [Course Policies](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#course)
* [Academic Policies and Services](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#academic)

## **COURSE OVERVIEW**

### **INSTRUCTOR**

Jeffrey A. McLean, [mclean@unc.edu](mailto:mclean@unc.edu?subject=STOR%20455), Hanes Hall 135

### **INSTRUCTIONAL ASSISTANTS**

Grace Smith, [gvsmith@unc.edu](mailto:gvsmith@unc.edu?subject=STOR%20455), Hanes Hall B52

Kendall Thomas, [ketho@unc.edu](mailto:ketho@unc.edu?subject=STOR%20455), Hanes Hall B30

### **COMMUNICATION**

We will use Piazza for class discussion. The system is catered towards getting you help fast and efficiently from classmates, instructional assistants, and myself. Rather than emailing content questions to the course staff, I encourage you to post your questions on Piazza. Since I tend to have hundreds of students each semester, this is the best way to make sure that you get a response. If you have personal questions that you think would be best directed towards myself or an Instructional Assistant individually, you can send those to our personal email addresses listed above.

### **COURSE FORMAT**

The lectures will meet:

* Section 001: MWF 1:25pm-2:15pm in Gardner Rm 0105
* Section 002: MWF 2:30pm-3:25pm in Gardner Rm 0105

**All lectures will be recorded and posted to Sakai before the next class meeting**.

### **OFFICE HOURS**

* McLean: [Tuesdays 1:00pm - 2:30pm (Zoom)](https://unc.zoom.us/j/93873545493) & Wednesdays 9:00am - 10:30am (in-person)
* Smith: [Mondays 11:00am - 12:30pm (Zoom)](https://unc.zoom.us/j/93873545493)& Thursdays 9:00am - 10:30am (in-person)
* Thomas: Wednesdays 10:30am - 12:00pm (in-person) & [Fridays 10:30am - 12:00pm (Zoom)](https://unc.zoom.us/j/93873545493)

### **TARGET AUDIENCE**

Undergraduate students in STAN major, and students throughout the natural and social sciences who are interested in applying regression analysis in their research and/or understanding the statistical concepts underlying the methodology.

## **REQUIRED MATERIALS**

### **TEXTBOOKS**

Stat2: Modeling with Regression and ANOVA, Cannon et. al. (Freeman 2019) 2nd edition

### **TECHNOLOGY**

We will use the open source R statistical software package in an environment called RStudio. Both are free for you to use. You can download R from [http://cran.us.r-project.org](https://cran.r-project.org/), and RStudio from [https://www.rstudio.com](https://www.rstudio.com/).

[Gradescope](https://www.gradescope.com/) will be used to submit nearly all assignments for the course. This platform allows us to create a living rubric for speedy grading of large courses.  You can login to Gradescope using your ONYEN.

## **ASSIGNMENTS AND EXAMS**

### **HOMEWORK (10) : 38% OF FINAL GRADE**

Much of the work that you will submit for the course will consist of both individual and group assignments in which you apply various techniques discussed in class to analyze data. Assignments should be completed by the due dates and submitted to Gradescope as knitted PDFs.

In additional to the graded assignments, practice homework exercises will be assigned from the textbook in most classes. These are designed to ensure that you are keep up with the material and do not need to be turned in.

### **QUIZZES (3): 18% OF FINAL GRADE**

Quizzes are scheduled during class time on Wednesday August 31st, Friday October 14th, and Friday November 18th. All quizzes will be open book, open notes, and anything other than direct communication with others. Quizzes are expected to be completed by the end of class and submitted to Gradescope as knitted pdfs. While you will have the full class to complete the quizzes, they are not intended to take the full class time. Make-up quizzes are only possible for [University excused absences](https://attendance.unc.edu/)]  or consent from the instructor due to extenuating circumstances. Unexcused quizzes will receive a score of 0. Unless you have accommodations as determined by the university or university excused absences, you must take the quizzes at the dates and times provided here. If you have accommodations, please provide the formal notification before the second week of classes.

### **MIDTERM EXAMS (2): 24% OF FINAL GRADE**

Midterm exams are during class time on Wednesday September 21st and Wednesday November 2nd. All midterm exams will be open book, open notes, and anything other than direct communication with others. Midterm exams are expected to be completed by the end of class and submitted to Gradescope as knitted pdfs. Make-up exams are only possible for [University excused absences](https://attendance.unc.edu/) or consent from the instructor due to extenuating circumstances. Unexcused exams will receive a score of 0. Unless you have accommodations as determined by the university or university excused absences, you must take the midterms at the dates and times provided here. If you have accommodations, please provide the formal notification before the second week of classes.

