Mel and Enid Zuckerman College of Public Health
University of Arizona

SYLLABUS

Data Management and the SAS Programming Language

BIOS 576D (3 units)

FALL 2017

Time: Tuesday and Thursday, 11:00am – 12:15pm

Location: Drachman Hall, Room A120 (Room A319 on November 14, 16 and 21)

Instructor: William “Bill” Degnan MPH, MBA, MS
SAS Certified Advanced Programmer for SAS 9
Graduate Associate, DrPH Student in Public Health Policy and Management
Drachman Hall room A226 (second floor, east wall)
Mobile: 520.471.0369
wjd3@email.arizona.edu

Office Hours: Monday and Wednesday, 1:00pm – 3:00pm (or by appointment)

Teaching Assistant: none

Catalog Description: This course will introduce students to the fundamentals of data management using the SAS programming language. Emphasis will be placed on data manipulation, including reading, processing, recoding, and reformatting data. The approach will be to teach by example, with an emphasis on hands-on learning.

Course Description: This is a fast-paced course focused on the SAS v9.4 programming language. Students will learn to use three interfaces to SAS v9.4: SAS Studio within SAS University Edition, Base SAS Windowing Environment (also called Display Manager), and SAS Enterprise Guide. Quizzes based on reading assignments will be given weekly using D2L. Homework normally will be assigned every other week and will consist mainly of problems of a bio-statistical/biomedical nature for which you must write SAS code to solve. A take-home mid-term and final exam also will be given; both will require a high level of SAS programming skill to complete.

The topics of this course will incorporate those appearing on the SAS base certification test (importing and exporting raw data files; manipulating and transforming data; combining SAS data sets; creating basic detail and summary reports using SAS procedures; identifying and correcting data, syntax and programming logic errors) as well those covered in the SAS advanced certification test (writing and interpreting basic SAS SQL
code; creating simple SAS macros; and learning select advanced DATA step programming statements and efficiency techniques).

**Course Prerequisites:** Basic computer literacy, BIOS 576A, EPID 573A, or the instructor’s permission

**Course Learning Objectives:** At the end of the course, you should be able to:

- Demonstrate basic and intermediate data management and programming skills using the SAS programming language.
- Perform basic macro programming in SAS such as text substitution in code, automating and customizing the production of SAS code, conditionally or iteratively construction SAS code, etc.
- Demonstrate basic skills in structured query language (SQL) with SAS and optimizing SAS programs such as querying and sub-setting data, summarizing and presenting data, combining tables, including joins and merges.
- Take and pass the “SAS Certified Base Programmer for SAS 9” exam offered through the SAS Institute ([http://support.sas.com/certify/creds/bp.html](http://support.sas.com/certify/creds/bp.html)) and have a head start preparing for advanced certification.

**Competencies Covered:** At the end of the course, you should be able to demonstrate:

**Analytical Skills:**
- Define a problem
- Determine appropriate uses and limitations of data
- Select and define variables relevant to defined public health problems
- Evaluate the integrity and comparability of data and identify gaps in data sources

**Communication Skills:**
- Communicate effectively both in writing and
- Interpret and present accurately and effectively demographic, statistical, and scientific information for professional and lay audiences adapting and translating public health concepts to individuals and communities

**Basic Public Health Skills:**
- Understand research methods in all basic public health sciences
- Apply the basic public health sciences including behavioral and social sciences, biostatistics, epidemiology, environmental public health, and prevention of chronic and infectious diseases and injuries

**Data Management Competencies:**
- Identify appropriate tools to address specific scientific questions
- Demonstrate excellent presentation skills and the ability to explain statistical concepts and findings to a general scientific audience
- Demonstrate understanding of methods of data analysis and data monitoring

**Course notes/material:** A webpage has been created for this class using the Desire 2 Learn (D2L) interface. The course website contains the syllabus, lecture notes, links to instruction videos, reference materials, reading assignments, quizzes, exams, and all information you need for the homework assignments. You may also be given additional examples of specific SAS programs that will also be discussed in class. Students are responsible for all material distributed during the semester.

To access the BIOS 576D D2L website, login at: https://d2l.arizona.edu
- Click the ‘UA NetID Login’ button
• Enter your NetID and password, the same way you would access your UA student account
• Under ‘My Courses” click on BIOS 576D FA17 001
  o **Announcements**: This section contains any class announcements, such as changes in lecture topics and homework assignments, addition of new reference material, etc.
  o **Content**: Access the syllabus, lecture notes, reading assignments, instruction videos, quizzes, homework assignments, exams and reference material in this section.

