Introduction

This course is intended for students with an interest in analytic methods that are used in planning and public decision-making. It focuses on quantitative models used in the analysis of demographic, economic, land use, transportation, and environmental phenomena in urban and regional planning. The principal topics include: the roles and limitations of mathematical and statistical models in planning; models used in evaluating and managing public projects and programs; models used for the optimization and allocation of resources and economic activity; linear and nonlinear trend extrapolation techniques; and models used in regional income and employment analysis. The course has four student learning objectives:

1. To gather, analyze, and interpret secondary data used in planning;
2. To promote confidence in supporting written arguments with quantitative reasoning;
3. To become proficient in using computer spreadsheets; and
4. To gain a critical perspective of how models are used in urban and regional planning.

Prerequisites

The course assumes that students have had mathematical training in basic algebra and the use of logarithms, as well as exposure to descriptive and inferential statistics such as Plan 601, Econ 321, Pols 310, Geog 380, Psy 210, Soc 475, or the equivalent. Knowledge of computer spreadsheets (e.g., Excel) is essential for completion of all homework assignments. If you need a tutorial on spreadsheets, please inform the instructor.
Course Requirements

The course uses a lecture and class discussion format. Lectures are based on assigned readings listed in the attached Class Schedule. Course requirements include:

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<tr>
<th>Requirement</th>
<th>Points</th>
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<tr>
<td>Six homework assignments</td>
<td>500</td>
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<tr>
<td>Class participation</td>
<td>50</td>
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<td>Term paper proposal</td>
<td>30</td>
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<td>Term paper</td>
<td>170</td>
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<td>Mid-term exam</td>
<td>100</td>
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<td>Final exam</td>
<td>150</td>
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Homework assignments will be distributed in class and should be submitted at the end of class on the dates indicated in the Class Schedule. Written tutorials will be distributed to help students develop math and computer skills needed to do the homework assignments and possibly the term paper. Tutorials will not be graded.

Students are expected to participate in class discussions and to stay current in the readings. Students who participate regularly in class are more likely to receive a better grade for the course.

Both examinations will cover topics discussed in the lectures, readings and homework assignments. Examinations will consist of multiple-choice questions and short problems similar but less complex than the homework assignments. The instructor will review pertinent topics on the exam during the class period prior to the exam. Bring pencils, erasers, and a well-charged, battery-operated calculator to each exam. Students will not be allowed to use computers or smartphones during exams.

Grading Policy

The following table shows the minimum points needed to earn certain grades:

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<th>Grade</th>
<th>Points</th>
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<tr>
<td>A+</td>
<td>976</td>
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<tr>
<td>A</td>
<td>926</td>
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<tr>
<td>A-</td>
<td>900</td>
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<tr>
<td>B+</td>
<td>876</td>
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<td>B</td>
<td>826</td>
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<td>B-</td>
<td>800</td>
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<tr>
<td>C+</td>
<td>776</td>
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<td>C</td>
<td>726</td>
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<td>C-</td>
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Incomplete grades will be given only if you have compelling reasons, such as extended illness or unexpected overseas travel. Please notify the instructor whenever you must be absent from classes for an extended period. Time management is an important academic and job skill. Hence, insufficient time to complete assignments is not an adequate reason for requesting an incomplete grade.

Office Hours

My office is located in Saunders 107A. Regular office hours are from 3:00 to 4:30 p.m. on Mondays and from 4:30 to 6:00 p.m. on Tuesdays. If these hours are not convenient, please make an appointment. At the university, I can be reached by telephone (956-8684), facsimile (956-6870), and e-mail (flachsba@hawaii.edu). Please leave a voice mail message if I am not in the office. If you send assignments to me by facsimile, please note that the department may assess page charges. Please do not submit written assignments as attachments to e-mail messages unless instructed to do so.

Lecture Notes

I am willing to share digital copies of his lecture notes with students upon request. These notes may include topics that will not be presented or discussed in class. Please pick up handouts distributed in classes that you are unable to attend.

Readings

Several lectures are based on the following textbooks. These books are not on sale at the University Bookstore, but they will be on the reserve shelf in the Wong Audio Visual Center on the third floor of Sinclair Library.


Listed below are assigned readings in the Course Reader (CR). In the Class Schedule, the symbol (CR) appears after pages assigned from these readings. I will transfer a digital file of the Course Reader, which is about 147 MB in size, to your thumb drive.


