Department: Geography

Course No: GEOG 242Q

Title: Geographic Data Analysis

Credits: 4

Contact: Alexander Vias

WQ: Q

Catalog Copy: GEOG 242Q. Geographic Data Analysis. Second Semester. Four credits. Three class periods and one 2-hour laboratory. Prerequisite: MATH 101 or passed Q Readiness Test or passed a Q course. Recommended preparation: 100-level STAT. An introduction to the use of quantitative methods in conducting research, with particular emphasis on the processing and analysis of geographic data.

Course Information:

1. Course goals, objectives, requirements, themes, issues etc.

a. The purpose of this course is to consider the nature of geographic data and to teach

students quantitative methods for analyzing geographic and thematic attribute data for objects of analysis modeled as points, lines, and areas. The course requires students to view data both graphically and cartographically (in graph and map forms) and

numerically. Some of the graphical and numerical analysis will be accomplished through a series of laboratory exercises using SAS for the personal computer. Some laboratory exercises will not require use of the computer. Students completing the course readings, exercises and examinations should be able to explain the nature of geographic data,

select appropriate cartographic and numerical methods for answering a question, use SAS software to perform selected analysis, and interpret the results of the analysis.

b. Student evaluation is based on class participation, 25 laboratory exercises, a midterm

examination, and a comprehensive final examination. Performance on the laboratory exercises accounts for most of the student's final grade.

c. The course begins with a consideration of the special properties of geographic data and

basic issues in measurement, graphing, and mapping. Quantitative methods for describing point features including their position and spatial distribution are covered. Methods for analyzing line features (measuring the length of a stream, for example)

and linear networks are addressed as are methods for describing areas. The last section of the course considers methods for comparing points distributions, determining whether or not a point lies inside an area, and so on. Database concepts are also emphasized. The course is an important foundation for understanding geographic information systems.

Q Criteria:

Although 200 level courses do not require a Q designation under the new General Education guidelines, the Geography Department wishes to submit GEOG 242Q for Q designation. GEOG 242Q is a 200 level course that has a 100 level Q prerequisite but Geography is a department that has no 100 level Q courses and the course fulfills a requirement for our majors. The course may also be used to satisfy a requirement for majors in the Urban and Community Studies program. Students in other majors have also taken the course.

1. GEOG 242Q includes the use of mathematics and/or statistics at or above the basic algebra level as an integral part of the course. Students learn how to convert data from one measurement system to another, recognize and apply linear, power, exponential, and logarithmic functions in various models, calculate and apply univariate and multivariate descriptive statistics for map classification and other purposes, and calculate measures of spatial autocorrelation in data.

2. Laboratory assignments require students to develop conversion factors, graph linear, power, exponential, and logarithmic functions, calculate distances based on Euclidean and other metrics, calculate basic univariate descriptive statistics like mean, median, mode, midpoint of the range, range, variance, and standard deviation by hand and using

the computer, and many other types of analysis.

3. Students work with a data set describing Connecticut's public institutions of higher

education drawn from real world sources and with several other data sets describing geographic features in Connecticut. Laboratory exercises require students to

analyze the data by carrying out actual mathematical or statistical manipulations, map and graph data and results, and answer questions or draw conclusions based on the geographic data analysis.

Role of Grad Students: Graduate assistants in the course attend the laboratory sessions, which are taught by the faculty member. The graduate assistant provides additional support to students as they complete the laboratory assignment for the day. Graduate assistants prepare laboratory exercises. Graduate assistants hold office hours to provide extra help for students outside of class in addition to the office hours provided by the faculty. Graduate assistants provide help to students who have missed a laboratory class period. The faculty member grades all laboratory assignments and examinations.

Supplementary Information: Course Syllabus and Sample Exercise/Lab shown below.

Geography 242Q-01 Ellen K. Cromley

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Spring Semester, 2003 486-5952

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http://www.geog.uconn.edu

OFFICE HOURS W 9:00 am - 10:00 am, 1:00 pm - 2:00 pm

Tu, Th 11:00 am - 12:00 pm

By appointment at other times

PURPOSE

The purpose of this course is to consider the nature of geographic data and to teach students quantitative methods for analyzing geographic and thematic attribute data for objects of analysis modeled as points, lines, and areas. The course requires students to view data both graphically and cartographically (in graph and map forms) and

numerically. The graphical and numerical analysis will be accomplished through a series of laboratory exercises using SAS for the personal computer. Students completing the course readings, exercises and examinations should be able to explain the nature

of geographic data, select appropriate cartographic and numerical methods for answering a question, use SAS software to perform the selected analysis, and interpret the results of the analysis.

This course is a 4-credit hour course. The course satisfies a "Q" requirement and is required of all geography majors.

TEXTBOOKS

Required: Lora D. Delwiche and Susan J. Slaughter, 1998, The Little SAS Book: a Primer 2nd edition, Cary, NC: SAS Institute Inc.

POLICIES

Regular attendance is a necessity. This applies to lecture and laboratory periods.

Students are expected to observe all rules and regulations governing use of the Geography Department's Teaching Laboratory and its facilities. Student use of computers during the laboratory period must be limited to class work for 242Q only.

Make-up exams will be scheduled only in the event of personal illness, schedule conflict or other extraordinary circumstance. Anyone who will miss an exam must notify me in advance of the exam date and time.

Dates of assignments, other handouts, and examinations are given on the attached pages. Unless otherwise announced, laboratory exercises are due at the end of the laboratory period. Late assignments will be accepted up to one week following the due date

with a 25% deduction for lateness. No assignments will be accepted for credit after one week past the due date unless a student has made special arrangements with me before one week after the due date.

