Proposal for Revision to the
Geographic Information Systems (GIS) Curriculum
Community College of Philadelphia

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I. Abstract

This revision is designed to refine and strengthen the GIS Program by addressing changes in the profession and in the educational needs of students. In particular, it emphasizes the streamlining of coursework. The following summarizes the proposed changes:

1. Eliminate three redundant courses from the curriculum (Applications in GIS--GIS 105, Problem Solving with GIS--GIS 202, and Database Development for GIS--GIS 205). The material taught in these three courses is very similar to material taught in other GIS courses.
2. Eliminate one highly specialized course from the curriculum (Spatial Analysis and Mapping in GIS-GIS 103) that would be more appropriate for the graduate level.
3. Combine two similar GIS courses (Applications in Global Positioning Systems Technology, GIS 203 and Remote Sensing, GIS 204). GIS 204 will be subsumed into GIS 203 which will include an introduction to the topics currently planned for GIS 204. (GIS 204 has not been developed.)
4. Offer students more directed electives in the areas of Geography; Mathematics; Computer Information Systems (CIS;) Art and Design; and Architecture, Design and Construction (ADC).
5. Eliminate CIS 104- PC Operating Systems: Windows as a required course and instead offer students the opportunity to take CIS 105-Windows Professional Operating System as a directed elective. CIS 104 has been discontinued and, in any case, CIS 105 provides a better background for students interested in developing advanced skills working with Windows.
6. Add a requirement for graduation that students must earn a 'C' or better in all GIS courses.

These changes will reduce the number of required GIS courses from ten to five and reduce the number of credits required for graduation from 66 to 60.

II. OVERVIEW OF THE EXISTING PROGRAM

Along with general education, the GIS Program provides students with the knowledge and practical skills necessary to develop and manage geographic information projects and to interpret and to apply GIS technology to spatial problems. The current curriculum was created by a non-GIS professional when there were few academic models available. At that time it was believed that the existing requirements were needed to provide a thorough theoretical base to enable a student to enter the field or transfer for a more advanced degree. Since the adoption of the original curriculum, the Program has cultivated connections with GIS professionals and has developed experience with students interested in GIS. At the same time, curricula at likely transfer institutions have evolved. The current A.A.S degree requires the completion of thirty credits in GIS courses, nine credits of CIS courses and three credits in ADC (CAD Basics). Sixty-six credits are required for the degree.

III. DESCRIPTION OF PROPOSED REVISION

This proposed revision continues to meet the Student Learning Outcomes of the current curricula (See Appendix A Curriculum Map). Advisory Board members and other experts in the field have expressed the opinion that students can be well prepared for the workplace and for baccalaureate

level study in GIS with a reduction in the number of GIS courses. In summary, the curriculum was originally developed based on information available at that time in a rapidly emerging field. This revision is the result of actual experience in working with professionals in the field and assisting potential students. The overall goal of this revision is to reduce the number of GIS courses and reduce the number of total credits required for the degree while continuing to provide students with a firm grounding in the discipline.

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Description of Proposed Changes:

This revision consists of six changes to the curriculum:

1. Elimination of Three Redundant Courses

As courses were developed for the curriculum, it became apparent that there is significant overlap in some of the required GIS courses. Specifically, there are three courses—Applications in GIS (GIS 105), Problem Solving with GIS (GIS 202), and Database Development for GIS (GIS 205)—which can be eliminated because the content is adequately covered in other GIS courses.

Applications in GIS—GIS 105

The original vision for GIS 105 focused on contemporary, individual research application of GIS. However, after consultation with GIS professionals and GIS faculty from other institutions, it is clear that there is significant overlap between GIS 105 and GIS 201. In effect, the main course goals of GIS 105 and GIS 201 are similar -- to provide students with practical experience applying GIS to contemporary technical issues and research directions in GIScience.

In GIS 201, students learn about many applications of GIS, including advanced geospatial concepts (modeling data and schema designs, Geoprocessing, and Enterprise GIS). The GIS 201 course is taught using case studies and relevant examples drawn from a local network of GIS professionals, current events and trade/industry publications. GIS 201 helps students to understand the connection between the academic pursuit of GIS knowledge and its practical application in a professional setting. In effect GIS 201 subsumes the goals of GIS 105.

Problem Solving with GIS--GIS 202

GIS 202 was originally intended to focus on the analysis and communication of geographic information, including problem solving of spatial and attribute queries, map overlay and buffering of various data, but faculty have found that these topics are sufficiently explored in GIS 101. For instance, students learn a variety of querying options in GIS 101, such as selection by attribute using structured query language (SQL) and definition query. Similarly, students utilize interactive selection tools for spatial queries in GIS 101. GIS 101 also introduces spatial analysis for proximity (buffer tool) and overlay (clip and union tools). Advanced study at the 200 level is not necessary for associate degree programs.