**Reserved Readings**

Some of the assigned readings in the Class Schedule can be found on the reserve shelf of the Wong Audio Visual Center on the third floor of Sinclair Library (SL).


Homework Assignments

The purpose of the six homework assignments is to develop your analytical skills in the use of quantitative methods and models in planning applications. These assignments will be distributed in class throughout the semester. Students may discuss and work together on these assignments but must submit independent work. Unless otherwise indicated, please submit each assignment after class on the date shown in the Class Schedule. Do not send completed assignments to the instructor by e-mail.

Please show all work in an organized format and underline or highlight final answers to each question. You do not need to type your work if you can write or print legibly. Attach pages with a staple or paper clip in the upper left-hand corner. About 20 percent of the maximum value of the assignment will be deducted for each school day that your assignment is late. This rule is necessary to be fair to students who submit their assignments on time.

Graded assignments will usually be returned within a week after the due date. Any assignment submitted after it has been graded and returned will be considered “very late.” The maximum points that can be earned for a “very late” assignment are half the indicated point value of the assignment. Exceptions may be granted in cases involving extended absence from class due to illness or comparable reasons.

Term Paper

The term paper will give you an opportunity to develop your own planning model, support written arguments with quantitative reasoning, and instill a critical perspective of models used in planning applications. For this paper, you may either (A) develop a model using secondary data that allows you to analyze or understand a current planning problem, or (B) analyze and evaluate a model developed by someone else. Each option is described in more detail below. Please consult with the instructor prior to finalizing a topic.

The first task will be to describe your topic in a brief memorandum, which is due on the date shown in the Class Schedule. This memo should not exceed three pages. The proposal should contain:
a preliminary title
the purpose and scope of your project
why you think the topic is important
questions you intend to answer
how you intend to accomplish the work
anticipated data sources
some preliminary references

This memo will help me to assist you with your topic and offer suggestions. Do not propose a project that cannot be finished this semester. Once I have approved the topic, continue your research and write the paper. Unless you receive permission, the final paper should not exceed 12 double-spaced pages with one-inch margins (not counting tables, figures, references, and appendices which should be attached at the end of the paper), using a legible font (e.g., 12 point). Appearance, format and writing style count, because they are important in professional planning practice. Please read the following article, which is in the Course Reader, on how to improve your writing skills. The term paper is due on the date shown on the Class Schedule.


Term papers will be penalized 10 percent of their maximum point value for each working day that the assignment is late. The two options for the term project are described below.

A. **Model Development**

This option is better suited to students who have completed Plan 601 or equivalent, as well as students who are doing research on a master's thesis or a doctoral dissertation that involves the analysis of quantitative data. This option will allow you to further develop skills that you learn in Assignments #2-1 and #3-1. Knowledge of statistical software (e.g., SAS, SPSS) may be necessary to develop your model.

In this option you will develop a multivariate regression model or models that help you understand and analyze a planning problem. The problem should involve forecasting future employment, population, travel behavior, housing supply/demand, or energy, environmental or social phenomena. Please use annual historical data available from secondary sources, such as:

State Department of Business, Economic Development and Tourism. *State of Hawai’i Data Book*. Honolulu, Hawaii. (Spreadsheets of various tables in this book can be found at this Web site: Hawaii.gov/dbedt/info/economic/databook/.)


Begin by defining an urban or environmental problem and important elements of a system affecting that problem. Describe a simple conceptual model of 10 to 12 interrelated
elements or factors of the system and illustrate your description with a diagram. Identify the elements of the system that are amenable to measurement using secondary data. Identify the independent and dependent variables. For independent variables, state which could be controlled or influenced by public policy, which are affected by the private sector, and which variables are beyond human control.

Next, collect and “clean” the data for the variables in your models. Assess the extent of missing data for each variable and determine whether any variables are highly correlated using appropriate statistical measures. Then develop the parameters for several, multivariate regression models using your data set and suitable computer software (e.g., SAS, SPSS). Evaluate and interpret the results of your models and make recommendations on how they could be improved.

B. Model Evaluation

This option will enable you to become familiar with quantitative models used in urban and regional planning. There are three choices for this option:

1. Planners use models for forecasting and evaluation in various fields of planning including economic development, environmental protection, housing, resource management, and transportation. With assistance from the instructor, select a model used by a governmental agency or its consultant, or a model discussed in the planning literature, such as those listed below:


Stone, Brian Jr., Adam C. Mednick, Tracey Holloway, and Scott N. Spak. 2007. “Is compact growth good for air quality?” Journal of the American Planning Association 73 (4): 404-418. [See also the companion article by Steve Winkelman in the same issue of this journal.]


