

## ST 555 SAS Programming I Course Outline

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### COURSE INFORMATION

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**Course Website:** [wolfware.ncsu.edu](http://wolfware.ncsu.edu)

**Course Credit Hours:** 3

**Course Description:** An introduction to programming and data management using SAS, the industry standard for statistical practice. Detailed discussion of the program data vector and data handling techniques that are required to apply statistical methods. Topics are based on the current content of the Base SAS Certification Exam and typically include importing, validating, and exporting of data files; manipulating, subsetting, and grouping data; merging and appending data sets; basic detail and summary reporting; and code debugging. Additional topics with practical applications are also introduced, such as graphics and advanced reporting. Statistical methods for analyzing data are not covered in this course.

**Prerequisites/Corequisites:** Graduate Standing. There are no prerequisite courses for ST 555. However, some prerequisite knowledge is absolutely necessary; students should be familiar with Windows-based file structures and have previous exposure to basic concepts such as programming syntax, conditional logic, and loops. As such, while no previous programming experience *with SAS* is needed, previous (and recent) exposure to a programming language is beneficial. Familiarity with some basic statistics (e.g. mean, median, standard deviation) is expected.

If you have no previous experience programming, this course may require more time than a typical course. Please plan accordingly.

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### COURSE DELIVERY AND STRUCTURE

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This online asynchronous course delivers all learning materials, activities and assignments through **Moodle**, a secure and easy-to-use online learning platform. Moodle is a web-based tool (often referred to as a learning management system or LMS) used for web-enhanced and online courses. Instructors use Moodle to facilitate class communication, provide course materials and deliver assignments and other assessments.

Students and instructors use a web browser to access their courses, Slack for communication, Gradescope for assignment submission and grading, and students must have access to SAS via the VTL Courses are provided in a password-protected environment, ensuring student privacy within the class. Students with a UnityID (issued by the University) [Click here to learn more about Moodle](#) through quick training module

The course is **asynchronous**; students have no real-time class meeting requirements. Learning materials and activities include:

- **Weekly assignments:** Administered through Moodle in the form of quizzes or homework.

- **Discussion forums (may not be applicable for your course. Depends on instructor.**
- [University DELTA Testing Services](https://testing-services.delta.ncsu.edu/testing-services-remote/off-campus-submit-request/) (if applicable to your class). If your instructor plans to use the campus or remote proctor testing options, you can learn more about it by visiting the website (<https://testing-services.delta.ncsu.edu/testing-services-remote/off-campus-submit-request/>)
- Synchronous office hours or meeting times

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## **COURSE LEARNING OUTCOMES**

This course has the dual purpose of preparing you for the SAS Base Specialist exam and providing many of the skills necessary for you to be successful as an entry-level SAS programmer or as a programming-capable statistician. While there is much overlap between these two skill-sets, some skills are only relevant to one of these purposes.

Upon completion of this course, students will be able to:

1. Write original SAS programs that read data from common sources and use the generated data sets via the application of basic SAS procedures
2. critique and revise provided code
3. describe the contents of the Input Buffer and Program Data Vector given a DATA step and input data set
4. modify data set contents while controlling the resulting output
5. create basic and intermediate reports and graphs

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## **COURSE TOPICS AND SCHEDULE**

### **Topic List and Schedule**

- Introduction to SAS and text editor software, important SAS settings, Good Programming Practices, SAS Log
- File paths, LIBNAME, PROC CONTENTS, PROC PRINT, Intro to ODS
- Variable attributes, PROC SORT, PROC PRINT
- PROC MEANS, PROC FORMAT, WHERE logic, PROC FREQ
- FILENAME, Simple List Input, Column Input, Variable attributes
- Compilation and execution phases, Properties of the input buffer, Properties of the program data vector
- Creating and directly referencing global macro variables, tips for debugging the DATA step, PROC COMPARE
- Modified List Input, Formatted Input, Column pointer controls
- ODS, PROC SGPLOT
- Handling missing data
- Anomalous value detection and correction
- Vertical combination of data sets, PROC REPORT
- Data set management via KEEP, DROP, RENAME, and IN, Conditional logic
- Conditional logic, DO groups
- PROC UNIVARIATE, PROC SGPLOT
- Data joins
- Details of match-merge, OUTPUT statement

- PROC TRANSPOSE
- Reading intermediate raw data sets
- Loops
- Arrays
- PROC REPORT usages and DEFINE statement
- PROC REPORT BREAK, RBREAK, and COMPUTE statements
- COMPUTE blocks
- Accessing structured files, DATA step SUM statement, RETAIN, BY-group processing

