

# COMPUTER APPLICATIONS IN THE GEOSCIENCES

-- FALL 2008 --



**INSTRUCTOR:** Dr. Bridget Konter

**OFFICE:** GEOL. 305

**OFFICE HOURS:** Mondays & Tuesdays 3-4, or by appointment

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**WEBPAGE:** <http://www.geo.utep.edu/pub/bkonter>

**COURSE LECTURE DAY/TIME:** Thursdays 8:30-10:20

**LOCATION:** GEOL. 4<sup>th</sup> floor computer lab

**COURSE REF. NUMBER:** 11511 and 15796

**COURSE DESCRIPTION:** This course will consist of weekly lectures and “hands on” computer exercises designed to expose you to common software and computational methods frequently utilized in the geological sciences. Lecture topics will include introductory Unix applications, webpage design, general MS Office and Adobe suite tips/tricks, and computational techniques using MATLAB, GMT, and visualization (Fledermaus, GRASS) software. The course will also focus on the development and presentation of 2 projects: 1) Software Manual Project and 2) Visualization Project. For the Software (Sw) Manual Project, you will be required to write a user’s manual for a software package of your choosing. For the Visualization Project, you will be required (don’t worry, it will be fun!) to develop a visualization scene (a 3-D interactive map) of a research area of your choosing.

WEEK	DATES	LECTURE TOPIC	DUE DATES/ ETC.
1	Aug. 28	Intro to Department Computing	
2	Sep. 4	Unix basics	
3	Sep. 11	Word & Data Processing	Project topics (2) due
4	Sep. 18	Presenting and Publishing	
5	Sep. 25	MATLAB	Sw Manual outline due
6	Oct. 2	GMT	
7	Oct. 9	Sw Manual work day	GSA week
8	Oct. 16	Visualization I (Fledermaus)	
9	Oct. 23	Visualization II (GRASS)	Visualization outline due
10	Oct. 30	Surfer	1 <sup>st</sup> draft Sw Manuals due
11	Nov. 6	Google Earth & ARC GIS	Sw Manual critiques due
12	Nov. 13	Sw Manual presentations	
13	Nov. 20	Visualization project work day	Final Sw Manual due
14	Nov. 27	Thanksgiving Holiday	No Class!
15	Dec. 4	Visualization presentations	
16	Dec. 11	Finals week	No Class!

**CLASS WEBSITE:** [http://www.geo.utep.edu/pub/bkonter/geol\\_5215](http://www.geo.utep.edu/pub/bkonter/geol_5215)

Check the class website often for updates and announcements. The website is a key part of the class and will be the venue for a lot of important class business.

**TEXTBOOK:** No text will be used for this course. Handouts will be given in class when applicable.

**ATTENDANCE:** Attendance is expected each week. As class meetings will be mostly “hands on” practice, it is highly recommended that you not only bring your body to class, but your mind and your concentration as well! If you need to miss a class, please let me know ahead of time. It will be your responsibility to collect notes from a fellow classmate. **PLEASE BE ON TIME!**

**GRADING:**

<b>WEBPAGE DESIGN &amp; MAINTENANCE</b>	<b>10%</b>
<b>HOMEWORK ASSIGNMENTS</b>	<b>30%</b>
<b>SOFTWARE MANUAL PROJECT</b>	<b>30%</b>
<b>VISUALIZATION PROJECT</b>	<b>30%</b>

**WEBPAGE:** An integral part of this course will be the development and maintenance of a personal webpage. Your webpage will be hosted on the Department server at <http://www.geo.utep.edu/pub/username>. You will use this webpage to 1) showcase YOU, 2) showcase your research, 3) communicate (and archive) computer exercises and materials in this course. Your webpage should be professional and organized, but should also reflect your creative side as much as possible. For this class, your webpage will serve as a type of “computer journal”, where you will post each completed computer exercise to your own personal computer class page. More details on how to do this and grading criteria will follow.

**HOMEWORK:** Homework assignments will be assigned weekly. Each assignment will be due the following week at the beginning of class. You will be required to post each completed assignment to your website, where I will then grade each assignment and provide any necessary feedback.

*Free-homework-pass:* Your lowest graded homework will not be counted in your final grade tally. This means that you have ONE no-questions-asked excused homework, so use it wisely.

*Working together on homework:* Studies have shown that students learn best when they work together. I encourage you to work with each other on assigned homeworks. However, each student must turn in his or her own assignment, using his or her own words. Any student who fails to follow this rule will receive zero credit for homework assignment.