Database Development for GIS—GIS 205

GIS 205 was originally intended to focus on creating a digital geographic database (geodatabase) from base maps and managing attribute data and metadata (data about data). However, geodatabases are sufficiently covered in GIS 102. For instance, within GIS 102, students learn the benefits of using geodatabases (such as multiple editors and ability to record topology), which shapefile data format cannot do. In GIS 102, students also learn the geodatabase design model, from the conceptual design to the logical design to the physical design. Regarding the management of attribute data and metadata, these topics are covered in GIS 101 and GIS 102. In GIS 101, students learn the basics of non-spatial attribute data, such as qualitative versus quantitative data, data types (nominal, ordinal, interval, and ratio) as well as field data types (numeric and non-numeric). In GIS 101, students also learn how to obtain and update metadata. In GIS 102, students learn how to join and relate attribute data between tables. With regard to editing data, students work on the basics of editing data in GIS 101 and continue learning more intermediate editing tools in GIS 102 (such as snapping and spatial adjustments with transformations, rubbersheeting and edgematching). Given this redundancy, this revision removes GIS 205 from the program.

2. Elimination of one highly specialized course: Spatial Analysis and Mapping in GIS--GIS 103

When the GIS curriculum was originally developed, it included one proposed course that is especially advanced: Spatial Analysis GIS 103.

At other institutions, Spatial Analysis is typically an upper-level undergraduate or graduate-level course. Penn State for example offers Spatial Analysis I (GEOG 454) and Demography and Spatial Analysis (DEMOG 597); while West Chester University offers Geographical Analysis (GEO 326) for undergraduate students and GIS Spatial Data Analysis (GEO 534) for graduate students. The University of Pennsylvania offers three courses in Spatial Analysis, all at the graduate level (CPLN 667: Introduction to Spatial Analysis and Modeling, CPLN 646: Spatial Analysis for Public Health, ESE 502: Advanced Spatial Analysis). Temple University has Spatial Analysis Techniques/Geographic Information Systems (GIS 413) at their Ambler Campus.

A review of GIS degree requirements at nine two year institutions further supports this conclusion (See Appendix B). Of those reviewed, only one includes a course in spatial analysis. (That program at Cayuga Community College in New York includes a total of six GIS courses in its degree – considerably less than CCP's current requirements.).

Finally, a survey of the GIS Advisory Board members resulted in the unanimous agreement that the current course is too advanced for the associate degree level.

The GIS curriculum will continue to include GIS 102, in which the ArcGIS extension Spatial Analyst is introduced at a level of depth which is sufficient for an associate degree program.

3. Elimination of GIS 204

The original curriculum provided for a separate course for Global Position Systems (GPS), GIS GIS 203, and another for Remote Sensing (RS), GIS 204. However, offering a separate course for each of these technical topics would mean too much specialization at the associate degree level. Other colleges address these topics in upper division undergraduate courses. For

instance, at Penn State, the remote sensing classes are offered at the upper-level undergraduate or graduate-level (Image Analysis (GEOG 352), Advanced Remote Sensing (GEOG 497), Remote Sensing and Spatial Data Handling (FOR 455), and Multispectral Remote Sensing (FOR 555) with no course in GPS. RS is introduced at West Chester University within their course Introduction to Maps and Remote Sensing (GEO 225) and studied further in their graduate course Maps and Aerial Photographs (GEO 507). West Chester University does not have a separate course in GPS. Temple University and the University of Pennsylvania do not offer specific courses in GPS or RS.

Other two-year programs such as that at the Community College of Baltimore County in Maryland offer a combined course, Remote Sensing and Global Position Systems for GIS (GEOA 150), and this appears to be the most effective model for CCP to follow. The revised GIS 203 will provide students with an introduction to the topics which were originally planned to be explored in GIS 204.

4. Increase in Directed Electives

Based on preliminary experience in the classroom and discussion with various stakeholders, the GIS faculty has come to realize that a deeper understanding of geography, mathematics, computer information systems and design will be beneficial to GIS students. Students will choose directed electives based on interest, career goals and transfer plans. Some students may choose a cluster of electives within one area such as Math or CIS while other students' needs may be best served by favoring breadth and selecting electives from multiple disciplines. The GIS degree at Community College of Baltimore County in Maryland, for example, offers students a range of directed electives in the aforementioned fields and that curriculum served as a model for this revision.

