Behind the Buttons: Math and Literature in Geography

Class Time: **Class Location:**

Instructor: Melissa Rura **office:** **tel:** **email:** Melissa.Rura@utdallas.edu

Web address: Melissa.Rura.us

Office hours: **or make an appointment**

Teaching Assistant: (here to help you learn how to use the library; and second line of defense for questions)

Office Hours: **or make an appointment**

Primary Text: Introduction to Mathematical Techniques used in GIS by Peter Dale CRC Press

Grading: Midterm Exam 33%, Final Exam 33% and Homework 33%

Homework: Collaboration is OK, but you must hand in your own work.

Programming: Some programming will be required for homework, become familiar with MATLAB or an equivalent program.

Homework*:

Class meeting	
Week 1 (3 hours)	Introductions, Syllabus, Discuss Midterm and Final Hw: Read Chapter 1 Characteristics of Geographical Information sec. 1.1 -1.4 pgs. 1-7 Vocabulary List (Write your own definitions, in a paragraph or less, to ten terms from the vocabulary list. Back them up with cites, other than Dale, or justifications, include a bibliography style of your own choosing. Please state the bibliographical style.) Begin reading midterm book
Week 2 (3 hours)	Turn in: Research Interest Topic form, Midterm Book Request form, first installment of portfolio, vocabulary list Hw: Read Chapter 2 Numbers and Numerical Analysis sec. 2.1 - 2.4 pgs. 9-17 Read midterm book
Week 3 (3 hours)	Turn in: Second installment of portfolio Hw: Read Chapter 3: Algebra – Treating Numbers as Symbols sec. 3.1 – 3.4 pgs. 23-31 Read midterm book
Week 4 (3 hours)	Turn in: Third installment of portfolio Hw: Read Chapter 3: Algebra – Treating Numbers as Symbols sec. 3.5 -3.7 pgs. 31-41 Read midterm book
Week 5 (3 hours)	Turn in: Midterm Hw: Read Chapter 4: The Geometry of Common Shapes sec. 4.1-4.4 pgs. 43-53

	Application Reading: Chapter 2.1 pgs. 65-70. Spatial Tessellations: Concepts and Applications. Okabe, Boots, Sugihara
Week 6 (3 hours)	Turn in: Fourth installment of portfolio Hw: Chapter 4: The Geometry of Common Shapes sec. 4.5, 4.6 pgs. 53 – 57 Application Reading: Chapter 3.2.2 - 3.2.8 pgs. 37 – 44. Introduction to Modern Photogrammetry. Mikhail, Bethel, McGlone
Week 7 (3 hours)	Turn in: Fifth installment of portfolio Hw: Chapter 5: Plane and Spherical Trigonometry sec. 5.1- 5.3 pgs. 59-67 Application Reading: Chapter 2.3 pgs. 38 – 44. Remote Sensing The Quantitative Approach. Swain and Davis
Week 8 (3 hours)	Turn in: Sixth installment of portfolio Hw: Chapter 5: Plane and Spherical Trigonometry sec. 5.4 , 5.5 pgs. 67-76 Application Reading: Chapter 55 sec. 55.1 – 55.2 pgs. 55-1 – 55-4. Geodesy. B.H.W. van Gelder in The Civil Engineering Handbook Ed. 2
Week 9 (3 hours)	Turn in: Seventh installment of portfolio Hw: Chapter 7: Matrices, Determinants, and Vectors sec. 7.1-7.3 pgs. 91-98 Application Reading: Chapter 4.5.1 pgs. 92 – 95 Introduction to Modern Photogrammetry. Mikhail, Bethel, McGlone
Week 10 (3 hours)	Turn in: Eighth installment of portfolio Hw: Chapter 7: Matrices, Determinants, and Vectors sec. 7.4 – 7.5 pgs. 98- 105 Application Reading: Chapter 2.6.1 pgs. 32 - 35 General Mathematical and Physical Concepts Mikhail et. al.
Week 11 (3 hours)	Turn in: Ninth installment of portfolio Hw: Chapter 7: Matrices, Determinants, and Vectors sec. 7.6 - 7.7 pgs.105 – 114 Application Reading: Chapter 1.3.2 pgs.13-16. Spatial Tessellations: Concepts and Applications. Okabe, Boots, Sugihara
Week 12 (3 hours)	Turn in: Tenth installment of portfolio Hw: Chapter 9: Transformations sec. 9.4 – 9.7 pgs. 140- 151 Application Reading: Chapter 55 sec. 55.2 pgs. 55-4 – 55-11. Geodesy. B.H.W. van Gelder in The Civil Engineering Handbook Ed. 2
Week 13 (3 hours)	Turn in: Eleventh installment of portfolio Hw: Chapter 9: Transformations sec. 9.4 – 9.7 pgs. 140- 151 Application Reading: Chapter 2 pgs. 78 – 88. Geographic Area and Map Projections. W. Tobler. in Spatial Analysis: A Reader in Statistical Geography
Week 14 (3 hours)	Turn in: Twelfth installment of portfolio Hw: Chapter 10: Basic Statistics sec. 10.1 – 10.3 pgs. 153 – 163 Application Reading: Chapter 3 pgs. 31 – 63. Spatial Sampling. Stehman and Overton in Practical Handbook of Spatial Statistics
Week 15 (3 hours)	Turn in: Thirteenth installment of portfolio Hw: Chapter 11: Best-Fit Solutions sec.11.1 – 11.3 pgs. 173 – 181 Application Reading: Chapter 3 pgs. 31 – 63. Spatial Sampling. Stehman and Overton in Practical Handbook of Spatial Statistics
Week 16 (Exam)	Turn in: Final Portfolio

