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## Proposal to the Senate Educational Policy Committee

**PROPOSAL TITLE:** Proposal to revise the Computer Science B.S. degree in the College of Engineering.

**SPONSOR:** Lenny Pitt, Professor and Director of Undergraduate Programs, Computer Science  
Tel: 333-7505, Email: [pitt@illinois.edu](mailto:pitt@illinois.edu).

**COLLEGE CONTACT:** Kevin Pitts, Associate Dean for Undergraduate Programs and Professor, College of Engineering, 217-333-3946, [kpitts@illinois.edu](mailto:kpitts@illinois.edu).

### BRIEF DESCRIPTION:

This is a major revision that includes a variety of changes:

1. Replace and discontinue CS 242 with new course CS 126
2. Replace CS 231 + CS 232 requirement with CS 233
3. Replace CS 373 + CS 473 requirement with new course CS 374
4. Replace MATH 461 or 463 requirement with new course CS 361
5. Remove requirement of taking either PHYS 213 or 214
6. Replace CHEM 102 +103 requirement with a broader “additional science” requirement.
7. Replace the “Technical Track” requirement with the requirement to take at least eight technical electives from a list maintained by the CS department, and meeting additional criteria determined by the CS faculty.

### JUSTIFICATION:

1. CS 242 is taken too late in the current curriculum to allow students to benefit from the instruction on good coding practice. Also, CS 126 will introduce a number of topics that are currently not covered in the curriculum. Finally, CS 126, placed between software/programming courses CS 125 and CS 225, will engage students in the practice of programming during their second semester, where there is currently a hole in the curriculum that has resulted in students going eight months or more without programming following their initial exposure.
2. CS 233 combines material from both CS 231 and CS 232, while eliminating an undue focus on digital logic more relevant to computer engineering. CS 233 also includes deeper coverage of important topics such as parallel architectures. The reduction of two credit hours (3+3 to 4) will also allow students to take more advanced technical electives.

3. CS 373 contained dated material that was of dubious value for current CS students. CS 473 was taken too late in the curriculum for other courses to benefit, because CS 373 was a prerequisite. The new four-hour CS 374 blends together topics from these two computer science theory courses, presenting them in a more unified manner, and accessible earlier in the curriculum. The reduction of two credit hours (from 3+3 to 4) will also allow students to take more technical electives.
4. Modern computer science practice increasingly relies on probabilistic and statistical methods to deal with large amounts of data. It has become a sufficiently important topic that it is desirable to introduce this material earlier in the curriculum than MATH 461 or 463 could (since the latter two require MATH 241 instead of just MATH 221 and 225). It is also important to focus on the particular topics that are relevant to CS, and to have students solve real-world problems via programming applied statistical and probabilistic methods.
5. There is no reason that CS students would need either PHYS 213 or 214; this requirement is inherited from the Engineering College, in which many other departments need this material. Data collected also shows that only a very small number of CS students transfer into other Engineering College departments; they mostly transfer into LAS, where these courses are not required.
6. CS is widely applicable across many sciences, and there is little reason to require chemistry over, say, biology or astronomy or genetics or a number of other serious science courses in which computing applications are numerous.
7. Our old track options are obsolete, and two of the three did not meet ABET accreditation requirements. We have moved to a simpler structure requiring that students first take a solid but condensed core of foundational courses, followed by eight technical electives (two more than our current program), reflecting the breadth of the field. Students will also be required to obtain depth in one focus area of computer science. The list of technical electives and focus areas will vary as new courses are introduced, and dated courses retired. Consequently, it is desirable to allow revision of the list to be approved at the department level, just as are the details of the current “technical tracks”.

#### **BUDGETARY AND STAFF IMPLICATIONS:**

##### 1) Resources

- a. How does the unit intend to financially support this proposal?

There is no net gain in the number of CS courses required. If anything, by shrinking the number of specifically required courses and allowing more technical electives course demand will be better balanced across upper level courses.

- b. How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?

No surplus or additional capacity is needed beyond that which is already required to handle our natural growth.

- c. Will the unit need to seek campus or other external resources? If so, please provide a summary of the sources and an indication of the approved support.

No additional campus or external resources will be needed due to the revision in program

- d. Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.

## 2) Resource Implications

- a. Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.

No additional faculty resources will be needed due to this revision, as the revision does not increase the overall teaching load, rather it redistributes students across technical electives.

- b. Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units. *(A letter of acknowledgement from units impacted should be included.)*

There will be a drop in students electing MATH 461 or STAT 400. Recently, there have been no more than 60 CS students in each course each semester. The math and statistics departments are aware of these changes. There will be a drop in enrollments in PHYS 213 and 214 (on average 50-75/course/semester). There will be a drop in enrollment in CHEM 102 and CHEM 103, and likely increase in enrollments in other sciences, but we cannot anticipate how much interest there may be in any one course. However, many of our students already come in with AP Chemistry credit, so would not need to take another science besides physics.

- c. Please address the impact on the University Library *(A letter of estimated impact from the University Librarian must be included for all new program proposals. If the impact is above and beyond normal library business practices, describe provisions for how this will be resourced.)*

None anticipated

- d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)

None anticipated

### **DESIRED EFFECTIVE DATE:**

Fall, 2015

<http://cs.illinois.edu>

Head of Department: Rob A. Rutenbar

Department Office: 2232 Siebel Center, 201 N. Goodwin Avenue, Urbana, (217) 331-3373

## For the Degree of Bachelor of Science in Computer Science

The computer science curriculum provides both a broad and deep knowledge of the theory, design, and application of computer systems, with an emphasis on software systems. Because computing is ubiquitous, application areas involve virtually any field imaginable - from developing gene sequencing algorithms via techniques in computational biology, to designing user interfaces for mobile applications; from designing methods for high frequency trading, to creating computer generated graphics and special effects in the gaming industry, and from creating embedded real time systems to be deployed in medical devices, to analyzing social data from internet communication patterns. During the first two years the curriculum provides a strong foundation in mathematics, science, and computation. Advanced coursework in areas of the student's choosing follows in the second two years, which include either a senior thesis or a senior project. Graduates may go on to graduate study or leading positions in industry. A combined B.S.-M.S. Computer Science degree program is available. Its admission and course requirements are described in the [College of Engineering program information section](#). A [Software Engineering Certificate](#) is also available to all students in the computer science curriculum interested in a career in software engineering. It provides the depth and breadth necessary for satisfying possible future software engineering accreditation requirements.

## Overview of Curricular Requirements

The curriculum requires 128 hours for graduation and is organized as shown below. A technical grade point average requirement for graduation applies to students in this curriculum. This rule is summarized at the College of Engineering's [undergraduate advising website](#).

### Orientation and Professional Development

These courses introduce the opportunities and resources your college, department, and curriculum can offer you as you work to achieve your career goals. They also provide the skills to work effectively and successfully in the engineering profession.