**Required Texts (needed for reading assignments and quizzes):**

**Optional Text:** Cody R. Biostatistics by Example Using SAS Studio. The SAS Institute, 2016. 978-1-62960-328-5. Amazon: $44.95 + tax paperback; $18.35 + tax for Kindle

**Useful websites:**
- [http://www.ats.ucla.edu/stat/sas/](http://www.ats.ucla.edu/stat/sas/)
- [https://support.sas.com/documentation/](https://support.sas.com/documentation/)

**Special Materials:** I recommend you obtain access to SAS University Edition installed on a 64-bit laptop computer. SAS University Edition is free and can be downloaded directly from SAS on a Windows PC, Mac OS X, or Linux machine. It works with virtualization software and your browser (IE, Firefox, Chrome or Safari); no internet access is required. Go to [https://www.sas.com/en_us/software/university-edition.html](https://www.sas.com/en_us/software/university-edition.html) for download instructions. I recommend running SAS University Edition locally on your machine using Oracle VirtualBox downloaded from [https://www.virtualbox.org/wiki/Downloads](https://www.virtualbox.org/wiki/Downloads). Note: A QuickStart Guide for installing Oracle VirtualBox and the SAS University Edition vApp is also available on the course D2L site.

**Course Requirements and Policies:**
1. Reading assignments. Read the required text and any other assigned reading. Assignments are posted weekly on D2L. Please bring questions about the readings with you to the lecture.
2. Quizzes. Weekly quizzes will be given using D2L. Quizzes will typically consist of 10 questions taken from the reading assignment and will be worth one point each. They must be completed independently. Quiz solutions not submitted by the posted due date and time will receive a grade of zero. Quiz solutions will be discussed in class.
3. Homework
   a. Homework assignments will be assigned in D2L with the due date posted. Students may work either independently or in groups on the homework. Whether worked independently or in groups, each student must submit their solutions to the homework individually by the date due to the course drop box on D2L, now called “Assignments”.
   b. Guidance for preparing and submitting the homework:
      i. Pretend that I am a busy Principal Investigator (PI) with a short attention span.
      ii. I want to see your results in an MS Word or PDF document. Succinctly summarize the task at hand, present just the SAS output that directly answers/addresses the question/problem, and interpret the results. I do not want to wade through several pages of computer output that are not relevant to solution.
iii. In addition, please include a copy of your code annotated with comments so that I (and you, at a later date) can understand your thought process, what you did, and why. Also, include a copy of the SAS log from your final code run.

iv. For each problem assigned, students are expected to turn-in their final successful code and output. If you cannot get your code to run, please contact me by email or see me during office hours and I’ll help you the best I can.

v. I prefer to grade liberally, but I am less inclined to do so when I have to struggle with your documentation.

c. Scoring: Each homework question is worth 3 points unless otherwise specified. Partial credit will be given if an honest attempt at the problem was made even without the correct answer. No credit (zero points) is given if no attempt was made to answer the question.

d. Remember to put your name and assignment number on the front page of your submittal.

e. Homework solutions will be discussed in class.

f. Late assignments will be docked 10% of total possible points if submitted after the due date/time. The D2L drop box will close 24 hours after the due date/time, after which a late submission will not be accepted and a score of zero assigned.

g. Keep copies of all of your code and assignments. They will be helpful for the mid-term and final examinations.

4. Mid-Term Exam

a. One midterm exam will be given.

b. It will be a take-home, project style assessment that will test knowledge, concepts, and programming skills acquired during the first half of the course.

c. Students will be expected to complete the mid-term exam independently; i.e. no collaborating with other persons inside or outside the class. Direct all questions about the mid-term exam to the instructor.

d. Guidance for preparing and submitting the mid-term exam: See 3(b) above.

e. Late exams will be docked 20% of total possible points if submitted after the due date/time. The D2L drop box will close 24 hours after the due date/time, after which a late submission will not be accepted and a score of zero assigned.

f. Mid-term solutions will be discussed in class.

5. Final Exam

a. The final exam is an opportunity for you to show me your programming knowledge and that you understand the problems of data management and basic statistical analysis using SAS.

b. It will be a take-home, project style assessment that will test knowledge, concepts, and programming skills covered during the entire course.

c. Students are expected to complete the final exam independently; i.e. no collaborating with the other persons inside or outside the class. Direct all questions about the final exam to the instructor.

d. Guidance for preparing and submitting the final exam: See 3(b) above.

e. Late exams will be docked 20% of total possible points if submitted after the due date/time. The D2L drop box will close 12 hours after the due date/time, after which a late submission will not be accepted and a score of zero assigned.

6. Extra Credit: I plan to offer one extra credit assignment with total points possible worth one quiz; more information will be provided later in the semester.

