

GIS in Water Resources

There are three questions on this exam. Do all three questions. For the first two questions, prepare a 2-page typed theme paper. For the third question use ArcGIS to prepare the map and answers requested. *Staple all three solutions together in the order of the questions*, and turn in the result to the CEE secretary in EL211, by 5PM on Friday, December 15. This is a take-home exam. You are honor bound not to discuss this exam with your colleagues in the class. Your answers should be the result of your work and thought alone. Be assured that if essentially the same idea appears in answers from more than one person, it is fairly easy to recognize that when the grading is being done. If that happens, it is not clear from whom the idea originated and who is just using somebody else's knowledge. So, keep your ideas to yourself!

The term papers that you choose to describe in answering Questions 1 and 2 should be mutually exclusive, that is, if you focus on particular term papers in answering one of the questions, don't focus on the same papers when answering the other question. The Texas class term project listing can be found at:

<http://www.ce.utexas.edu/prof/maidment/giswr2006/docs/termprojlist.htm>. The Utah class term project listing can be found at:

<http://www.engineering.usu.edu/cee/faculty/dtarb/giswr/2006/students.html>. The Nebraska class term project listing can be found at:

<http://bse.unl.edu/airmak/giswr/2006/TermPaperProjects.html> You will need to use projects from three locations in preparing your answers.

What we are looking for in grading your answers to the first two questions is:

- **Knowledge of the facts.** Make sure you lay out the facts of what has actually been done before you start offering opinions about what could have or should have been done. This particularly applies to the discussion of term papers. Make sure you discuss what was actually done in the term paper not just about the general subject itself.
- **Thoughtful evaluation.** How do you evaluate the advantages and limitations of the principles, methods and data that have been used? How does the knowledge you've learned in this class relate to the world around us? I am looking for a sense of reflection here, of seeing you set individual situations and facts in a larger context in an intelligent way.

Questions

1. Compare and Contrast Two Applications Dealing with the same Theme

Choose two term papers that deal with the same or similar themes or topics. Neither of these papers should be your own term paper. Briefly summarize the contents of the papers (the problem examined, the method of analysis, the results achieved). Compare and contrast the approaches to the problem that the two papers took. Which technical approach do you think was more effective? Why? Which paper does a more effective job of communicating its results?

Why? Suppose you were undertaking a study of this same subject. Having studied these two papers, what have you learned about how to go about your investigation effectively? What would you do differently from what the authors of these papers did?

2. Write an Assessment of the Utility of GIS in a Particular Application Area

Student term papers on a range of topics have been presented. Select four papers that fall within a similar subject area and present a critique of how effective GIS is in its application in this subject area. What is the scope of the application area? How has GIS been used? What types of problems have been solved effectively? What limitations exist that have yet to be overcome in the application of GIS in this area? *In your answer, you must refer specifically to work presented in term papers prepared in this course.* In other words, I am not looking here just for a general statement about your opinions in the field but rather a deduction based on the term papers presented in this class of what has been done and how you judge the effectiveness of that. At least one of the papers should be from each of the participating Universities (i.e. at least one from each of Texas, Utah and Nebraska, with the fourth from wherever you choose).

3. San Marcos Basin Urban Area

Background and Context. Urbanization has a significant affect on hydrology through the increased impervious surfaces, urban drainage and pollutants that enter streams from urban areas.

Question. The zip file ex5.zip

(<http://www.ce.utexas.edu/prof/MAIDMENT/giswr2006/Ex5/Ex5.zip>) that you worked with in exercise 5 contains the NHDPlus information for the San Marcos Watershed. The zip file nlcd.zip (<http://www.engineering.usu.edu/cee/faculty/dtarb/giswr/2006/nlcd.zip>) contains the National Land Cover Dataset for this region downloaded from the seamless data server. NLCD summary information is also in the table 'catchmentattributesnlcd' in the NHDPlus geodatabase but for some questions you will need to use the NLCD grid in the nlcd.zip file. The classification system used by NLCD data is described in the brochure (<http://erg.usgs.gov/isb/pubs/factsheets/fs10800.pdf>) that is attached. Urban areas are indicated by NLCD codes 21, 22 and 23. The map below shows the NHDPlus flowlines and catchments for the San Marcos Watershed from ex5.zip. Also shown is Urban land cover and the 8 USGS stream gages that are in the SanMarcos_NHDPlus_raw.mdb/Hydrography/USGSGageEvents feature class.

- a) Calculate both the area and the fraction of each NHDPlus catchment that is urbanized and prepare a map that shows the catchments with a graded color scheme depicting the fraction that is urbanized. Add a legend, scale and other appropriate labeling to the map to give it a professional appearance.
- b) Identify the catchment that has the highest fraction of area that is urbanized. For this catchment report the COMID, Area and Fraction of Area that is Urban. Also report the name and COMID of the NHDFlowline stream that flows through this catchment.
- c) For each NHDPlus stream segment calculate the following:
 - Urban area that is within a 200 m buffer of the NHD streams. (Hint: Use the "buffer" tool.).

- Fraction of area within the 200 m buffer of the streams that is urbanized.
 - Identify the stream segment that has the highest fraction of area urbanized within the 200 m buffer of streams. Report the COMID, Name, buffer area and fraction of area within the 200 m buffer that is urban.
- d) For the three USGS gages, "San Marcos River at San Marcos, TX", "San Marcos River at Ottine, TX" and "Plum Creek near Lockhart, TX" calculate the following quantities:
- Total Drainage Area
 - Total Drainage Area that is Urban
 - Fraction of Drainage Area that is Urban
 - Urban area in the upstream catchments that is within the 200 m buffer of streams
 - Fraction of area in upstream catchments that is within the 200 m buffer of streams that is urban.

In preparing your answers describe the ArcGIS steps and functions used to obtain your results. Also describe any approximations you made and discuss the likely magnitude of error that may be due to these approximations.