<a href="#">CS 100</a>	Freshman Orientation **	1
<a href="#">CS 210</a>	Ethical & Professional Issues	2
<a href="#">ENG 100</a>	Engineering Orientation	0
Total Hours		3

*This optional course is highly recommended and may be used to help meet free elective requirements.*

\* External transfer students take [ENG 300](#) instead

### Foundational Mathematics and Science

These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

<a href="#">CHEM 102 Science Elective†</a>	<a href="#">General Chemistry-I</a>	3	*
<a href="#">CHEM 102</a>	<a href="#">General Chemistry-lab-I</a>	1	†
<a href="#">MATH 221</a>	Calculus I *	1	
<a href="#">MATH 231</a>	Calculus II	3	
<a href="#">MATH 241</a>	Calculus III	4	
<a href="#">MATH 415</a>	Applied Linear Algebra	3 OR 4	
<a href="#">PHYS 211</a>	University Physics: Mechanics	1	
<a href="#">PHYS 212</a>	University Physics: Elec & Mag	4	
<a href="#">PHYS 213</a>	<a href="#">Univ Physics-Thermal Physics</a>	2	

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or **PHYS 211**

Intro Physics-Quantum Physics

Total Hours

2825

Refer to departmental website for acceptable Science Electives

\* **MATH 220** may be substituted, with four of the five credit hours applying toward the degree. **MATH 220** is appropriate for students with no background in calculus.

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### Computer Science Technical Core

These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of computer science.

<b>CS 125</b>	Intro to Computer Science	4
<b>CS 126</b>	Software Design Studio	3
<b>CS 173</b>	Discrete Structures	3
<b>CS 225</b>	Data Structures	4
<b>CS 233</b>	Computer Architecture	4
<b>CS 241</b>	System Programming	4

**CS 242**

Programming Studio

3

<b>CS 352</b>	Numerical Methods I	3
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<b>CS 361</b>	Probability & Statistics for CS	2
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<b>CS 3743</b>	Theory of Computation Algorithms & Models of Computation	4
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<b>CS 421</b>	Programming Languages & Compilers	2
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**MATH 361**

Probability Theory

3

or **STAT 499**

Statistics and Probability I

Total Hours

2835

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### Technical Electives

These courses stress the rigorous analysis and design principles practiced in major subdisciplines of computer science. Students select eight courses, at least six of which must be advanced CS courses. Three courses must be selected from one area of CS.

Technical electives to be chosen from departmentally approved list. Refer to department website

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### Technical Track Option Electives

These courses stress the rigorous analysis and design principles practiced in several major subdisciplines of computer science. Students must choose to specialize in one of the following technical tracks:

\* **Computer Science**

\* **Computational Science and Engineering** (discontinued for students entering Fall 2013 or later)

\* **Mathematics** (discontinued for students entering Fall 2013 or later)

In the Computational Science and Engineering track, a scientific specialization must be selected from a departmentally approved list. Since specializations are subject to change, please consult the department website for the most current information.

Technical track electives to be chosen from departmentally approved lists for the Technical Track Option choices presented above.

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### Liberal Education

The liberal education courses develop students' understanding of human culture and society, build skills of inquiry and critical thinking, and lay a foundation for civic engagement and lifelong learning.

Electives from the campus General Education social & behavioral sciences list.	6
Electives from the campus General Education humanities & the arts list.	6
Electives either from a list approved by the college, or from the campus General Education lists for social & behavioral sciences or humanities & the arts	6
<b>Total Hours</b>	<b>18</b>

Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

### Composition

These courses teach fundamentals of expository writing.

<b>RHET 105</b>	Writing and Research	4
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**Advanced Composition.** May be satisfied by taking any course in either the liberal education or free elective categories which has the Advanced Composition designation, or by completing CS 499 Senior Thesis.  
**Advanced Composition.** May be satisfied by completing one of the following: CS 499, the sequence CS 122 + CS 129, the sequence CS 492 + CS 493, or a course taken in either the liberal education or free elective categories which has the Advanced Composition designation.

<b>Total Hours</b>	<b>4</b>
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### Free Electives

These unrestricted electives, subject to certain exceptions as noted at the College of Engineering advising Web site, give the student the opportunity to explore any intellectual area of unique interest. This freedom plays a critical role in helping students to define research specialties or to complete minors.

Free electives. Additional unrestricted course work, subject to certain exceptions as noted at the College of Engineering advising Web site, so that there are at least 128 credit hours earned toward the degree. (19 if a 32-credit-hour Technical Track is chosen; 22 if a 24-credit-hour Technical Track is chosen.)

[College of Engineering advising website.](#)

## Suggested Sequence

The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken.

First Year		
First Semester		Hour
<a href="#">CHEM 103 Science Elective</a> <a href="#">General Chemistry-I</a>		3
<a href="#">CHEM 103</a>	<a href="#">General Chemistry Lab-I</a>	4
<a href="#">MATH 221</a>	Calculus I	4
<a href="#">RHET 105</a> (or liberal education elective)***	Writing and Research	3-4
<a href="#">CS 100</a>	Freshman Orientation	1
<a href="#">CS 125</a>	Intro to Computer Science	3
<a href="#">ENG 100</a>	Engineering Orientation	0
	<b>Semester Hours</b>	<b>15-16</b>
Second Semester		
<a href="#">CS 126</a>	<a href="#">Software Design Studio</a>	3

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<a href="#">CS 173</a>	Discrete Structures	3
<a href="#">MATH 231</a>	Calculus II	3
liberal education elective		3
<a href="#">PHYS 211</a>	University Physics: Mechanics	4
<a href="#">RHET 105</a> (or liberal education elective) <sup>max</sup>	Writing and Research	3-14-3
<b>Semester Hours</b>		<b>16-17-17-16</b>
Second Year		
First Semester		
<a href="#">CS 225</a>	Data Structures	4
<a href="#">CS 233</a>	<a href="#">Computer Architecture</a>	4
<a href="#">MATH 241</a>	Calculus III	4
<a href="#">PHYS 212</a>	University Physics: Elec Mag	4
liberal education elective		6
<b>Semester Hours</b>		<b>18-16</b>
Second Semester		
<a href="#">CS 241</a>	System Programming	4
<a href="#">CS 249/CS 361</a>	<a href="#">Computer Architecture Prob. &amp; Stat for CS</a>	3-4
<a href="#">MATH 415</a>	Applied Linear Algebra	1-0-4
<a href="#">PHYS 213</a> or <a href="#">214</a> liberal education electives Univ Physics: Thermal Physics		2-6
liberal education electives		3
<b>Semester Hours</b>		<b>16-6</b>
Third Year		
First Semester		
<a href="#">CS 249/CS 357</a>	<a href="#">Ethical/Professional Issues/Numerical Methods</a>	3-3
<a href="#">CS 242</a>	Programming Studio	3
<a href="#">CS 373</a>	<a href="#">Theory of Algorithms &amp; Models of Computation</a>	1-3
<a href="#">CS Technical elective</a>		3
liberal education elective/elective		3
Free elective		4-3
<b>Semester Hours</b>		<b>16-6</b>
Second Semester		
<a href="#">MATH 461/CS 210</a>	<a href="#">Probability Theory/Ethical &amp; Professional Issues</a>	2-3
<a href="#">CS Technical track electives/electives</a>		9
<a href="#">Liberal education elective</a>		3
Free elective		3

