GEOL 5315
Geocomputation Syllabus (DRAFT)
Fall 2015
CRN 16032

Lecture: M 2:30-4:20 GEO 302
Lab: W 2:30-4:20 GEO 409

Instructor
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Department of Geological Sciences
GEO 305C
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Office Hours: TBD, during lab, or by appointment

General Information
This course focuses on spatial simulation, computation and analytics using GIS in conjunction with other analysis and modeling software packages. Students will be introduced to fundamentals of scientific programming using NetLogo, ArcGIS, R Statistical Software, and Python. In the last few weeks of the class students will be introduced to emerging topics in “big data” relevant to geospatial analysis and modeling.

Prerequisite: An introductory GIS course or equivalent experience.

Course Objectives
• Expand breadth and depth of GIS analysis and modeling concepts and skills
• Develop knowledge of tools, techniques, and methods used in spatial simulation
• Develop knowledge of principles of programming and practical programming skills
• Introduce newly emerging “big data” analysis and modeling approaches
• Foster ability to efficiently solve complex geospatial problems
• Develop experience completing a GIS project

Academic dishonesty
A student’s submission of work for academic credit indicates that the work is the student’s own. Any outside assistance should be acknowledged. While cooperation during class and in lab is encouraged, all assignments must be constructed and written by each individual student.

Makeup policy
Due dates are firm. 10% will be deducted for each day an assignment is late. Assignments will not be accepted more than one week late. Reading assignments must be complete prior to class. Summaries of assigned journal articles are due at the beginning of class. No late summaries of the reading will be accepted since the purpose is for you to be prepared for class.

Labs are due at the beginning of the next lab.

Students with Disabilities
Students with disabilities are encouraged to meet with the instructor in order that course materials can be updated and adapted appropriately to better foster a positive teaching and learning experience.
**Drop Deadline**
The deadline to drop this class is October 30th. No requests for a withdrawal will be approved by the College of Science after that date.

**Course Textbooks**
Computational Thinking online book:

Reading assignments will be made from Computational Thinking, a free, online source during the first portion of the course, and from journal articles after that. Journal readings will be made available to you in one of the following ways (depending on logistics and copyright issues):

- on the Internet (e.g., certain open-access journal articles and websites);
- at UTEP library hardcopy reserve at the Circulation Desk;
- on UTEP library electronic reserve via library homepage (choose: Services =>course reserves =>type “Geol5315”=>Pennington=>Readings);
- from a UTEP library database (go to the UTEP library home page, and type the exact name of the journal's title into the search window on the left side under E-Journals. This usually results in your being able to access the journal from one or more sources. Be aware that sometimes the listing suggests that fewer years are available than actually are, so always click as far as you can); or
- sent by email to the email address that UTEP has on file for you.

**Grading**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Class participation</td>
<td>20%</td>
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<tr>
<td>Homework</td>
<td>25%</td>
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<tr>
<td>Labs</td>
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<tr>
<td>Final project presentation</td>
<td>10%</td>
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<tr>
<td>Final project write up</td>
<td>20%</td>
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**Class participation**
Class will be participatory rather than lecture based, and depends on your attendance and prior preparation. Your participation grade will be based half on attendance and half on a summary of assigned reading due at the beginning of each class. A sign in sheet will be available; you must sign in and turn in your summary by 2:30 to receive full credit. Late sign-ins will receive half credit for attendance for the day. The summary should be ½ page single spaced, and should demonstrate that you completed the entire reading assignment. Late summaries will not be accepted since the purpose is to ensure you are prepared for class.

**Homeworks**
Homeworks will be assigned to ensure that you understand the methods discussed in class and employed in lab. These will be throughout the course and will be given in lieu of a midterm exam.

**Lab**
Lab will be comprised of a set of exercises and accompanying questions to be answered, along with supporting maps and/or other visualizations. Please ensure that ALL visual products conform to the following guidelines:
A good map/visual should be technically correct, aesthetically pleasing, communicative, and thought provoking. Every map that you turn in will be reviewed using the following six guidelines:

1. Is the purpose clear? Is there a succinct and descriptive title?
2. Are all of the data selected relevant to the purpose? Are there one or more reference layers to provide context?
3. Is the selected level of detail appropriate for the purpose?
4. Are symbols distinctive, intuitive, and easy to interpret?
5. Are the categories appropriate for the purpose, and are there few enough to be cognitively manageable (seven or less)? Are the boundaries of the categories logical?
6. Are explanatory aids present? This includes title, date, author, legend, north arrow, scale bar, and data sources.

**Preliminary project proposal**

The project will be developed around any topic of interest to the student. The project must include some form of simulation that represents entities in space through time, and some outcome of interest that can be measured from simulation results.

The purpose of the project proposal is to verify that the work is appropriate in scope, that the methods proposed are appropriate, that any new data required in fact exist, and that it is possible to complete the project in the time allocated. This description should be 1-2 pages in length. Make sure to include the following:

- What problem will be addressed and why it is of interest to you.
- Goal: What is the big picture goal of this work?
- Objectives: What objectives will need to be conducted to accomplish this project?
- What data are required and if new data are needed, where do you intend to obtain these data?
- What methods do you intend to use?
- What concerns do you have or what problems do you anticipate encountering?

**Final Project**

The project must involve spatial simulation through time including a major GIS component. It can be conducted from within any of the environments introduced in this class, but if outside of GIS, it must utilize GIS plugins and extensions in significant ways. Results will be presented during a presentation November 23 or 30, and in a project report due Monday December 7 at 4:00 pm.

**Report Guidelines**

Report sections must include:
- Introduction
- Goals and objectives
- Methods
  - Input data types
  - Data abstraction table
  - Algorithmic flowchart
- Results
  - At least one map
  - At least one graph showing analytical results through time
- Conclusions
<table>
<thead>
<tr>
<th>DATE</th>
<th>LECTURE</th>
<th>READING</th>
<th>DUE</th>
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<tbody>
<tr>
<td>24-Aug</td>
<td>Introduction; Computational thinking</td>
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<tr>
<td>31-Aug</td>
<td>Computational thinking</td>
<td>CT 1.1, 1.3, 2.3</td>
<td>HW 1: Essay</td>
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<td>7-Sep</td>
<td>Labor Day - no class</td>
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<td>14-Sep</td>
<td>Computational thinking</td>
<td>CT 2.2-2.4</td>
<td>HW 2: Abstractions</td>
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<td>21-Sep</td>
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<td>HW 3: Algorithms</td>
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<td>28-Sep</td>
<td>Geosimulation, ABM, Cellular automata</td>
<td>Manca (2014); Zvoleff (2014)</td>
<td>HW 4: Application</td>
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<td>article &amp; handout</td>
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<td>26-Oct</td>
<td>Geosimulation applications</td>
<td>Lee (2014); Rivaes (2014)</td>
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<td>2-Nov</td>
<td>Geosim apps/emerging trends</td>
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<td>9-Nov</td>
<td>Data science</td>
<td>Guest speakers</td>
<td>HW 5: Essay</td>
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<td>16-Nov</td>
<td>Data science</td>
<td>Guest speakers</td>
<td>Slides, One page</td>
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<td>23-Nov</td>
<td>Project presentations</td>
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<td>30-Nov</td>
<td>Project presentations</td>
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<tr>
<td>7-Dec</td>
<td>Final</td>
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<td>Project write up</td>
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CT = Computational Thinking (online)