Final grades will be based on total points earned for the above examinations and exercises. No extra credit will be given.

I encourage you to contact me outside of class for further help. The office hours shown are times when I will generally be available. To ensure that I will not be meeting with another student, I request that you make an appointment to see me, even during my office hours.

GRADING

Class Participation 50

Laboratory Exercises 300

Midterm Examination 65

Final Examination 85

TOTAL 500

Date Topic and Lab

January 23 Geographic Data Lab #1

What it is; Field v. object (continuous v. discrete);

Points, lines, areas; Database concepts; Introduction to SAS

January 28 Measurement Lab #2

Integers and real numbers (fractions, decimals, degrees);

Count data v. ratio data; Nominal, ordinal, interval, ratio;

Precision, accuracy, reliability; Scale; Metric system;

Scientific notation

January 30 Graphing Lab #3

Number line; Cartesian coordinates (origin, ordinate,

abscissa, four quadrants)

February 4 Point Data - Measuring Location Lab #4

Define location; Lat/lon; Scale and projection;

Coordinate systems (UTM, State Plane)

February 6 Data Conversion Lab #5

For attribute data (mi to km, Fahrenheit to Centigrade);

For geographic data (decimal degrees to deg/min/sec)

February 11 Variation and Distance Lab #6

Distance calculation in univariate space;

Variation as 'distance' squared;

Distance calculation in bivariate space (Euclidean & other)

February 13 Descriptive Univariate Statistics Lab #7

Mean (variation);

Median (absolute deviation);

Mode (maximize access);

Midpoint of range (minimize maximum deviation);

Range, variance, standard deviation

February 18 Point Data - Describing Patterns Lab #8

Descriptive Bivariate Statistics

Bivariate mean, bivariate median, modal,

Range (bounding box, midpoint of range)

Standard deviational ellipse

February 20 Point Data - Clustering Lab #9

Nearest neighbor; Thiessen polygons; Cluster analyses

February 25 Line Data Lab #10

Types of lines (naturally occurring v. human);

Length; Sinuosity

February 27 Line Data Lab #11

Direction

March 4 Networks Lab #12

Types of network; Stream networks (numbering systems)

March 6 Networks Lab #13

Nodal accessibility; Matrix concepts;

Beta and gamma coefficients in planar v. nonplanar graphs

March 11 Review

March 13 MIDTERM EXAMINATION

March 18, 20 SPRING BREAK -- No Classes

March 25 Area Data Lab #14

Tessellations (regular and irregular for field data);

Delimitations (area class, choropleth for object data)

March 27 Area Data Lab #15

Calculation of area, perimeter; Shape indices

April 1 Scatterplots and Functional Relationships Lab #16

Different kinds of functions;

Linear - simple linear regression;

Nonlinear (various kinds);

Logarithmic transformation

April 3 Point to Point Comparison Lab #17

Methods for comparing two point distributions;

Index of association

April 8 Area to Area Comparison Lab #18

Methods for comparing two area distributions;

Boolean algebra;

Intersection; Union; Overlay;

Index of association

April 10 Point in Area Comparisons Lab #19

Point in polygon; areal aggregation

April 15 Observations Made at Points Lab #20

Spatial sampling; Scalar;

Interpolation and contour maps

April 17 Attributes of Objects--Scaling Lab #21

Guttman scaling--central place hierarchies

April 22 Attributes of Objects--Classification Lab #22

Point in class determination;

Frequency and cumulative frequency;

n-tile, equal interval, user-defined

April 24 Attributes of Objects--Concentration Lab #23

Location quotient/shift share

April 29 Attributes of Objects--Spatial Autocorrelation Lab #24

Spatial autocorrelation

May 1 Chi-square Analysis of Classified Data Lab #25

Looking for associations

May 6 Review

Thursday, May 15 FINAL EXAMINATION

1:00 - 3:00 pm

SAMPLE EXERCISE/LAB

Name ______________________________ Date Due ________ Evaluation _____

GEOGRAPHY 242Q - Geographic Data Analysis

LAB #24 - Spatial Autocorrelation

1. The information in the table below shows the pattern of voting in towns of Tolland County, Connecticut. On the attached Map 1, shade towns that voted Democratic and leave towns that voted Republican unshaded.

Town Vote

A Somers Republican

B Stafford Republican

C Union Republican

D Ellington Democrat

E Tolland Republican

F Willington Republican

G Vernon Democrat

H Bolton Republican

I Coventry Democrat

J Mansfield Democrat

K Andover Democrat

L Hebron Republican

M Columbia Republican

B = number of towns that are Democrat =

W = number of towns that are Republican =

p = probability town is Democrat =

q = probability town is Republican =

2. On the attached Map 2, label the town polygons based on the their letter in

the table above and indicate the joins. Use queen's case joins in this

analysis.

Circle the joins connecting Democrat/Republican areas.

3. Fill in the attached Table 1 to calculate the number of joins and the L(L-1)

values for each polygon. Answer the following questions.

What is J, the total number of joins?

What is the observed number of Democrat/Republican joins?

4. Now, test the hypothesis that the spatial arrangement of Democrat and

Republican town votes is random using the sampling without replacement

hypothesis. Use a two-tailed test for significance at the 0.05 level. Show

all work below.

Observed black/white joins=

Expected black/white joins=

Standard deviation=

Test statistic z=

Critical z score=

Do we reject the null hypothesis? That is, is the pattern significantly

different from random?

Table 1. Calculation of Join Counts

Area L (L-1) L(L-1)

(L= ((L(L-1)=