The proposed directed electives are divided into five groups: Geography, Mathematics, Computer Information Systems, Art, and ADC. The student's choice will be based on his or her personal academic study or career objectives and made in consultation with an academic advisor.

5. Eliminate CIS 104

CIS 104 has been discontinued. In any case, an in-depth understanding of the Windows operating system is not necessary for GIS professionals. Therefore, the new curriculum will not require a course on Windows. For those students who wish to develop advanced skills in working with Windows, CIS 105 will be offered as a directed elective. CIS 105 will be more valuable to students because it reflects the current technology.

6. Add a requirement for graduation that students must earn a 'C' or better in all GIS courses.

A new graduation requirement has been added. Students must earn a 'C' or better in all GIS courses. The five GIS courses that remain in the program all teach critical skills that are necessary to be a competent GIS technician. A grade of C is the minimum grade that indicates mastery of the skills needed to be a GIS technician.

IV. EFFECTS OF THE REVISIONS

Program Coherence and Impact on Students: The proposed GIS curriculum is a coherent curriculum built around understandings of the field and the academic and professional needs of both students and employers. The changes being proposed continue in the spirit of providing a well-rounded experience. As described previously in this document, the proposed changes will reduce the number of required GIS courses in order to allow more flexibility and provide students with the opportunity to take more directed electives suited to their academic and career goals.

Effect upon Graduation Requirements

This revision will reduce the minimum number of credits needed for graduation from 66 to 60.

This revision will require no additional budget, personnel, or College support structure and resources and will affect other departments and curricula only in that students will have the opportunity to take more courses outside of GIS.

V. CATALOG DESCRIPTION

GIS is a computerized spatial database management system for capture, storage, retrieval, analysis, and display of geographic information. Along with general education, the GIS program will provide students with the knowledge and practical skills necessary to develop and manage geospatial projects and to interpret and implement GIS as a decision support tool.

Upon completion of this program, graduates will be able to:

- Identify how geospatial technologies can be utilized within various organizations/applications
- Identify necessary equipment (software & hardware) and data needed to complete projects
- Manage geodatabases (creating, obtaining & updating geospatial data resources)
- Effectively use various geospatial technologies (Geographic Information Systems GIS, Global Positioning Systems GPS, & Remote Sensing RS)
- Conduct geospatial analyses (geocoding, buffer, clip, distribution, correlation, and network)
- Work productively on geospatial projects, both independently and in teams
- Design cartographic representations (maps) of geospatial analyses, draw conclusions, prepare reports and presentations that convey geospatial research/application/conclusions

The curriculum is designed to prepare students to enter employment after completing the AAS degree or to continue their education at a baccalaureate institution. For those students who plan to work upon program completion, they will be prepared to enter the field of GIS in the public or private sector in such positions as GIS technician or specialist.

Program Entry Requirements:

New students are required to take College placement tests. Students identified as needing developmental course work must satisfactorily complete the appropriate English and mathematics courses in addition to the requirements of the Program.

Program of Study and Graduation Requirements:

To qualify for the Associate in Applied Science (A.A.S.) degree in Geographic Information Systems, students must complete the appropriate 60 credit hours with a minimum cumulative grade point average of 2.0 (C average). All students must earn a C or better in all GIS courses.

Course Number and Name	Prerequisites and Corequisites	Credits	Gen Ed Requirement
FIRST SEMESTER			
GIS 101 - Introduction to GIS	CIS 103 (may be taken concurrently)	3	
GEOG 101 – Introduction to Physical Geography or GEOG 103 – Introduction to Human Geography		3	Soc Science
ENGL 101 -English Composition I		3	ENGL 101
CIS 103 –Applied Computer Technology		3	Tech Comp
MATH 118 - Intermediate Algebra		3	Mathematics
SECOND SEMESTER			
GIS 102 - Intermediate GIS	GIS 101	3	
GIS 104 – Principles of Computer Cartography & Visualization	GIS 101	3	
GEOG 101 – Introduction to Physical Geography or GEOG 103 – Introduction to Human Geography or GEOG 180-Urban Geography or GEOG 222-World Regional Geography	 GEOG 101 or GEOG 103 for GEOG 222	3	
ENGL 102 -English Composition II	ENGL 101	3	ENGL 102 and Info Lit
Directed Elective (see list below)		3	
THIRD SEMESTER			
GIS 201 - Advanced Geospatial Applications	GIS 102	3	
GEOG 101 – Introduction to Physical Geography or GEOG 103 – Introduction to Human Geography or GEOG 180-Urban Geography or GEOG 222-World Regional Geography	 GEOG 101 or GEOG 103 for GEOG 222	3	
EASC 111 - Environmental Conservation		3	Natural Science
Directed Elective (see list below)		3	
General Elective		3	
FOURTH SEMESTER			
GIS 203 - Remote Sensing and Global Positioning Systems	GIS 101, Math 118	3	
Directed Elective (see list below)		3	
Humanities Elective		3	Humanities
Directed Elective (see list below)		3	
General Elective		3	
MINIMUM CREDITS NEEDED TO GRADUATE		60	