* The teacher reserves the right to change this schedule at any time

Literature Review Midterm

Choose one of the books on the book reading list or get consent from the instructor for a book of your choosing, which relates to the history of an application of geography or mathematics. This book must be over 100 pages. The student will be responsible for writing a position paper and giving a presentation to the class on the chosen book. The book must be selected by the 2nd class meeting and the paper and presentation will be due the week of midterm exams.

Paper: Includes an abstract of approximately 200 words. The paper should be written as a book review and be approximately two double spaced 11 or 12 pt. font pages excluding appendices, bibliography and abstract. At least the questions: Does this book give insight into an application of mathematics or geography? How or How not? and Would you a recommend this book to your colleagues and peers? Why or why not? should be answered. In addition a half to full page appendix on how this text relates or does not relate to your research interests and a bibliography (style should be consistent but is at the discretion of the author) should be included.

Presentation: This might be a Power Point presentation but does not have to be. The discussion should relate to your key points from the paper and included your discussion in the appendix how the book relates to your research. The duration should be 10 minutes maximum with an additional 5 minutes for questions. Long presentations will be cut off!!!! BE CONCISE!!!!!!

Literature Review Final:

Create a portfolio as described below:

Choose an application of geography in which you have interest such as but **not limited** to:

Human Geography, Physical Geography, Econometrics, Quantitative Geography, Military Geography, Transportation Geography, Medical Geography, Demography, Remote Sensing, Photogrammetry, Urban Planning, Geographical Information Science, Spatial Statistics, ect. …

If your application is not listed see the instructor to have it added to the list.

Each week for 10 weeks a peer reviewed article should be chosen from within your application of interest and read. A maximum 300 word abstract of the article should be written in your own words and a mock email written, addressed to the author of the article asking questions and making comments on what the student has read. This mock email should be no longer than a half page and will be judged on relevance and politeness (Would the author write you back because you ask good / interesting questions and were nice about?) **At least 3** of the articles must be published **before 1980, meaning 1979 or before**.

Each week of the semester excluding 1) the first class meeting and 2) the week of mid-term, one **installment of the portfolio should be turned in** for grading then placed in a 1 or 2 inch binder, which collects all installments, which should then be turned in for the final. Each installment

should include **the student's abstract of the article, a printed copy of the article, and the mock email**.

You should chose, by midterm, **a person of note** within their application. The **finals week** installment of the portfolio is to write a short **2 page biography (double spaced 11 or 12 pt font, bibliography not included in page count)** on that person of notes's contribution to your application of interest including some description of that person's personal life.

Extra Credit:
Find three comics that relate to your application of geography and explain in less than 2 pages how they relate. Include a copy of the comics.

Reading List (Books a short list to choose from):

1. Barabási, A.-L. (2002). **Linked: The new science of networks.** Cambridge, Mass: Perseus Pub.
2. Buchanan, M. (2003). **Nexus: Small worlds and the groundbreaking science of networks.** New York: W.W. Norton.
3. Barabási, A.-L. (2010). **Bursts: The hidden pattern behind everything we do.** New York, N.Y: Dutton.
4. Watts, D. (2003). **Six degrees: The science of a connected age.** New-York: Norton.
5. Oshinsky, D. M. (2005). **Polio: An American story.** Oxford: Oxford University Press.
6. Solomon, S. (2010). **Water: The epic struggle for wealth, power, and civilization.** New York: Harper.
7. Diamond, J. M. (1998). **Guns, germs, and steel: The fates of human societies.** New York: W.W. Norton & Co.
8. Alder, K. (2002). **The measure of all things: The seven-year odyssey and hidden error that transformed the world.** New York: Free Press.
9. Paulos, J. A. (1995). **A mathematician reads the newspaper.** New York: BasicBooks.
10. Kaplan, R. (2000). **The nothing that is: A natural history of zero.** Oxford: Oxford University Press.
11. Day, D. A., Logsdon, J. M., & Latell, B. (1998). **Eye in the sky: The story of the Corona spy satellites.** Smithsonian history of aviation series. Washington, D.C: Smithsonian Institution Press.
12. Brzezinski, M. (2007). **Red moon rising: Sputnik and the hidden rivalries that ignited the Space Age.** New York: Times Books.
13. Gladwell, M. (2000). **The tipping point: How little things can make a big difference.** Boston: Little, Brown.
14. Gladwell, M. (2005). **Blink: The power of thinking without thinking.** New York: Little, Brown and Co
15. Gladwell, M. (2008). **Outliers: The story of success.** New York: Little, Brown and Co.
16. Monmonier, M. (1996). **How to lie with maps.** Chicago: Univ. of Chicago Press