**Please note:** the course schedule is subject to change.

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## **COURSE MATERIALS**

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### **Required Materials**

- **Textbook:** Blum and Duggins **Fundamentals of Programming in SAS: A Case Studies Approach** (1st Edition). ISBN-13: 978-1-63526-672-6

1. If "materials" includes all software, then this needs to be amended:

SAS: Regular access to SAS will be required to follow along with lectures and to complete all programming assignments. SAS access is provided to you on a server to ensure a consistent experience for all students **Do not download SAS on your own. Follow the instructions provided by IT precisely! There are files available on the server that you cannot get on your own.**

2. Information about remotely accessing software can be found here:  
<https://statistics.sciences.ncsu.edu/resources/it/virtual-teaching-lab-wvd/>.
3. Slack: This will be our chat tool for the semester. It is available for Windows, Mac, and mobile devices. This is what you'll use if you want to send a question to the class and have me be able to see it. **You need to download this on your own. Links are on Moodle.**
4. Gradescope: This is simply a software that will make the grading easier for the TAs and make accessing and reviewing your grades easier than in Moodle. When you upload your work, this is where it will go and this is where you'll see your feedback. **You do not need to download anything for this.**

**Grading Scale (instructor will clarify in class syllabus):** This course uses the standard NCSU letter grading scale. Percentage cutoffs are firm, and no rounding occurs; for example, a percentage of 86.99 would correspond to a B.

| <b>Low(percentage)</b> | <b>Letter</b> |
|------------------------|---------------|
| 93 ≤                   | A             |
| 90 ≤                   | A-            |
| 87 ≤                   | B+            |
| 83 ≤                   | B             |
| 80 ≤                   | B-            |

|      |    |
|------|----|
| 77 ≤ | C+ |
| 73 ≤ | C  |
| 70 ≤ | C- |
| 67 ≤ | D+ |
| 63 ≤ | D  |
| 60 ≤ | D- |
| 0 ≤  | F  |

**Exam and Testing Instructions** (currently not used but may be in the future)

**Exam proctoring:** Your instructor may require proctored exams facilitated through [DELTA Testing Services](#). A proctor is an impartial third-party who verifies the identity of the student and ensures the academic integrity of an exam.

1. **Local students** — DELTA Testing Services will offer the exam(s) for this course on campus. Please visit the DELTA Testing Services website for [more information about on-campus testing](#).
  - **Step 1: Make an Appointment**. Exams at the DELTA Test Centers are by **appointment only**. To schedule your appointment, visit [go.ncsu.edu/takemytest](https://go.ncsu.edu/takemytest). Appointments must be made at least 24 hours in advance; however, the sooner – the better.
  - **Step 2: Come Prepared**
    - Bring a photo ID
    - Know your UnityID
    - If you are a DUO user, bring your registered device.
    - Arriving late for an appointment may result in the appointment cancellation; students can sign in for an appointment up to 15 minutes early.
2. **Students with Accommodations**— If you have approved accommodations with NC State's Disability Resources Office (DRO), DELTA Testing Services wants to ensure that you receive the appropriate accommodations when you go to the test center.
  - **Email Testing Services**. Send a PDF copy of your Accommodation Letter to [delta\\_accommodations@ncsu.edu](mailto:delta_accommodations@ncsu.edu). Once we have received a copy of your accommodation letter, a confirmation email will be sent informing you that your accommodations have been processed. You will *then* be able to schedule an

appointment.

3. **Remote students** — DELTA Testing Services will oversee the process of approving a remote proctor, sending all exam materials, and receiving any materials from your proctor

(<https://testing-services.delta.ncsu.edu/testing-services-remote/off-campus-submit-request/>)

- **Step 1: Submit a Request.** To use a remote proctor for an exam, you must submit an online request and it must be approved by DELTA Testing Services. The request should be submitted at the start of the semester. The approval process takes at least 72 hours.
  - Pre-approved proctors are marked on the map and are selectable in a drop-down menu in the request form.
  - If you do not see a pre-approved option in your area, it is your responsibility to find a proctor who meets the guidelines. When submitting a request, if your proctor is not pre-approved, select “other” and fill in the remote proctor’s information. (Please double-check the email address.)

Please note that the instructor does not communicate directly with proctors. Please refer all questions regarding proctoring to the distance proctoring center via [deproctor@ncsu.edu](mailto:deproctor@ncsu.edu) or call 919.513.1513.

This document is an example of course information that will be modified per instructor’s preference.