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	Semester Hours	126
<b>Fourth Year</b>		
<b>First Semester</b>		
<a href="#">CS 421</a>	<a href="#">Programming Languages &amp; Compilers</a>	3
<a href="#">CS Technical track electives-electives</a>		6 <sup>9</sup>
<a href="#">Liberal education elective<sup>8</sup></a>		3
Free electives		16
	Semester Hours	166
<b>Second Semester</b>		
<a href="#">CS Technical track electives-electives</a>		6
<a href="#">Technical track elective or free elective<sup>9</sup></a>		3
Free electives		28
	Semester Hours	157
	<b>Total Hours:</b>	128

*This optional course is highly recommended for freshmen, who may use it to help meet free elective requirements.*

<sup>9</sup> *Normally, CS entering freshmen should take [CS 125](#) their first semester and [CS 122](#) their second semester. Students placing out of [CS 125](#) should take [CS 122](#) their first semester.*

<sup>8</sup> *[MATH 220](#) may be substituted, with four of the five credit hours applying toward the degree. [MATH 220](#) is appropriate for students with no background in calculus.*

<sup>8</sup> *[BIET 105](#) should be taken in the first or second semester of the first year as authorized. The alternative is a social sciences or humanities elective.*

<sup>8</sup> *[Liberal education electives](#) must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.*

<sup>9</sup> *To be chosen from a departmentally approved [list for the Technical Track Option courses list](#), and to include at least three courses from a single focus area and a team project course.*

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## Appendix A: (Proposed Curriculum Revisions)

Current Requirements:	Current Hours	Revised Requirements:	Revised Hours
<b>Major Core Requirement</b>			
CS 100 (recommended)	(1)	CS 100 (recommended)	(1)
CS 125	4	CS 125	4
		<b>CS 126</b>	3
CS 173	3	CS 173	3
CS 210	2	CS 210	2
CS 225	4	CS 225	4
CS 231	3	<b>CS 233</b>	4
CS 232	3		
CS 241	4	CS 241	4
CS 242	3		
CS 357*	3	CS 357*	3
CS 373	3	<b>CS 374</b>	4
CS 473*	3		
CS 421*	3	CS 421*	3
<b>TOTAL CORE</b>	<b>38</b>	<b>TOTAL CORE</b>	<b>34</b>
* In the current curriculum, CS 357, 473, and 421 are typically listed as part of each CS Technical Track (below). We have separated them out and listed them above because they are viewed as “core” courses, and because this makes clear the proposed changes to the curriculum.			
<b>CS Technical Track Requirement (select one)</b> CS track Math track CSE track	<b>18**</b>	<b>CS Technical Electives</b> (must satisfy certain constraints to be listed on department controlled web page)	<b>24</b>
** The hours listed in the technical tracks excludes those for CS 357, 421, and 473, because those are included above under Core Requirements.			
<b>Supporting Math/Science</b>			
MATH 221	4	MATH 221	4
MATH 231	3	MATH 231	3
MATH 241	4	MATH 241	4
MATH 415	3	MATH 415	3
MATH 461 or 463	3	<b>CS 361</b>	3
PHYS 211	4	PHYS 211	4
PHYS 212	4	PHYS 212	4
PHYS 213 or 214	2		
CHEM 102 & 103	4	<b>Science elective</b>	3
<b>TOTAL MATH/SCI</b>	<b>31</b>	<b>TOTAL MATH/SCI</b>	<b>28</b>
<b>Electives***</b>	<b>41</b>	<b>Electives***</b>	<b>42</b>
*** Includes Rhetoric, advanced composition, foreign language, and campus & college general education requirements			

## STATEMENT FOR PROGRAMS OF STUDY CATALOG:

# For the Degree of Bachelor of Science in Computer Science

The computer science curriculum provides both a broad and deep knowledge of the theory, design, and application of computer systems, with an emphasis on software systems. Because computing is ubiquitous, application areas involve virtually any field imaginable - from developing gene sequencing algorithms via techniques in computational biology, to designing user interfaces for mobile applications; from designing methods for high frequency trading, to creating computer generated graphics and special effects in the gaming industry; and from creating embedded real time systems to be deployed in medical devices, to analyzing social data from internet communication patterns. During the first two years the curriculum provides a strong foundation in mathematics, science, and computation. Advanced coursework in areas of the student's choosing follows in the second two years, with a deeper focus in one area. All students do a significant team project. Graduates go on to graduate study or leading positions in industry.

A combined B.S.-M.S. Computer Science degree program is available. Its admission and course requirements are described in the [College of Engineering program information section](#).

A [Software Engineering Certificate](#) is also available to all students in the computer science curriculum interested in a career in software engineering. It provides the depth and breadth necessary for satisfying possible future software engineering accreditation requirements.

## Overview of Curricular Requirements

The curriculum requires 128 hours for graduation and is organized as shown below.

A technical grade point average requirement for graduation applies to students in this curriculum. This rule is summarized at the College of Engineering's [undergraduate advising Web site](#).

## Orientation and Professional Development

These courses introduce the opportunities and resources your college, department, and curriculum can offer you as you work to achieve your

career goals. They also provide the skills to work effectively and successfully in the engineering profession.

Hours	Requirements
(1)	CS 100—Freshman Orientation in CS <sup>1,2</sup>
2	CS 210—Ethical & Professional Issues
0	ENG 100—Engineering Orientation <sup>2</sup>
<b>2</b>	<b>Total</b>

1. This optional course is highly recommended and may be used to help meet free elective requirements. 2. External transfer students take ENG 300 - Transfer Orientation instead.

## Foundational Mathematics and Science

These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

Hours	Requirements
4	MATH 221—Calculus I <sup>1</sup>
3	MATH 231—Calculus II
4	MATH 241—Calculus III
3	MATH 415—Applied Linear Algebra
4	PHYS 211—University Physics: Mechanics
4	PHYS 212—University Physics: Elec & Mag
3	Science elective, from departmentally approved list
<b>25</b>	<b>Total</b>

1. MATH 220—Calculus may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

## Computer Science Technical Core

These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of computer science.

Hours	Requirements
4	CS 125—Intro to Computer Science
3	CS 126—Software Design Studio
3	CS 173—Discrete Structures
4	CS 225—Data Structures
4	CS 233—Computer Architecture
4	CS 241—Systems Programming
3	CS 357—Numerical Methods I

3	CS 361—Probability and Statistics for CS
4	CS 374—Algorithms and Models of Computation
3	CS 421—Programming Languages and Compilers
<b>35</b>	<b>Total</b>

## Technical Electives

These courses stress the rigorous analysis and design principles practiced in major subdisciplines of computer science. Students select eight courses, at least six of which must be advanced CS courses. Three courses must be selected from one area of CS.