17. Huff, D., & Geis, I. (1954). **How to lie with statistics.** New York: Norton.
18. Levitt, S. D., & Dubner, S. J. (2005). **Freakonomics: A rogue economist explores the hidden side of everything.** New York: William Morrow.
19. Schlosser, E. (2001). **Fast food nation: The dark side of the all-American meal.** Boston: Houghton Mifflin.
20. Levitt, S. D., & Dubner, S. J. (2009). **Superfreakonomics: Global cooling, patriotic prostitutes, and why suicide bombers should buy life insurance.** New York: William Morrow.
21. Johnson, S. (2006). **The ghost map: The story of London's most terrifying epidemic--and how it changed science, cities, and the modern world.** New York: Riverhead Books.
22. Crosby, M. C. (2006). **The American plague: The untold story of yellow fever, the epidemic that shaped our history.** New York: Berkley Books.
23. Crosby, M. C. (2010). **Asleep: The forgotten epidemic that remains one of medicine's greatest mysteries.** New York: Berkley Books.
24. Fenn, E. A. (2001). **Pox Americana: The great smallpox epidemic of 1775-82.** New York: Hill and Wang.
25. Gore, A., & Melcher Media. (2006). **An inconvenient truth: The planetary emergency of global warming and what we can do about it.** New York: Rodale Press.
26. Hawken, P., Lovins, A. B., & Lovins, L. H. (1999). **Natural capitalism: Creating the next industrial revolution.** Boston: Little, Brown and Co.

Reading List (Articles*):

Below is a short list of journals that may be used as starting place to begin a search for articles of interest to a student. Please do not limit yourself to these titles or the topics contained within these journals. The best way to find articles of interest is often to search the topic of interest and find out who (e.g., which schools or researchers) is researching that topic. Often CVs on the internet will point you in the right direction toward newer research. Also, often your textbooks will have cites for topics that will connect you to older research. Always examine the bibliography of a text that you find interesting to "follow the trail" to the literature that pertains to your topic of interest.

A Few Notable Geography Journals:

Geographical Analysis
Photogrammetric Engineering and Remote Sensing (PE&RS)
Environment and Planning B: Planning and Design
Annals of American Geography (AAG)
Professional Geographer
Journal of Regional Science
International Journal of Geographical Information Science (IJGIS)
Transactions in GIS
Computers and Geoscience
Journal Geographic Systems
Geoinformatica
Economic Geography
Environment and Planning D: Society and Space
Geografiska Annaler. Series B. Human Geography
Journal of Cultural Geography
Journal of Historical Geography
Political Geography
Progress in Human Geography
Urban Geography

Vocabulary List

Map
Geography
Geographical Information Science
Human Geography
Physical Geography
Environmental Science
Information
Data
Numerical data
Categorical data
Nominal data
Ordinal data
Interval data
Ratio data
Discrete
Continuous
Scale
Coordinates
Polar coordinate
Cartesian coordinates
Origin
Bearing
Azimuth
Longitude
Latitude
Accurate
Precision
Vector
Raster
Pixel
Topology
Spatial Adjacency
Connectivity
Hypothesis
Dependent
Independent
Interpolation
Extrapolation
Centroid
triangulation
(Delauney triangulation / Dirichlet Voronoi Tesselation / Theissen polygons)
Great circle
Distance
Population
Sample
Link
Connection
Orthogonal
Polygon
Map Project
Map Transformation
Interaction
Measurement scale
Trend
Traverse
Stochastic model
Voxel
Spatial Buffer
Spatial Neighbor
Correlation
Autocorrelation
Null hypothesis
Significance level
Degrees of freedom
Covariate
Parametric equation
Non-parametric test
Residuals
Weights
Node
Measure of central tendency
Observation
Type I error
Type II error
Standard Deviation
Z- Score
Heuristic
Random
Best Route
Mean
Median
Mode
Variance

Research Interest Form

I, _____, am interested in researching topics within the realm of _____. They relate to the Geographical Information Science in the following ways:

_____

_____

_____

_____

_____

_____

_____

Some journals I will initially use to research this topic are the following:

_____

_____

_____

_____

_____

Submitted by: _____ Date: _____

Authorized by: _____ Date: _____

Midterm Book Request Form

I, _____, request the following book be used for my

Midterm Exam:

The complete Chicago Manual of Style cite:

_____

_____

I believe this book might relate to my field of research in the following ways:

_____

_____

_____

_____

_____

_____

Submitted by: _____ Date: _____

Authorized by: _____ Date: _____