# Data Science for Social Scientists and Agricultural and Environmental Scientists (AECN-396-002/AECN-896-002)

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**Instructor:** Taro Mieno, 209 Filley Hall, E-mail: tmieno2@unl.edu, Phone: 472-4134

**Lectures and Labs:**

- Lectures: MW 1:30 - 2:50 (zoom)

**Office Hours:** TBA or by appointment, Office 209, Filley Hall.

**Course Description:** The goal of this course is to prepare students for jobs that require quantitative skills beyond Microsoft Excel and graduate programs. The $R$ software is used throughout the course. In order to achieve the goal, students will be introduced to the basics of programming and how to apply it to real world issues in the field of agricultural (agricultural economics, agronomy, etc) and environmental sciences. By completing the course, students will know data wrangling (e.g., merging, transforming datasets), data visualization, and exploratory data analysis, spatial data management.

**Reading Material:** I will mainly follow the following textbooks:

Required: Grolemund, Garrett. and Wickham, Hadley. 2019 "R for Data Science." `https://r4ds.had.co.nz`.

Required: Lovelace, Robin., Nowosad, Jakub., and Muenchow, Jannes. 2019 "Geocomputation with R"

**Prerequisites:** Introductory statistics (STAT 218) or equivalent

**Grading:**

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|---|---|
| Assignments (3 assignments): | 30% |
| Quizes (8 quizzes): | 20% |
| Final project proposal: | 5% |
| Final project presentation: | 5% |
| Final project: | 40% |
| Total: | 100% |

- **Assignments:** There will be 3 take-home assignments that test programming skills learned during lectures. Late submissions will have 1/3 of a letter grade deducted from the grade for that submission, increasing by an additional 1/3 grade for each 24 hours beyond the deadline.

- **Quizes:** There will be 8 quizzes at the beginning of the first class of a week where you will be asked to write R programs to complete several tasks in 10 minutes. Each quiz is worth 2.5 points.

- **Group final project:** In this assignment, you will form a team of two to three students who have similar interests. The group write a short paper with a particular emphasis on programming using real-world data sets. The group must identify a topic that would involve collecting datasets from multiple different data sources. The topic has to be approved by me to avoid a final project without significant programming tasks by Oct, 5th. The proposal of your final project detailing what datasets to use, where you collect them, and how you use them have to be submitted by Nov 2nd.

- **Presentation:** You present your final project in class.

  The final project consists of the following components:

| | |
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| Introduction: | 1. clear identification of what you are trying to find out (research question) |
| | 2. why the research question is worthwhile answering |
| Data description and processing: | 1. describe the nature of the data with summary statistics table |
| | 2. processing data to create a dataset that is ready for exploratory data analysis and visualization |
| Exploratory Analysis: | 1. meaningful data visualization to gain insights into the problem you try to answer |
| | 2. simple exploratory analysis to gain insights into the problem you try to answer |
| Results and discussions: | 1. interpret and describe the results |
| | 2. implications of the results |
| Conclusions | conclusions |

**Important Deadlines:**

- final project topic approved by the instructor (Oct, 5th)

- final project proposal (Nov, 2nd)

- final project submission (Dec, 12th)

**Tentative Schedule:**

| Monday | | Wednesday | |
|---|---|---|---|
| Aug 17th<br>Introduction to R | **1** | 19th<br>Introduction to R, Rmarkdown | **2** |
| 24th<br>Rmarkdown (Quiz 1) | **3** | 26th<br>Data wrangling | **4** |
| 31st<br>Data wrangling | **5** | Sep 2nd<br>Data wrangling | **6** |
| 7th<br>Labor day | | 9th<br>Data wrangling | **7** |
| 14th<br>Merge and reshape datasets (Quiz 2) | **8** | 16th<br>Merge and reshape datasets | **9** |
| 21st<br>Miscellaneous data manipulations | **10** | 23rd<br>How to write and organize codes | **11** |
| 28th<br>Data visualization (Quiz 3) | **12** | 30th<br>Data visualization | **13** |
| Oct 5th<br>Data visualization | **14** | 7th<br>Data visualization | **15** |
| 12th<br>Download on-line data (Quiz 4) | **16** | 14th<br>Download on-line data | **17** |
| 19th<br>Writing your own function (Quiz 5) | **18** | 21st<br>Research flow illustration I | **19** |

| Monday | | Wednesday | |
|---|---|---|---|
| 26th<br>Looping | **20** | 28th<br>Parallel Computing | **21** |
| Nov 2nd<br>Spatial data (Quiz 6) | **22** | 4th<br>Spatial data | **23** |
| 9th<br>Spatial data (Quiz 7) | **24** | 11th<br>Spatial data | **25** |
| 16th<br>Spatial data | **26** | 18th<br>Spatial data | **27** |
| 23rd<br>Spatial data (Quiz 8) | **28** | 25th<br>Research flow illustration II | **29** |
| 30th<br>Final Project Presentation | **30** | Dec 2nd<br>Final Project Presentation | **31** |
| 7th | **32** | 9th | **33** |

**Academic Honesty:**
Students are expected to adhere to guidelines concerning academic dishonesty outlined in Section 4.2 of University's Student Code of Conduct (`http://stuafs.unl.edu/ja/code/`). Students are encouraged to contact the instructor for clarification of these guidelines if they have questions or concerns. The Department of Agricultural Economics has a written policy defining academic dishonesty, the potential sanctions for incidents of academic dishonesty, and the appeal process for students facing potential sanctions. The Department also has a policy regarding potential appeals of final course grades. These policies are available for review on the department's website (`http://agecon.unl.edu/undergraduate`)

**Students with disabilities:**

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.