Hours	Requirements
24	Technical electives to be chosen from departmentally approved list. Refer to department website.

## Liberal Education

The [liberal education courses](#) develop students' understanding of human culture and society, build skills of inquiry and critical thinking, and lay a foundation for civic engagement and lifelong learning.

Hours	Requirements
6	Electives from the campus General Education social & behavioral sciences list.
6	Electives from the campus General Education humanities & the arts list.
6	Electives either from a list approved by the college, or from the campus General Education lists for social & behavioral sciences or humanities & the arts.
<b>18</b>	<b>Total</b>

Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

## Composition

These courses teach fundamentals of expository writing.

Hours	Requirements
4	RHET 105—Principles of Composition
	Advanced Composition. May be satisfied by taking any course in either the

	liberal education or free elective categories which has the Advanced Composition designation, or by completing CS 499 Senior Thesis.
<b>4</b>	<b>Total</b>

## Free Electives

These unrestricted electives, subject to certain exceptions as noted at the [College of Engineering advising Web site](#), give the student the opportunity to explore any intellectual area of unique interest. This freedom plays a critical role in helping students to define research specialties or to complete minors.

Hours	Requirements
<b>18</b>	Free electives not counted above Additional unrestricted course work, subject to certain exceptions as noted at the <a href="#">College of Engineering advising Web site</a> . At least 128 credit hours must be earned to graduate.

## Suggested Sequence

The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken.

### First year

Hours	First Semester
3	Science elective
1	CS 100—Freshman Orientation in CS <sup>1</sup>
4	CS 125—Intro to Computer Science
0	ENG 100—Engineering Orientation
4	MATH 221—Calculus I <sup>2</sup>
4-3	RHET 105—Principles of Composition <sup>3</sup> or Liberal education elective <sup>4</sup>
<b>15-16</b>	<b>Total</b>

Hours	Second Semester
3	CS 126—Software Design Studio
3	CS 173—Discrete Structures
3	MATH 231—Calculus II
4	PHYS 211—University Physics: Mechanics

3-4	Liberal education elective <sup>4</sup> or RHET 105—Principles of Composition <sup>3</sup>
16-17	<b>Total</b>

## Second year

Hours	First Semester
4	CS 225—Data Structures
4	CS 233—Computer Architecture
4	MATH 241—Calculus III
4	PHYS 212—University Physics: Elec & Mag
16	<b>Total</b>

Hours	Second Semester
4	CS 241—Systems Programming
3	CS 361—Probability and Statistics for CS
3	MATH 415—Applied Linear Algebra
6	Liberal education electives <sup>4</sup>
16	<b>Total</b>

## Third year

Hours	First Semester
3	CS 357—Numerical Methods I
4	CS 374—Algorithms and Models of Computation
3	CS Technical elective
3	Liberal education elective <sup>4</sup>
3	Free elective
16	<b>Total</b>

Hours	Second Semester
9	CS Technical electives <sup>5</sup>
2	CS 210—Ethical & Professional Issues
3	Liberal education elective <sup>4</sup>
3	Free elective
17	<b>Total</b>

## Fourth year

Hours	First Semester
3	CS 421—Programming languages and compilers
6	CS Technical electives <sup>5</sup>
3	Liberal education elective <sup>4</sup>

4	Free electives
<b>16</b>	<b>Total</b>

Hours	Second Semester
6	CS Technical electives <sup>5</sup>
9	Free electives
<b>15</b>	<b>Total</b>

1. *This optional course is highly recommended for freshmen, who may use it to help meet free elective requirements.*

2. *MATH 220—Calculus may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.*

3. *RHET 105 should be taken in the first or second semester of the first year as authorized. The alternative is a social sciences or humanities elective.*

4. *Liberal education electives must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.*

5. *To be chosen from a departmentally approved list, and to include at least three courses from a single focus area.*

**CLEARANCES:** (Clearances should include signatures and dates of approval. **These signatures must appear on a separate sheet.** If multiple departments or colleges are sponsoring the proposal, please add the appropriate signature lines below.)

Signatures:



\_\_\_\_\_  
Unit Representative:

2/1/2015

\_\_\_\_\_  
Date:

\_\_\_\_\_  
College Representative:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Graduate College Representative:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Council on Teacher Education Representative:

\_\_\_\_\_  
Date:



## NEW COURSE OUTLINE

Departments/units should complete this form, obtain all necessary approvals and submit to their College Office to establish a new course. The outline will be reviewed by the College and forwarded to appropriate campus offices for additional approval.

All gray boxes on this form, except gray check boxes, are expandable text fields. Place your cursor in the box and start typing.

Instructions and guidance to complete certain numbered items in this form are contained in *Proposing New Courses* (<http://provost.illinois.edu/programs/cps/proposingcourses.html>) and *Procedures for Presenting New or Revised Graduate Courses* (<http://www.grad.illinois.edu/courses-procedures>).

Proposed Effective Term:  Fall  Spring  Summer – 2016

Department/Unit Name: CS

Department/Unit ORG Code: 1434

1. Course Subject and Number: CS 126
2. Course Title (limit to 30 characters): Software Design Studio
3. Course description (Include subject matter, and any special course requirements such as field trips, special equipment, etc. Exclude other course information of any numbered items below; the Office of the Registrar will include it in the *Course Catalog* entry. It should read like a publication abstract and ideally be limited to about 75 words.):  
Fundamental principles and techniques of software development. Design, documentation, testing, and debugging software, with a significant emphasis on code review.
4. Course prerequisites (prerequisite statements are not enforced through the Banner system):  
CS 125
5. Is there a restricted audience for this course? (Audience restrictions may only be placed in the Class Schedule. Do not include in prerequisite statement.)  
 Yes  No If yes, please specify the restrictions (e.g., “for majors only” or “junior standing required”): for majors only

## COURSE JUSTIFICATION

6. Please attach the course syllabus. The syllabus should include basic and recommended texts (author, title, year of publication) as well as a list of the principal topics covered in this course, number of examinations, contact hours, work required of students, and basis for determining grade.
7. Justify the course in terms of new subject matter and how the addition of this course relates to the overall pattern of courses in your unit: This course is being created to replace CS242-Programming Studio because we've recognized that our students would benefit from encountering the course material earlier in the curriculum. Changes are being made to make the course suitable for students who are

at an earlier point in our program and to introduce some human-computer interface content into our required course sequence.

8. Explain the nature and degree of duplication or overlap with existing courses on campus: This course has a significant degree of overlap with CS 242, which it will replace. This course contains introductory material related to a number of our electives (e.g., CS427: Software Engineering, CS465: User Interface Design), but is taught in considerably less depth and at a lower level than these courses.

Note: If the proposed course has significant overlap with an existing course outside your unit, please obtain a letter of comment from that unit's executive officer.