7. Requests for incompletes (I) and withdrawal (W) must be made in accordance with University policies. University policy regarding grades and grading systems is available at: http://catalog.arizona.edu/policy-type/grade-policies
Grading/Student Evaluation: Attendance, quizzes, homework, midterm project, and final exams contribute to your final grade as follows (due dates provided on D2L):

- Attendance (29, pro-rated) 10%
- Quizzes (12) 10%
- Homework (7) 30%
- Mid-term exam (1) 20%
- Final exam 30%

Final grades are based on the following point system:

- A = 90-100%
- B = 80-89%
- C = 70-79%
- D = 60-69%
- E = 59% or less

The instructor reserves the right to revise this scale, if necessary.

Class Attendance/Participation: Class attendance will be recorded and is strongly encouraged. If a student misses class, they are responsible for meeting all course deadlines and for working with other students and the instructor (during office hours) to catch up. The UA’s policy concerning class attendance, participation, and administrative drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop. The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy. Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored, http://deanofstudents.arizona.edu/

Course Schedule: See table below. Updates will be announced during lecture or on the D2L site. You are responsible for obtaining information on any changes, even if you miss class.
<table>
<thead>
<tr>
<th>Week #</th>
<th>Date</th>
<th>Material (1)</th>
<th>Videos (2)</th>
<th>Reading</th>
<th>Homework #</th>
<th>Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22-Aug</td>
<td>L1: Course overview</td>
<td>SAS Inside Out, Using SAS User Interfaces, Getting Started With SAS Studio</td>
<td>TLSB Chapter 1  SAS Studio Supplement to TLSB, pp 1-19 (Intro, sections 1.6 - 1.12)</td>
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<tr>
<td>2</td>
<td>29-Aug</td>
<td>L3: No class (Room A319 reserved for DrPH comp exam). Watch videos on Data Management in D2L</td>
<td>Data Management for Analytics, What is Master Data Management</td>
<td>SAS Studio Supplement to TLSB, pp 20 (sections 1.13-2.20)</td>
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<td></td>
<td>31-Aug</td>
<td>L4: Getting Data into SAS Studio</td>
<td>Using the Import Data Utility in SAS Studio</td>
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<td>1</td>
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<tr>
<td>3</td>
<td>5-Sep</td>
<td>L5: Getting Data into SAS Studio (cont.)</td>
<td>Creating a SAS Table from a CSV File, Reading and Generating CSV Files Using Snippets in SAS Studio</td>
<td>TLSB Chapter 3</td>
<td>2</td>
<td>1</td>
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<td></td>
<td>7-Sep</td>
<td>L6: Working with Your Data</td>
<td>Creating a New Column in SAS, Performing Conditional Logic in SAS</td>
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<td>2</td>
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<td>4</td>
<td>12-Sep</td>
<td>L7: Working with Your Data (cont.)</td>
<td>Filtering a SAS Table in a DATA Step, Formatting Values in SAS</td>
<td>TLSB Chapter 4</td>
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<td></td>
<td>14-Sep</td>
<td>L8: Sorting, Printing and Summarizing Your Data</td>
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<tr>
<td>5</td>
<td>19-Sep</td>
<td>L9: Sorting, Printing and Summarizing Your Data (cont.)</td>
<td></td>
<td>TLSB Chapter 5  SAS Studio Supplement to TLSB, pp 20-22 (sections 5.1, 5.4, 5.5)</td>
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<td></td>
<td>21-Sep</td>
<td>L10: Enhancing Your Output with ODS</td>
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<td>6</td>
<td>26-Sep</td>
<td>L11: Enhancing Your Output with ODS (cont.)</td>
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<td>TLSB Chapter 6</td>
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<td>4</td>
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<tr>
<td></td>
<td>28-Sep</td>
<td>L12: Modifying and Combining SAS Data Sets</td>
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<td>Week #</td>
<td>Date</td>
<td>Material (1)</td>
<td>Videos (2)</td>
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<td>7</td>
<td>3-Oct</td>
<td>L13: Modifying and Combining SAS Data Sets (cont.)</td>
<td>Merging SAS Tables in a Data Step</td>
<td>TLSB Chapter 8</td>
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<td>8</td>
<td>5-Oct</td>
<td>L14: Visualizing Your Data</td>
<td>Creating a Bar Chart Using SAS Studio, Creating a Histogram in SAS Studio</td>
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<td>5</td>
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<td>9</td>
<td>10-Oct</td>
<td>L15: Visualizing Your Data (cont.)</td>
<td>Creating a Scatter Plot Using SAS Studio, Creating a Series Plot Using SAS Studio</td>
<td>TLSB Chapter 9</td>
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<td>9</td>
<td>17-Oct</td>
<td>L17: Using Basic Statistical Procedures (cont.)</td>
<td>Multiple Linear Regression Using SAS Studio, One-Way ANOVA using SAS Studio</td>
<td>TLSB Chapter 10, SAS Studio Supplement to TLSB, pp 22 (section 10.2)</td>
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<td>10</td>
<td>19-Oct</td>
<td>L18: Exporting Your Data</td>
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<td>TLSB Chapter 11</td>
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<td>5</td>
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<td>10</td>
<td>24-Oct</td>
<td>L19: Debugging Your SAS Programs, Review for Mid-term Exam</td>
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<td>TLSB Chapter 7, Articles on SAS Macros</td>
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<td>11</td>
<td>26-Oct</td>
<td>L20: SAS Macros</td>
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<td>11</td>
<td>31-Oct</td>
<td>L21: SAS Macros (cont.)</td>
<td>TLSB Appendix (SQL), Articles on SAS SQL</td>
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<td>12</td>
<td>2-Nov</td>
<td>No class</td>
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<td>12</td>
<td>7-Nov</td>
<td>L22: SAS SQL</td>
<td>TLSB-EG Tutorial A - D, Chapter 1</td>
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<td>9-Nov</td>
<td>L23: SAS SQL (cont.)</td>
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<td>Week #</td>
<td>Date</td>
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<td>13</td>
<td>14-Nov</td>
<td>L24: SAS Display Manager, SAS Enterprise Guide Basics</td>
<td>Writing and Submitting SAS Code: Choosing an Editor</td>
<td>TLSB-EG Chapters 2 and 8</td>
<td>Articles on SAS EG Programming</td>
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<td>23-Nov</td>
<td>Thanksgiving - No Class</td>
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<td>15</td>
<td>28-Nov</td>
<td>L27: SAS Indexes and Efficient Programming Methods</td>
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<td>30-Nov</td>
<td>L28: SAS Indexes and Efficient Programming Methods (cont.)</td>
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<td>8</td>
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<td>16</td>
<td>5-Dec</td>
<td>L29: Last class of semester - Review for Final Exam</td>
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<td>8</td>
<td>Final</td>
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<td>7-Dec</td>
<td>No class - Reading Day</td>
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<td>17</td>
<td>12-Dec</td>
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<td>14-Dec</td>
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<td>Final</td>
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</table>