Directed Electives
ADC 103 - CAD Basics
ADC 186 - Surveying
ART 105 - Drawing I
ART 125 - Design I
ART 150 - Introduction to Computer Art/Graphics
CIS 105 - Windows Professional Operating System
CIS 150 - Data Communications
CIS 205 - Data Base Management Systems
CSCI 111 - Programming and Algorithm Development I
MATH 121 - Computer Mathematics and Logic
MATH 137 - Geometry for Design
MATH 161 - Precalculus I
MATH 162 - Precalculus II
MATH 163 - Discrete Mathematics
MATH 251 - Statistics for Science

GENERAL EDUCATION REQUIREMENTS

All General Education requirements are met through required courses (as indicated above) except for the **Writing Intensive** requirement, the **Interpretive Studies** requirement and the **American/Global Diversity** requirement**.** Therefore, in order to graduate, students in this program must choose one course that is designated Writing Intensive, one course that is designated Interpretive Studies and one course that is designated American/Global Diversity. The same course may be used to fulfill more than one of these requirements. A list of courses that fulfill these requirements and a more detailed explanation of the College's general education requirements appears elsewhere in this catalog and on www.ccp.edu.

Appendix A—Curriculum Map

Course	**Student Learning Outcomes**						
	Identify how geospatial technologies can be used with various organizations and applications	Identify necessary equipment (software and hardware) and data needed to complete projects.	Manage geodatabases (creating, obtaining and updating geospatial data resources)	Effectively use various geospatial technologies	Conduct Geospatial analyses (geocoding, buffer, clip, distribution, correlations and networking)	Work productively both independently and in teams on geospatial projects	Design cartographic representations (maps) of geospatial analyses, draw conclusions and prepare reports and presentations that convey geospatial research, applications and conclusions
GIS 101 Introduction to GIS	Introduced	Introduced	Introduced	Introduced	Introduced	Introduced	Introduced
GIS 102 Intermediate GIS	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
GIS 104 Principles of Computer Cartography and Visualization			Intermediate	Intermediate		Mastery	Mastery
GIS 201 Advanced Geospatial Applications	Mastery	Mastery	Mastery	Mastery	Mastery	Mastery	Mastery
GIS 203 Remote Sensing and Global Positioning Systems	Mastery	Mastery	Mastery	Mastery	Mastery	Mastery	Mastery

Please note that assessment evidence is obtained for each level of competency.

Appendix B

The Urban and Regional Information Systems Association (URISA) is a nonprofit association of professionals using Geographic Information Systems (GIS) and other information technologies to solve challenges in state/provincial, regional and local government agencies and departments. URISA's website (http://www.urisa.org/career/colleges) includes a table of post-secondary courses. (CCP's degree is included.) The links at that site were used to explore the current status of the GIS two year degrees listed there and the information on the table below was gathered from the URISA website and the websites of the colleges listed.

Two-year GIS degrees				
Institution	**Degree**	**Credits in Major /Total Credits for Degree**	**Notes**	**Course in Spatial Analysis?**
Anoka Ramsey Community College (MN)	A.S	18 credits in major 62-63 total credits for degree	Four courses (12 credits) in GIS Three courses (7 credits) in Geography	No
Baltimore Community College (MD)	A.A.S.	12 credits in Major 66	Four courses (12 credits in GIS)	No
Bismarck State Community College (ND)	A.A.S.	25 credits in major 62 total credits for degree	Seven courses (21 credits) in GIS One course (4 credits) in Geography	No
Brevard Community College (FL)	No degree listed		Four courses in GIS offered	No
Cayuga Community College (NY)	A.S.	18 credits in major 55—57 total credits	Six courses (18 credits) in GIS	Yes
Gray Harbor College (WA)			One three credit GIS course offered as an elective	No
Green River Community College (WA)	A.A.S.	21 credits in major 101-106 total credits for degree * Quarter System	Five courses (21 credits) in GIS	No
Harrisburg Area Community College (PA)	A.A.S.	30 credits in major 67 total credits	Six courses (18 credits) in GIS Five courses (5 credits total) in CAD One course (4 credts) in Engineering	No
San Jacinto College (CA)	A.S.	18 credits in major 63 total credits	All major courses are listed as "geography" courses; one course provides an introduction to cartography; all other major courses relate to GIS topics	No