### COURSE DETAIL

9. Frequency with which this course will be offered (mark all that apply):

Every fall    Every spring    Every summer    Other (describe, e.g. "Spring terms, odd years"):

\_\_\_\_\_

10. Duration of course:  Full term    Less than full term (describe) : \_\_\_\_\_

11. Anticipated enrollment: 200

12. Expected distribution of student registration:

Freshman: 90%

Sophomore: 10%

Junior: \_\_\_%

Senior: \_\_\_%

Graduate: \_\_\_%

Professional: \_\_\_%

13. Course credit (The number of class contact hours in organized instruction is one factor affecting the amount of credit earned. It is customary for courses to meet 14 to 20 hours per semester for each hour of credit earned. See *Student Code* Article 3, Part 7, § 3-704 (b) {[http://admin.illinois.edu/policy/code/article3\\_part7\\_3-704.html](http://admin.illinois.edu/policy/code/article3_part7_3-704.html)} for an explanation of the relationship between course credit and contact hours.):

**A. Undergraduate credit only**

100- to 300-level: 3\* undergraduate hours

400-level: \_\_\_\_\_\* undergraduate hours (no graduate credit available)

**B. Both Undergraduate and Graduate credit**

400-level: \_\_\_\_\_\* undergraduate hours and 400-level: \_\_\_\_\_\* graduate hours

Note: Courses offered for both undergraduate and graduate credit require completion of Item 14.

**C. Graduate credit only**

500-level: \_\_\_\_\_\* graduate hours

Note: Courses offered for graduate credit require completion of Item 14.

**D. Professional credit only**

600- and 700-level: \_\_\_\_\_\* professional hours

**E. Both Graduate and Professional credit**

\_\_\_\_\_ \* graduate hours and \_\_\_\_\_ \* professional hours

Note: Courses offered for both graduate and professional credit require completion of Item 14.

\* For A-E, if a course is offered for varying amounts of credit please select one of the two options:

- Variable credit: this course is available for a range of credit hours (e.g., 1 to 3 hours)  
 Differential credit: this course is only available for two distinct credit-hour options (e.g., 1 or 3 hours)

In addition, complete Item 15.

14. For any course awarding graduate credit, please justify why it should, in terms of level of content, previous knowledge required, relevance to current research, methodology, etc. (See *Graduate College Policy for Proposed New and Revised Courses that Carry Graduate Credit* for criteria to judge graduate courses.): \_\_\_\_\_
15. For any course requesting variable or differential credit, please justify why the amount of credit varies and specify the work required for the additional credit: \_\_\_\_\_
16. May this course be repeated? (See *Procedures for Presenting New or Revised Graduate Courses* or Provost's *Proposing New Courses* for guidance in completing Parts A - C.)  
 Yes  No If yes, please fill out A - C below:

#### A. Course Type

Indicate the **one** type of course the proposed course matches:

- Honors  Subject mastery/skill proficiency  Individualized instruction  
 Research or ongoing study  Special topics, seminars  Applied experiences

#### B. Repeatable – same term

May students register in this course more than once (duplicate registration) in the same term?

- Yes  No If yes, for how many total hours (fill all fields: NA = not applicable; U = unlimited)?  
\_\_\_\_\_ undergraduate; \_\_\_\_\_ graduate; \_\_\_\_\_ professional  
 check if “if topics vary” is an added qualifier

#### C. Repeatable – separate terms

May this course be repeated in separate terms?

- Yes  No If yes, for how many total hours (fill all fields: NA = not applicable; U = unlimited)?  
\_\_\_\_\_ undergraduate; \_\_\_\_\_ graduate; \_\_\_\_\_ professional  
 check if “if topics vary” is an added qualifier

17. Are there credit restrictions?

Yes  No If yes, please specify the restrictions (e.g., for MATH 221: “Credit is not given for both MATH 221 and MATH 220.”): Credit is not given for both CS 242 and CS 126.

18. Grading Type:

- Letter grade  
 S/U (Any course offered for zero hours of graded credit must include S/U grade mode.)  
 Both If Both is selected, which should be the default mode?  Letter grade  S/U  
 DFR If DFR is selected, please justify the use of the grade: \_\_\_\_\_

## CROSS-LISTING

19. Is this course to be cross-listed?

Yes  No If yes, please complete A and B and take notice of C:

A. Indicate the subject and course number of the cross-listing(s) (please note, all cross-listed courses must be offered at the same numerical level): \_\_\_\_\_

B. Please give the justification for establishing the cross-listing: \_\_\_\_\_

C. **Note: Additional approvals are required to establish a cross-listing.** An authorized official of each non-controlling department must endorse the cross-listing. In addition, if the cross-listing involves a different college, a dean of that college must also approve. (Letter, e-mail, or use of the Additional Approvals signature block at the end of this form are all acceptable methods of endorsement or approval.)

## ADDITIONAL COURSE INFORMATION

20. Does this course replace an existing course?

Yes  No If yes, please list the course to be discontinued and note that submission of a Course Revision Form is necessary to remove it from the Course Catalog: CS 242 - will be discontinued after students who still need to take it have cycled through

21. Does the addition of this course impact other courses (i.e., prerequisite or credit restriction statements)?

Yes  No If yes, please list the course(s) affected, and note that submission of Course Revision Form(s) are necessary to update the impacted course(s): Will serve as a prerequisite course for CS 225.

22. Does the addition of this course have any impact on your department's current curriculum (i.e., Programs of Study catalog, concentrations, minors, etc.)?

Yes  No If yes, please specify the curriculum and explain: Will be a required course for all undergraduate CS programs.

23. Has this course been offered as a special topics or other type of experimental course?

Yes  No If yes, please indicate the Banner subject, course number, section ID, term, and enrollment for each offering: CS 242, from which CS 126 is derived has been taught each semester at scale. A pilot of the new CS 126 is currently being taught as CS 199 section SDS, fall 2014, 4 enrolled. Planned offering as CS 199 section 126 in Fall 2015

24. Will this course be submitted for General Education credit?

Yes  No

25. Does this course require students to register in multiple schedule components (e.g., lecture and a lab)?

Yes  No

26. Is a special facility needed to effectively teach this class (e.g., lab, studio, or ITS room)?

Yes  No If yes, please describe: \_\_\_\_\_

27. Will this course be offered on-line?

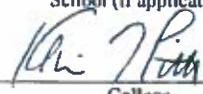
Yes, online only  Yes, online and traditionally  No

28. Faculty member(s) who will teach this course: Mike Woodley, Lawrence Angrave

29. Course proposed by: Lenny Pitt Date: August 21, 2015

**NEW COURSE OUTLINE APPROVALS** Course Subject and Number: CS 126

(Signatures required)

 _____ Department/Unit	<u>8/21/2015</u> _____ Date
School (if applicable) _____  College	_____ Date <u>9/28/15</u> _____ Date
Graduate College (Requests for Graduate Credit) <small>Digitally signed by Kathryn A. Martensen DN: cn=Kathryn A. Martensen, o=University of Illinois at Urbana Champaign, ou=Office of the Provost and Vice Chancellor for Academic Affairs, email=kaam@uiuc.edu, c=US Date: 2015.12.23 11:18:25 -0600</small> <b>Kathryn A. Martensen</b> _____ Provost	_____ Date _____ Date

**ADDITIONAL APPROVAL(S)**

The space below may be used for additional approvals involving cross-listed courses. – see Section 19.C; – in lieu of letters or e-mails. Indicate department or college after signature and provide date.