**SOFTWARE MANUAL PROJECT:** For the Software Manual project, you will write a user's manual for a software package of interest to you. It can either be for software we currently have available in the Department that is poorly documented, or can be freeware/shareware that you have found on the internet that you would like to get installed and running during the semester. Tentative benchmarks for this process are described below:

- DISCUSSION OF POSSIBLE SOFTWARE MANUAL PROJECT TOPICS: **SEPTEMBER 11**
- SHORT (1 PAGE) OUTLINE OF MANUAL PROJECT DUE: **SEPTEMBER 25**
- 1<sup>ST</sup> DRAFT MANUAL DUE: **OCTOBER 30**
- MANUAL CRITIQUES DUE: **NOVEMBER 6**
- PRESENTATIONS: **NOVEMBER 13**
- FINAL VERSION OF MANUAL DUE: **NOVEMBER 20**

The 1st draft of your software manual will be due Thursday, October 30<sup>th</sup> at the beginning of class. You must provide both a paper copy and post a pdf document of your manual on your webpage. Each person in the class will then be assigned to read/critique 2 other manuals. I will also read each manual and provide comments for improvement. Software manual critiques will be given back to you the following week, November 6<sup>th</sup>. Short oral presentations (~10 minutes) of your software manual will be given on November 13<sup>th</sup>. You will use the feedback/questions from both your critiques and presentation to revise your manual, with a final version to be turned in by 5pm on November 20<sup>th</sup>.

You should shoot for a manual that is roughly 10-15 pages, complete with figures, examples, and text following the guidelines below. At a minimum, your software manual must contain the following:

1. **Table of Contents**
2. **Introduction:** explain what the software does, how it may be useful in geological/environmental applications, and where it can be found in the department (specific computers may have it installed, others may not).
3. **Simple Tutorial:** describe what the user needs to know to get started with the software, provide examples like input, output, graphics of screen captures, etc.
4. **Advanced Applications:** describe any other kinds of analyses the user can do with the software, how the software works in more advanced cases.
5. **Conclusions:** summarize the advantages/disadvantages/pitfalls of using the software package, compare to other software packages with similar attributes.
6. **Quick Guide:** a one-page "cheat sheet" showing the most useful options/commands in the software package that someone can use for a quick reference

7. **Optional:** Appendices showing additional information (other input/output, advanced examples)

Grading will be based on:

- 1) *Content* (50%): does the manual contain all of the required items from above?
- 2) *Readability* (25%): is the manual readable, understandable; do both the student reviewers and I find it easy to follow?
- 3) *Creativity, and organization* (25%): is the manual more than just a how-to list for generating numbers or figures, or did you make an effort to make it interesting, applicable, and helpful; is the manual organized well?

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**VISUALIZATION PROJECT:** The goal of the Visualization Project is to learn how to gather, display, and present research quality data to both technical and general audiences using 3-D visualization and multimedia techniques. You will be given the opportunity to choose a geographic region to “visualize”. If you are already working on a research project for your thesis, I highly recommend that you develop your visualization project around this topic. The fundamental goal for your visualization project should be to develop a 3-D interactive map of data and images that you can use in future settings (i.e., scientific presentations, poster displays, general education talks, classroom teaching). We will work toward building a final visualization scene that can be displayed on the monitors outside the Cyber-ShARE Center, located on the 1<sup>st</sup> floor of the Geological Sciences Department. Tentative benchmarks for this process are described below:

- DISCUSSION OF POSSIBLE VISUALIZATION PROJECT TOPICS/REGIONS: **SEPTEMBER 11**
- SHORT OUTLINE (LIST OF DATA) FOR VISUALIZATION PROJECT DUE: **OCTOBER 23**
- VISUALIZATION PRESENTATIONS: **DECEMBER 4**

You will have the option of using either Fledermaus or GRASS visualization software for this project. The basis of your visualization project will be SRTM topography, which will serve as the backdrop setting for your visualization. We will practice using this dataset in class, using both Fledermaus and GRASS software.

***Your primary task throughout the semester will be to search for data resources that you can include in your visualization scene. These can be from the internet, or you may already have a dataset ready to go, or you may have to make a dataset from scratch.***

An example visualization of the San Andreas Fault might include the following elements:

- 1) SRTM topography
- 2) San Andreas fault locations
- 3) Major cities/county lines
- 4) Coastlines
- 5) Earthquake locations, color-coded according to magnitude
- 6) Imbedded aerial images of the tectonic landscape

Your final visualization project will include the following:

1. A “packaged” visualization scene, which must contain at least 5 “layers” of interactive data.
2. A short digital movie of your visualization “fly-through”.
3. A short summary of your visualization and any conclusions that you are able to make about the data you are presenting (a few paragraphs to 1 page in length is fine).
4. A reference list of data used in the visualization.