Your paper should try to answer the following questions and whatever additional questions you think are appropriate.

- What planning problems are addressed by the model?
- What is the purpose of the model?
- What assumptions does the model make?
- What are the model's limitations?
- What are the inputs and outputs of the model?
- What are the policy relevant inputs and outputs?
- How accurate and reliable are the forecasts made by the model?
- How was or could the model be used to support planning decisions?
- How does variation in model inputs affect outputs?

2. Select a model discussed in one of the following two books on reserve at Sinclair Library. To evaluate the model, you may use the data provided by the author(s) or you may use other data if they are available. In your paper, answer the questions above (at the end of Section B-1) as appropriate.


This book has a companion diskette that must be used on an IBM PC. The diskette is available from the instructor. Select one of the following chapters:

Chapter 13  SMOKE: Air Pollution Dispersion
Chapter 14  RISK-EQ: Earthquake Risk Analysis
Chapter 15  MANAGER: Project Management
Chapter 17  AHP: Multiple Criteria Evaluation
Chapter 19  REIA: Real Estate Investment Analysis
Chapter 20  TRANSIT: Guideway Systems Cost Estimation
Chapter 21  RETAIL: Retail Trade Spatial Interaction
This book does not have a companion diskette. First, read the introduction, “Simulation Modeling and Spreadsheets” on pages 1-16. Then select one of the following chapters listed below and build the model discussed in that chapter using a computer spreadsheet. The recipe to build the model appears in the appendix. Run the model using data provided by the author to verify that you have correctly constructed the model. Then test the sensitivity of the model’s outputs to different inputs. Discuss the model and your results in the paper. Choose your model from one of the following chapters:

Chapter 1  Blowing Smoke: Atmospheric Dispersion of Air Pollution
Chapter 2  Running Water: The Underground Transport of Pollutants
Chapter 4  Sustainable Yield: Managing the Forest for the Trees
Chapter 5  Here Comes the Sun: Energy from a Flat-Plate Collector
Chapter 6  Macroeconomic Policy: Econometrics and the Klein Model
Chapter 7  Urban Form: The Lowry Model of Population Distribution
Chapter 8  Affordable Housing: The Bertaud Model
Chapter 9  Traffic on the Roads: Modeling Trip Generation and Trip Distribution
Chapter 10 Throwing Things Away: A Model for Waste Management
Chapter 11 Multi-Criteria Analysis: An Environmental Impact Assessment Model

3. Become familiar with a simulation game such as SimCity or SimEarth. A brief description of each follows:

a) In SimCity, you make decisions on zoning, balancing budgets, installing utilities, manipulating the city's economy, and controlling crime, traffic and pollution. You can create your own city or start with different pre-built cities.

b) In SimEarth, you work with a model of the earth's ecosystems to learn about the interdependence of our planet's physical and ecological systems. Some knowledge of the earth's ecosystem is necessary to play SimEarth.

If you choose Option B-3, do the following:

• Briefly review the origin and evolution of simulation games.

• Select one aspect of the game (e.g., pollution in SimCity or global warming in SimEarth) and create a conceptual diagram that includes both the important variables involved and the functional relationships between them.

• Describe the specific strengths and weaknesses of the simulation. Suggest ways the simulation could be improved to remove weaknesses.
• Evaluate the overall reality of the simulation. Determine whether any important variables or functional relationships are missing from the game.

• Recommend how the simulation could be used in planning, both as an educational tool and as a means to inform or make policy decisions.

Here are four references for this option:


Gaber, John. 2007. “Simulating planning: SimCity as a pedagogical tool,” *Journal of Planning Education and Research* 27 (2): 113-121. [This article is toward the front of the Course Reader.]


**Calculator and Personal Computer**

You will need a calculator and access to a personal computer to complete the homework assignments and term project. Microsoft Excel will be the standard computer software for this course. In addition to the department’s computer lab in Saunders 112, there are PC and Mac labs on campus. Bring your calculator to class for in-class exercises and during examinations. Laptop computers will not be allowed during exams, but may be used during lectures. If you need to purchase a calculator, buy one that has the following basic key functions:

- standard arithmetic operations (+ - x ÷)
- logarithmic and exponential functions of numbers
- mean and standard deviation of a set of numbers
- powers and roots of numbers
- reciprocals of numbers