Revised 8/2012

## Syllabus for CS 126 – Software Design Studio

**CREDIT:** 3 undergraduate hours

**MEETING SCHEDULE/CONTACT HOURS:** Three 50-minute or two 75-minute lectures and/or guided discussion sections (3 contact hours) per week.

**REQUIRED TEXTBOOK:** Code Complete: A Practical Handbook of Software Construction, Second Edition, Auth: Steve McConnell, Pub: Microsoft Press.

### TOPIC OUTLINE:

<u>Topics</u>	<u>Contact Hours</u>
<b>Style, refactoring, code reviews</b>	7
<i>layout, commenting, variable usage and naming, writing control structures</i>	
<b>Test-driven development, testing frameworks, coverage</b>	6
<i>Defensive programming, assertions, exceptions recursion review / in assignments (in this section or the one above)</i>	
<b>Design, design of routines, object-oriented design</b>	7
<i>Design patterns, event-driven programming, model/view/controller (MVC)</i>	
<b>User interface design, usability guidelines, GUI frameworks, prototyping, user testing</b>	6
<b>Debugging and debuggers</b>	3
<b>Client/server architecture, http, JSON, noSQL data storage</b>	3
<b>C++ syntax; pointers (new/free), operator overloading, templates; tools: make, valgrind, gdb</b>	10
<b>Total</b>	42

### GRADING BASIS:

Students do weekly programming assignments and meet in groups for code reviews, moderated by teaching assistants. The grade is based 90% on the assignments, and 10% on a handful of quizzes throughout the semester.

**PROPOSED BY:** Lenny Pitt



## NEW COURSE OUTLINE

Departments/units should complete this form, obtain all necessary approvals and submit to their College Office to establish a new course. The outline will be reviewed by the College and forwarded to appropriate campus offices for additional approval.

All gray boxes on this form, except gray check boxes, are expandable text fields. Place your cursor in the box and start typing.

Instructions and guidance to complete certain numbered items in this form are contained in *Proposing New Courses* (<http://provost.illinois.edu/programs/cps/proposingcourses.html>) and *Procedures for Presenting New or Revised Graduate Courses* (<http://www.grad.illinois.edu/courses-procedures>).

Proposed Effective Term:  Fall  Spring  Summer – 2016

Department/Unit Name: Computer Science

Department/Unit ORG Code: 1434

1. Course Subject and Number: CS 361
2. Course Title (limit to 30 characters): Prob & Stat for Computer Sci
3. Course description (Include subject matter, and any special course requirements such as field trips, special equipment, etc. Exclude other course information of any numbered items below; the Office of the Registrar will include it in the *Course Catalog* entry. It should read like a publication abstract and ideally be limited to about 75 words.):

Introduction to probability theory and statistics with applications to computer science. Topics include: visualizing datasets, summarizing data, basic descriptive statistics, conditional probability, independence, Bayes theorem, random variables, joint and conditional distributions, expectation, variance and covariance, central limit theorem, Markov inequality, Chebyshev inequality, law of large numbers, Markov chains, simulation, the PageRank algorithm, populations and sampling, sample mean, standard error, maximum likelihood estimation, Bayes estimation, hypothesis testing, confidence intervals, linear regression, principal component analysis, classification, and decision trees.

4. Course prerequisites (prerequisite statements are not enforced through the Banner system):  
Math 220 or 221; credit or concurrent registration in Math 225
5. Is there a restricted audience for this course? (Audience restrictions may only be placed in the Class Schedule. Do not include in prerequisite statement.)

Yes  No      If yes, please specify the restrictions (e.g., “for majors only” or “junior standing required”): For majors only

## COURSE JUSTIFICATION

6. **Please attach the course syllabus.** The syllabus should include basic and recommended texts (author, title, year of publication) as well as a list of the principal topics covered in this course, number of examinations, contact hours, work required of students, and basis for determining grade.
7. Justify the course in terms of new subject matter and how the addition of this course relates to the overall pattern of courses in your unit: This course offers familiarity with practical ideas in probability and statistics. The course is intended to replace a probability/statistics requirement that does not cover topics needed later in Computer Science curricula. The subject matter is a new composite of traditional topics. The course emphasizes statistical topics much more than comparable probability courses. In comparison with statistics courses, there is more information on algorithmic ideas like simulation and pagerank, and we treat topics traditionally omitted from a first course (principal component analysis, classification, linear regression, decision trees), because they are of great value to practicing computer scientists. There is heavier emphasis on multivariate models, common in computer science practice, than in the current requirement. We do not emphasize topics that are traditionally important (hypothesis testing; combinatorial probability; central limit theorem; distributions other than normal, Poisson, beta, gamma, exponential) because they are of less immediate relevance to computer science students. A strong percentage of the homework involves writing practical data analysis programs with messy, publicly available datasets (for example, obtaining data for and constructing estimates of correlation between planetary temperature and FEMA declared disasters; classifying large datasets treating expected earnings).
8. Explain the nature and degree of duplication or overlap with existing courses on campus: Potential overlap is with Math 461, Stat 400., and ECE 313. Math 461 treats: Combinatorial Analysis, 4 hours; Axioms of Probability, 4 hours Conditional Probability and Independence, 4 hours; Random Variables, 6 hours; Continuous Random Variables, 7 hours; Jointly Distributed Random Variables, 5 hours; Properties of Expectations , 7 hours; Limit Theorems, 3 hours (data from <http://www.math.uiuc.edu/~kkirkpat/461C13.html>). In contrast, this course deals with continuous random variables, limit theorems, combinatorial probability, and expectations rather superficially. This course covers visualizing datasets, summarizing data, basic descriptive statistics, Markov chains, simulation, the PageRank algorithm, populations and sampling, sample mean, standard error, maximum likelihood estimation, Bayes estimation, hypothesis testing, confidence intervals, linear regression, principal component analysis, classification, and decision trees. Math 461 does not deal with these topics. The overlap is likely 1/3 of content.

Stat 400 covers Probability and random variables; Discrete and continuous distributions ; The central limit theorem and normal approximation; Point estimation and confidence intervals ; Hypothesis testing (data from <http://publish.illinois.edu/xiaohuichen/teaching/stat400/>). In contrast, this course covers visualizing datasets, summarizing data, basic descriptive statistics, Markov chains, simulation, the PageRank algorithm, populations and sampling, sample mean, standard error, linear regression, principal component analysis, classification, and decision trees. Stat 400 does not deal with these topics. The overlap is likely 40% of content.

ECE 313 covers probability and random variables; discrete and continuous distributions; hypothesis testing in



\_\_\_\_\_ \* graduate hours and \_\_\_\_\_ \* professional hours

Note: Courses offered for both graduate and professional credit require completion of Item 14.

