#11

23 March 1987

SUBJECT: Resubmittal of Course Proposal: GE 416/516 Computer-Assisted Cartography

TO: Curriculum Committee

FROM: Ruth I. Shirey, Chair
Geography and Regional Planning

Attached to this memorandum is the course proposal for GE 416/516 Computer-Assisted Cartography, revised as the committee requested. The list of exercises is on page 7. The bibliography begins on page 10.

Signoffs on this course were submitted previously. The catalog description is on page 5.

A3.

This course is designed give our majors and minors experience in the use of the current cartographic technology. Without the information presented in this course students who wish to specialize as, and work as, cartographers, will be uncompetitive with students from other universities. This course is, and has been, a part of every geography department in major universities for at least 5 years. The course, as designed, is a natural continuation of geography 313 (cartography by hand). In GE 313 students learn the standard traditional methods cartographers use in map preparation. GE 481 provides students with exposure to the new technology being employed in the government and industry.

A4.

No, the content of other courses is not affected.

A5.

It is a traditional laboratory course in the same vein as the cartography course. Lectures are heavily augmented with student experimentation in the use of the equipment.

A6.

Yes, it has. The course has been offered three times with enrollments of in 1984, in 1985 and 14/5 in 1986.

A7.

Yes. It has been submitted to the graduate committee.

A8.

Yes. Every geography department offers a course in digital (or computer) cartography, if at all possible.

Penn State Geography 458 Computer Mapping
Ohio State Geography 630 Fundamentals of computer assisted cartography
SUNY Buffalo Geography 385 Introduction to computer mapping

A9.

Many governmental agencies look more favorably on potential employees, especially those applying as cartographers, that have experience generating maps made by computers. Essentially, this is because these agencies use automated mapping processes. Examples include:

Defense Mapping Agency
United States Geological Survey
Central Intelligence Agency

Several professional organizations suggest the course is critical to obtaining a job as a geographer or cartographer including:

Association of American Geographers, Cartographic Specialty

Group
American Congress of Surveying and Mapping
American Society of Photogrammetry

B1.
By a single instructor.

B2.
Yes. Several other courses are in the design phase and will be presented for approval at a later date. These courses include: Advanced cartography, Advanced Digital Cartography, and Geographic Information Systems. These courses, in addition to the proposed course and GE313, are necessary for students desiring a specialization in cartography. Without experience at multiple levels our students cannot hope to compete for cartographic positions with students from other programs where extensive cartographic training is the rule.

B3.
This could be an important application specific course for students from the Computer Science Department who wish to specialize in cartography. This has been discussed with the Computer Science Department who recommends it as part of a Geography minor for the Computer Science major. Nothing written has changed hands.

B4.
Probably not, given the prerequisites and level of specialization required.

C1.
Examinations, project presentations, and laboratory assignments will be given and performance on each evaluated to determine grades. Graduate students will fulfill all undergraduate assignments. They will additionally, prepare a written work on a topic they select, and participate in a developmental project for the lab.

C2.
This course will be offered for 3 credits only.

D1.
a. Course requires an instructor who is currently allocated to teach the course annually.
b. Course requires a classroom and access to a microcomputer laboratory. The geography department microcomputer laboratory is barely adequate. If the projected enrollment of 20 is met groups of 4 will have to work together on a machine during class presentations, and the load on the lab during non-class hours will be great. We are attempting to secure additional computers, or to move the class to the proposed college laboratory.

Additionally, we need to obtain a matrix camera, such as the Polaroid Palette Box, for slide generation.

c. Students will be expected to provide their own diskettes, otherwise the prime material will be plotter pens and paper.

d. No additional library materials are required.

e. No travel funds will be required.

D2.

Annually. The course will be offered in the spring. This is primarily because GE 313, a prerequisite, is offered in the fall.

D3.

One.

D4.

Twenty. Yes by laboratory space.

E. None.

Catalog Description

GE 416 COMPUTER-ASSISTED CARTOGRAPHY.
This course introduces automated cartographic production techniques. Topics include the use of cartographic hardware and software, the distinction between vector and raster representations, data bases, the cartographer-machine interface, and designing computer generated maps. Prerequisites: GE 313, or equivalent, or permission of instructor. 3c-01-3sh

INDIANA UNIVERSITY OF PENNSYLVANIA
Department of Geography and Regional Planning

COMPUTER-ASSISTED CARTOGRAPHY
GE 416/516

Spring Semester, 1986

Class Meeting: 8:00- 9:30 Tuesday and Thursday, Leonard Hall Room 14

Instructor: Dr. Robert P. Sechrist, Leonard Hall, Room 2.

Required Texts:

Mark S. Monmonier, Computer-Assisted Cartography: Principles and Prospects, (Prentice-Hall Inc., Englewood Cliffs, NJ) 1982. ISBN 0-13-165308-3. x, 214pp.

James R. Carter, Computer Mapping: Progress in the 80s, Association of American Geographers, Washington DC) 1984. ISBN 0-89291-175-1. ix, 86pp.