**Notes:**

1. L1 = Lecture #1, L2 = Lecture #2, etc.
3. TLSB = The Little SAS Book (A Primer), Fifth Edition
4. TLSB-EG = The Little SAS Enterprise Guide Book
5. All quizzes are taken on D2L and due no later than 11:00am on the due date
6. All homework and exams are available at 12:15pm on the dates assigned
7. All homework and exams are take-home, submitted on D2L, and are due no later than 11:59pm on the due date

**Communications:** You are responsible for reading emails sent to your UA account from your instructor and the announcements that are placed on the course web site. Information about readings, news events, your grades, assignments and other course related topics will be communicated to you with these electronic
methods. The official policy can be found at: https://www.registrar.arizona.edu/personal-information/official-student-email-policy-use-email-official-correspondence-students

Disability Accommodations:
It is the University’s goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately, so that we can discuss options. You are also welcome to contact the Disability Resources (520-621-3268) to establish reasonable accommodations (as it is very important that you be registered with the DRC). For additional information on Disability Resources and reasonable accommodations, please visit http://drc.arizona.edu/students

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercise must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity, available through the office of the UA Dean Students: http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity

Classroom Behavior: (Statement of expected behavior and respectful exchange of ideas:
Present policies to foster a positive learning environment, including use of cell phones, mobile devices, etc.). Students are expected to be familiar with the UA Policy on Disruptive Student Behavior in an Instructional Setting found at: http://policy.arizona.edu/education-and-student-affairs/disruptive-behavior-instructional-setting

Threatening Behavior Policy: The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to one’s self, http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students

Nondiscrimination and Anti-harassment Policy:
The University of Arizona is committed to creating and maintaining an environment free of discrimination, http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

UA Smoking and Tobacco Policy:
The purpose of this Policy is to establish the University of Arizona’s (University) commitment to protect the health of University faculty, staff, students, and visitors on its campuses and in its vehicles, http://policy.arizona.edu/ethics-and-conduct/smoking-and-tobacco-policy

Syllabus Changes: Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Plagiarism: What counts as plagiarism?
• Copying and pasting information from a web site or another source, and then revising it so that it sounds like your original idea.
• Quoting a passage without quotation marks or citations, so that it looks like your own.
• Paraphrasing a passage without citing it, so that it looks like your own.
• Hiring another person to do your work for you, or purchasing a paper through any of the on- or off-line sources.