\* For A-E, if a course is offered for varying amounts of credit please select one of the two options:

- Variable credit: this course is available for a range of credit hours (e.g., 1 to 3 hours)  
 Differential credit: this course is only available for two distinct credit-hour options (e.g., 1 or 3 hours)

In addition, complete Item 15.

14. For any course awarding graduate credit, please justify why it should, in terms of level of content, previous knowledge required, relevance to current research, methodology, etc. (See *Graduate College Policy for Proposed New and Revised Courses that Carry Graduate Credit* for criteria to judge graduate courses.): \_\_\_\_\_
15. For any course requesting variable or differential credit, please justify why the amount of credit varies and specify the work required for the additional credit: \_\_\_\_\_
16. May this course be repeated? (See *Procedures for Presenting New or Revised Graduate Courses* or Provost's *Proposing New Courses* for guidance in completing Parts A - C.)  
 Yes  No      If yes, please fill out A - C below:

#### A. Course Type

Indicate the **one** type of course the proposed course matches:

- Honors     Subject mastery/skill proficiency     Individualized instruction  
 Research or ongoing study     Special topics, seminars     Applied experiences

#### B. Repeatable – same term

May students register in this course more than once (duplicate registration) in the same term?

- Yes     No    If yes, for how many total hours (fill all fields: NA = not applicable; U = unlimited)?  
\_\_\_\_\_ undergraduate;    \_\_\_\_\_ graduate;    \_\_\_\_\_ professional  
 check if “if topics vary” is an added qualifier

#### C. Repeatable – separate terms

May this course be repeated in separate terms?

- Yes     No    If yes, for how many total hours (fill all fields: NA = not applicable; U = unlimited)?  
\_\_\_\_\_ undergraduate;    \_\_\_\_\_ graduate;    \_\_\_\_\_ professional  
 check if “if topics vary” is an added qualifier

17. Are there credit restrictions?  
 Yes     No      If yes, please specify the restrictions (e.g., for MATH 221: “Credit is not given for both MATH 221 and MATH 220.”): Credit is not given for both CS 361 and ECE 313
18. Grading Type:  
 Letter grade  
 S/U (Any course offered for zero hours of graded credit must include S/U grade mode.)  
 Both      If Both is selected, which should be the default mode?     Letter grade     S/U  
 DFR      If DFR is selected, please justify the use of the grade: \_\_\_\_\_

## CROSS-LISTING

19. Is this course to be cross-listed?

Yes  No      If yes, please complete A and B and take notice of C:

A. Indicate the subject and course number of the cross-listing(s) (please note, all cross-listed courses must be offered at the same numerical level): STAT 361

B. Please give the justification for establishing the cross-listing: The course will also be an elective course in the Statistics & CS major. Faculty from Statistics may teach the course from time to time.

C. **Note: Additional approvals are required to establish a cross-listing.** An authorized official of each non-controlling department must endorse the cross-listing. In addition, if the cross-listing involves a different college, a dean of that college must also approve. (Letter, e-mail, or use of the Additional Approvals signature block at the end of this form are all acceptable methods of endorsement or approval.)

## ADDITIONAL COURSE INFORMATION

20. Does this course replace an existing course?

Yes  No      If yes, please list the course to be discontinued and note that submission of a Course Revision Form is necessary to remove it from the Course Catalog: \_\_\_\_\_

21. Does the addition of this course impact other courses (i.e., prerequisite or credit restriction statements)?

Yes  No      If yes, please list the course(s) affected, and note that submission of Course Revision Form(s) are necessary to update the impacted course(s): ECE 313 credit restriction

22. Does the addition of this course have any impact on your department's current curriculum (i.e., Programs of Study catalog, concentrations, minors, etc.)?

Yes  No      If yes, please specify the curriculum and explain: This course replaces a requirement in our current CS curriculum that students take either MATH 461 or STAT 400.

23. Has this course been offered as a special topics or other type of experimental course?

Yes  No      If yes, please indicate the Banner subject, course number, section ID, term, and enrollment for each offering: CS 498 section DAF FA12, 27 enrolled; FA13, 52 enrolled; FA14, 88 enrolled; CS 498 section CL1 SP15, 72 enrolled. The discrepancy between the proposed enrollment (~150) and the enrollments of previous CS 498 Special Topics offerings of this course (~75-80) can be explained by the persistence of advising material showing the current options for satisfying this requirement (MATH 461 and MATH 463/STAT 400)

24. Will this course be submitted for General Education credit?

Yes  No

25. Does this course require students to register in multiple schedule components (e.g., lecture and a lab)?

Yes  No

26. Is a special facility needed to effectively teach this class (e.g., lab, studio, or ITS room)?

Yes  No      If yes, please describe: \_\_\_\_\_

27. Will this course be offered on-line?

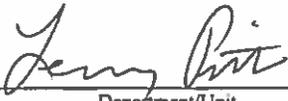
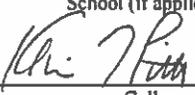
Yes, online only  Yes, online and traditionally  No

28. Faculty member(s) who will teach this course: David Forsyth, and others as available and needed

29. Course proposed by: Lenny Pitt      Date: August 20, 2015

**NEW COURSE OUTLINE APPROVALS**    Course Subject and Number: CS 361

(Signatures required)

 _____ Department/Unit	<u>8/20/2015</u> Date
_____ School (if applicable)	_____ Date
 _____ College	<u>9/30/15</u> Date
_____ Graduate College (Requests for Graduate Credit)	_____ Date
Kathryn A. Martensen <small>Digitally signed by Kathryn A. Martensen DN: cn=Kathryn A. Martensen, o=University of Illinois at Urbana-Champaign, ou=Office of the Provost and Vice Chancellor for Academic Affairs, email=kmartens@illinois.edu, c=US Date: 2015.12.23 11:28:39 -0600</small>	_____ Date
_____ Provost	_____ Date

**ADDITIONAL APPROVAL(S)**

The space below may be used for additional approvals involving cross-listed courses. – see Section 19.C; – in lieu of letters or e-mails. Indicate department or college after signature and provide date.

Revised 8/2012

## Syllabus for CS 361 Prob & Stat for Computer Sci

**Credit:** 3 hours

**Meeting schedule/contact hours:** Three 50-minute or two 75-minute lecture/discussion sections

**Textbook:** Currently, comprehensive set of notes drafted by instructor. Current version available at:

<http://luthuli.cs.uiuc.edu/~daf/courses/Probcourse/Probcourse-2014/book-6-withbd-18-Aug.pdf>

### Topic Outline:

See the course website for the most recent syllabus:

<http://luthuli.cs.uiuc.edu/~daf/courses/Probcourse/Probcourse-2014/498-home.html>

Topic	Hours
Descriptive Statistics	4
Discrete Probability	4
Expectations	3
Continuous probability	1.5
Standard distributions	1.5
Maximum likelihood inference	4.5
Bayesian inference	1.5
Populations and Sampling	3
Hypothesis testing	1.5
Confidence intervals	1.5
Plotting high dimensional data	3
Principal components analysis	3
Linear Regression	3
Classification	4.5
Randomized Decision Trees	1.5
Midterm Exam	1
<b>TOTAL</b>	<b>42</b>

**Number of exams:** one midterm, one final

**Work required of students:** Attend lecture and participate. Complete homeworks (currently 7). Complete midterm and final exam.