I. Course Description

This course is designed to teach the student the proper use of microcomputer technology in the creation, storage, and production of maps. Students will learn how data are stored, methods for data entry, use of software to manipulate and display the data, and the use of peripherals for saving images on permanent media. The ability to rapidly produce maps will also enable the student to better comprehend standard cartographic principles, such as the impact of class interval on reader comprehension of the map.

II. Purpose and Organization

In the last 10 years major changes have occurred in the production of maps. Producing a map used to be a formidable task. A task that required hours of compilation and calculation. Each map for a common area had to be recreated from scratch. With the development of computer-assisted mapping it becomes much easier to display multiple data on multiple maps. Once the first map is produced, the second can be generated as fast as the data are entered.

Unique computer generated maps are more costly than hand drawn maps. It is in the production of the second map that returns begin to become realized, and the more maps made of an area the lower the per map cost. Further, it becomes possible to create very specialized maps that were previously cost prohibitive.

If we intend to give our students a chance to compete in the market we need to provide them with instruction in how to make proper use of the new technology. The overriding objective of

the course is to show the student how to integrate his/her knowledge of cartographic principles learned in geography 313, or its equivalent, with the processing and display capabilities of the computer. Software currently available to generate maps, and new software anticipated over the several years, can draw the maps, yet the software cannot select design formats the way a trained cartographer can. A trained cartographer starts with the machines basic display and embellishes it, making it more comprehensible to the reader. Embellishments commonly performed include: selection of map type (chloropleth, isopleth, graduated circle, cartogram, dot, etc.), selection of interval, selection of color, patterns, textures for display elements, and the positioning of textual information. Through the course the student's ability to include the above embellishments will increase as their experience and exposure increases. The knowledge gained in this course will feed back into the student's overall knowledge of cartographic principles.

The lectures in GE 416/516 will treat various aspects of the computer-assisted mapping process such as: data capture, map data encoding, symbolization in raster and vector data structures, the use of microcomputers, computer peripheral devices, computer software for map production, and computer-assisted map design. Much of the student instruction will take place in the department's laboratory.

III. Course Requirements and Evaluation

Students are expected to complete midterm and final examination and several class assignments. The midterm will represent 25% of the final grade. The final examination will be comprehensive of the material covered in the readings and lectures, and will also represent 25% of the final grade. An additional 25% of the student's grade is represented by the completion of a special project. In the special project the student is expected to create an atlas composed of 25 or more maps of a selected area. The atlas and the student's discoveries about the mapped area will be presented verbally to the class.

* Class assignments, will be given on a regular basis and will give students experience in using software and hardware while sharpening their skills in preparation of completing the class project. Assignments will cover such topics as:

1. use of digitizer to create a vector map base. Each student will digitize a selected area in preparation for making their atlas. (25 pts)
2. Each student will, using a predefined map base, make a map using the mapping package. (10 pts)
3. Each student will generate chloropleth maps of a single piece of data for a particular area using equal interval, equal distribution, natural break and statistically derived class intervals. (40 pts.)
4. Each student will create a bivariate using the boolean capabilities of the mapping package. (10 pts)
5. Each student will generate a set of Thiessen polygons for a region. (15pts)

These assignments will represent 25% of the final grade.

Graduate students are expected to meet all of the above requirements and, to prepare in writing a report on an aspect of digital cartography, and to participate in a laboratory development project selected by the instructor.

IV. Materials Covered and Associated Readings

A. Introduction — Carter
B. Using the Hardware & Intro to PC-Dos
C. Computer Mapping Algorithms and Systems — Monmonier Ch. 2
    1. Using Atlas AMP
    2. Computer-assisted map design — Monmonier ch. 8
D. Data Capture
    1. Data transfer
    2. Equipment for Recording Spatial Coordinates
    3. Cartographic data bases
        a. federal data bases available
        b. extracting data from stf1 & stf3
E. Handling Point data
    1. encoding
    2. storage techniques
    3. methods for representation
        a. gridding
        b. kriging
        c. sectorial search and interpolation
    4. functions
        a. trend surfaces
        b. smoothing using planar moving averages
F. Handling Line data
    1. encoding
    2. storage techniques
    3. methods for representation
G. Handling Areal data
    1. encoding
    2. storage techniques
    3. methods for representation
        a. polygon storage
        b. arc & node storage
        c. Theissen polygons
H. Cartographic Data Structures
    1. Coordinate Systems
        a. lat-lon
        b. UTM
        c. arbitrary
    2. Vector — Monmonier ch. 5
        a. polygons
        b. positives and negatives
            of vector storage

c. depicting linear and areal data
d. polygon fill techniques

3. Raster — Monmonier ch. 3 & 4
   a. vector to raster conversion
   b. economizing storage of
   c. depicting linear and areal data
5. Cartographic Data structures — Monmonier ch. 7

F. Student Project Reports

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