### **FINAL EXAM: 20% OF FINAL GRADE**

The final exam is required for a passing grade, and will be held for **section 001** (MWF 1:25pm-2:15pm) on Saturday December 3rd 12:00pm - 3:00pm and for **section 002** (MWF 2:30pm-3:25pm) on Friday December 2nd 4:00pm - 7:00pm. You are expected to complete the final exam during the University Scheduled exam time. The final exam is open book, notes, course materials, internet, and all things that are not direct communication with others. Unless you have accommodations as determined by the university or university excused absences, you must take the final exam at the date and time provided here. If you have accommodations, please provide the formal notification before the end of the second week of classes.

### **LATE ASSIGNMENTS**

Quizzes and exams **cannot** be taken or submitted late for credit without a [University excused absence](https://attendance.unc.edu/) (or with accommodations or consent from the instructor due to extenuating circumstances).

Homework will be accepted up to 48 hours late. Assignments submitted fewer than 24 hours after the deadline will receive a maximum of **3/4 credit**. Those submitted between 24 and 48 hours after the deadline will receive a maximum of **1/2 credit**. No credit will be received for assignments submitted more than 48 hours after the deadline. Late assignments can still receive full credit with a [University excused absence](https://attendance.unc.edu/) or consent from the instructor due to extenuating circumstances.

You will get one "get out of jail free card" that entitles you to submit one individual assignment (not including the group assignments) within 24 hours of the due date and still receive full credit. I recommend that you do not plan on using this option and instead keep it for last minute submission issues. This will automatically apply to the first individual homework assignment that you submit (0, 24) hours after the deadline.

## **GRADING**

Percentages will be converted to letter grades according to the following scale.

| **Letter Grade** | **Percentage** | **Meaning** |
| --- | --- | --- |
| A | 93–100% | Excellent: Far exceeds standard |
| A- | 90–92% |
| B+ | 87–89% | Good: Exceeds standard |
| B | 83–86% |
| B- | 80–82% |
| C+ | 77–79% | Fair: Meets standard |
| C | 73–76% |
| C- | 70–72% |
| D+ | 67–69% | Poor: Shows growth but falls below standard |
| D | 60–66% |
| F | 0–59% | Failing: Deficient |

### **Academic Policies and ServicesClick to collapse**

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## **ACADEMIC POLICIES AND SERVICES**

* [Honor Code](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#honor)
* [IT Acceptable Use Policy](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#it)
* [Data Security and Privacy](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#data)
* [Accessibility](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#accessibility)
* [Student Support](https://sakai.unc.edu/portal/site/f312a13e-0e15-4436-9ae5-f0c1117cb374/tool/7a22a08e-8c18-4d4e-8eb7-5b8926bdc731#support)

### **HONOR CODE**

Remember that as a student of UNC-Chapel Hill, you are bound by the University’s  [Honor Code](http://honor.unc.edu/), which states that “It shall be the responsibility of every student at The University of North Carolina at Chapel Hill to obey and support the enforcement of the Honor Code, which prohibits lying, cheating, or stealing when these actions involve academic processes or University students or academic personnel acting in an official capacity.” An especially serious Honor Code violation is plagiarism. You may wish to take a [tutorial on plagiarism](http://www.lib.unc.edu/plagiarism/)  that was developed by librarians at UNC, Duke, NCSU, and NCCU. If you have questions, please consult your instructor. Please note that downloading or printing out the quizzes or exams in Sakai is prohibited; doing so is considered a violation of the Honor Code.

#### **Plagiarism**

[Plagiarism](http://writingcenter.unc.edu/handouts/plagiarism/) is a serious violation of the Honor Code. To become more familiar with the issues surrounding plagiarism, and how to best avoid this academic issue, view this brief [Plagiarism Tutorial](http://guides.lib.unc.edu/plagiarism/purpose) created by the librarians of UNC-Chapel Hill, Duke University, NC State University, and NC Central University. If you have any questions about what constitutes plagiarism or how to properly cite a source, please contact your instructor.

### **IT ACCEPTABLE USE POLICY**

By enrolling as a student in this course, you agree to abide by the University of North Carolina at Chapel Hill policies related to the acceptable use of IT systems and services. You may be asked to participate in online discussions or other online activities that may include personal information about you or other students in the course.  The rights and protection of other participants are protected under the UNC-Chapel Hill [Information Technology Acceptable Use Policy](https://unc.policystat.com/policy/6875241/latest/), which covers topics related to using digital resources, such as privacy, confidentiality, and intellectual property.

Consult the University website "[Safe Computing at UNC](https://safecomputing.unc.edu/)" for information about the data security policies, updates, and tips on keeping your identity, information, and devices safe.

### **DATA SECURITY AND PRIVACY**

#### **University and LMS Privacy Policies**

* [UNC-Chapel Hill Privacy Statement](https://www.unc.edu/about/privacy-statement/)
* Sakai's Discussion Forum, Assignments, DropBox, Gradebook, and Tests & Quizzes tools are designed to share FERPA-protected information privately between instructors and individual students.

#### **UNC-Supported Vendor Privacy Policies**

* [Microsoft](https://www.microsoft.com/online/legal/v2/?docid=43)
* [Zoom](https://zoom.us/privacy)

When using online resources offered by organizations not affiliated with UNC-Chapel Hill, such as Google or YouTube, please note that the terms and conditions of these companies and not the University’s Terms and Conditions apply. These third parties may offer different degrees of privacy protection and access rights to online content. You should be well aware of this when posting content to sites not managed by UNC-Chapel Hill. When links to sites outside of the unc.edu domain are inserted in class discussions, please be mindful that clicking on sites not affiliated with UNC-Chapel Hill may pose a risk for your computer due to the possible presence of malware on such sites.

### **ACCESSIBILITY**

#### **Office of Accessibility/Accommodations**

If you are a student with a documented disability, you can receive services through  [Accessibility Resources & Service (ARS).](https://accessibility.unc.edu/)  You must self-identify through ARS to receive services or accommodation from either of these offices. ARS works closely with programs, offices, and departments throughout the University to help create an accessible environment.

The office is located in Suite 2126 of the Student Academic Services Building (SASB), 450 Ridge Road, Chapel Hill, NC, and is open from 8 am to 5 pm Monday through Friday. You can contact them by phone at 919-962-8300 or 711 (NC-RELAY), or by email at  [accessibility@unc.edu](mailto:accessibility@unc.edu).

#### **Accessibility Statements**

##### **University and LMS Accessibility Statements**

* [UNC-Chapel Hill Accessibility Statement](https://www.unc.edu/about/accessibility/)
* [Sakai Voluntary Product Accessibility Statement](https://confluence.sakaiproject.org/pages/viewpage.action?pageId=110690616)

##### **Supporting Sites and Technologies Accessibility Statements**

* [Microsoft Office Accessibility Statement](http://www.microsoft.com/enable/default.aspx)
* [YouTube Accessibility Statement](https://support.google.com/youtube/answer/189278?hl=en)

### **STUDENT SUPPORT**

#### **Cancellation, Withdrawal, and Suspension**

A registered student may terminate registration in three possible ways: cancellation, withdrawal, and suspension, depending on the circumstances. For definitions of these terms and the steps necessary to process each of them, see the [University Policy Memorandum](https://registrar.unc.edu/academic-services/policies-procedures/university-policy-memorandums/upm-7-cancellation-withdrawal-and-suspension/).

#### **Policy on Non-Discrimination**

The University is committed to providing an inclusive and welcoming environment for all members of our community and to ensuring that educational and employment decisions are based on individuals’ abilities and qualifications. Consistent with this principle and applicable laws, the University's [Policy Statement on Non-Discrimination](https://unc.policystat.com/policy/4467906/latest/) offers access to its educational programs and activities as well as employment terms and conditions without respect to race, color, gender, national origin, age, religion, creed, genetic information, disability, veteran's status, sexual orientation, gender identity or gender expression.  Such a policy ensures that only relevant factors are considered and that equitable and consistent standards of conduct and performance are applied.

#### **Reporting Harassment or Discrimination**

If a student is experiencing harassment or discrimination, they can seek assistance and file a report through the Report and Response Coordinators (see contact info at [safe.unc.edu](https://safe.unc.edu/learn-more/harassment/)) or the [Equal Opportunity and Compliance Office](http://eoc.unc.edu/).

Any administrator or supervisor, including a department chair, associate dean or other administrator, who receives notice of a student’s complaint of alleged prohibited harassment, including sexual misconduct, or discrimination must contact the Equal Opportunity/ADA Office as soon as possible upon receipt of the complaint at 137 E. Franklin St., Suite 404, 919-966-3576.

Faculty and staff who experience discrimination or harassment can file a complaint on the [Equal Opportunity and Compliance Office](http://eoc.unc.edu/) web site (look for the “Make a report” link on that page).

#### **Gender-Inclusive Language**

The University of North Carolina at Chapel Hill is committed to providing an inclusive and welcoming environment for all members of our community. Consistent with that commitment, the gender-inclusive terms (chair; first-year student; upper-level student, etc.) should be used on University documents, websites and policies.

The UNC Writing Center has a [handout on Gender-Inclusive Language](http://writingcenter.unc.edu/tips-and-tools/gender-inclusive-language/).

#### **Student Support Email and Phone Numbers**

* To report acceptable use problems at UNC-Chapel Hill, call **919-962-HELP** or email: [abuse@unc.edu](mailto:abuse@unc.edu).
* For issues involving copyrights or other policy concerns, call **919-445-9393** or email: [copyright@unc.edu](mailto:copyright@unc.edu).
* For issues involving system security, call **919-962-HELP** email: [security@unc.edu](mailto:security@unc.edu).
* For any other issues, please send email to [abuse@unc.edu](mailto:abuse@unc.edu).