**Basis for determining grade:** Homework grades, midterm grades, and final grade. Typical weights: 1 each for first six homeworks; 2 for final homework; 2 for midterm; 4 for final.

**Proposed by:** Lenny Pitt

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

Department of Electrical and Computer Engineering  
Electrical and Computer Engineering Building  
306 North Wright Street  
Urbana, IL 61801



Rob A. Rutenbar  
Abel Bliss Professor and Head  
Department of Computer Science  
University of Illinois at Urbana-Champaign

Dear Rob:

I am writing to confirm the support of the Department of Electrical and Computer Engineering for **Prob & Stat for Comp Sci, CS 361**, despite its substantial overlap (~50% material) with ECE 313. We recognize that the 50% content of the proposed CS 361 that is not covered in ECE 313 is of essential nature for CS majors and, furthermore, large enrollment numbers in both CS and ECE make serving the CS students with a modified version of ECE 313 impracticable. We are therefore comfortable in providing support for the proposed CS 361.

Sincerely,

A handwritten signature in black ink, appearing to read 'Erhan Kudeki'.

**Erhan Kudeki**

Professor and Associate Head for Undergraduate Affairs  
Department of Electrical and Computer Engineering  
University of Illinois at Urbana-Champaign

**Subject:** CS and Stat/CS course and curriculum proposals  
**Date:** Wednesday, December 3, 2014 12:21:50 PM Central Standard Time  
**From:** Simpson, Douglas G  
**To:** Pitt, Leonard B  
**CC:** Rutenbar, Rob, Simpson, Douglas G, Carney, Karen M

Dear Lenny,

Thank you for the opportunity to review and work with you on the course and curriculum proposals for:

- 1) Proposed CS 361, "Prob/Stat for Computer Science;"
- 2) Proposed revision of the STAT/CS major; and
- 3) Revision of CS requirements in Statistics and probability.

I write to indicate the Department of Statistics approval of the following:

- 1) Statistics wishes to cross-list CS 361 as STAT 361;
- 2) Statistics approves of the revised Statistics and Computer Science major;
- 3) Statistics approves of the change in the undergraduate CS/Engineering degree program that replaces the Math 461 or Stat 400 requirement with the new CS/STAT 361 requirement.

Best regards,  
Doug Simpson

=====  
Douglas G. Simpson  
Professor and Chair  
Department of Statistics  
University of Illinois at Urbana-Champaign  
=====

**Subject:** Re: Proposal for the UAC

**Date:** Wednesday, December 31, 2014 1:29:24 PM Central Standard Time

**From:** Ahlgren, Scott David

**To:** Pitt, Leonard B

**CC:** , Muncaster, Robert G, Ando, Matthew A

Dear Lenny,

The Undergraduate Affairs Committee in the Math Department voted on this before the break, and approved the following proposal

%%

- 1) We approve of the proposed revision of the Math & CS degree in LAS
- 2) We approve of the proposed changes to the CS degree in Engineering.
- 3) We approve of the proposed revision to CS 473, which is cross-listed with MATH 473
- 4) We are aware of the overlap between our course Math 461 and the proposed course CS 361 (cross-listed with STAT 361), and the overlap with ECE 313 (cross-listed as MATH 362), and we are agreeable to the creation of this course.

%%

Best,  
Scott

On Dec 17, 2014, at 6:38 AM, Pitt, Leonard B <[pitt@illinois.edu](mailto:pitt@illinois.edu)> wrote:

attached

On Wed12/17/14 Dec 17,6:26 AM, "Ahlgren, Scott David" <[sahlgren@illinois.edu](mailto:sahlgren@illinois.edu)> wrote:

Hello,

Would you be able to send the revised proposals so that it's clear what is being approved? I think that we only have the old proposals.

Thanks,  
Scott

---

**Subject:** CS and Stat/CS course and curriculum proposals

**Date:** Wednesday, December 3, 2014 12:21:50 PM Central Standard Time

**From:** Simpson, Douglas G

**To:** Pitt, Leonard B

**CC:** Rutenbar, Rob, Simpson, Douglas G, Carney, Karen M

Dear Lenny,

Thank you for the opportunity to review and work with you on the course and curriculum proposals for:

- 1) Proposed CS 361, "Prob/Stat for Computer Science;"
- 2) Proposed revision of the STAT/CS major; and
- 3) Revision of CS requirements in Statistics and probability.

I write to indicate the Department of Statistics approval of the following:

- 1) Statistics wishes to cross-list CS 361 as STAT 361;
- 2) Statistics approves of the revised Statistics and Computer Science major;
- 3) Statistics approves of the change in the undergraduate CS/Engineering degree program that replaces the Math 461 or Stat 400 requirement with the new CS/STAT 361 requirement.

Best regards,  
Doug Simpson

=====  
Douglas G. Simpson  
Professor and Chair  
Department of Statistics  
University of Illinois at Urbana-Champaign  
=====



COURSE REVISION FORM

Departments/units should complete this form, obtain all necessary approvals and submit to their College Office to revise a course. The form will be reviewed by the College and forwarded to appropriate campus offices for additional approval.

All gray boxes on this form, except gray check boxes, are expandable text fields. Place your cursor in the box and start typing.

Instructions and guidance to complete certain items in this form are contained in Revising Existing Courses (http://provost.illinois.edu/programs/cps/revisingcourses.html)

Department/Unit Name: Computer Science
Department/Unit ORG Code: 1434
Course Subject and Number: CS 373
Course Title: Theory of Computation
Proposed Effective Term: [ ] Fall [X] Spring [ ] Summer - 2016
Please indicate current course cross-listings\*:

[X] COURSE DISCONTINUANCE (and all cross-lists\*, if any) ; IF CHECKED, SKIP TO #3

-OR- (check the box above or below)

[ ] TYPE OF REVISION(S) (check all that apply)
[ ] Subject [ ] Add [ ] Remove [ ] Revise - Cross-List\*
[ ] Number [ ] Add [ ] Remove [ ] Revise - Differential Credit
[ ] Title [ ] Add [ ] Remove [ ] Revise - Repeatability
[ ] Credit Hours [ ] Add [ ] Remove [ ] Revise - Credit Restriction
[ ] Description (subject matter) [ ] Add [ ] Remove [ ] Revise - Prerequisite
[ ] Grade Mode (e.g., request for use of DFR)
[ ] Other, describe:

1. HOW REVISION(S) INDICATED APPEAR CURRENTLY:

[Empty text box for current revision appearance]

2. HOW REVISION(S) INDICATED WOULD APPEAR AFTER CHANGE:

[Empty text box for revised appearance]

3. JUSTIFY REVISION OR REQUEST:

Some of the material in this course is dated and not of particular use to CS students. Some of the material of this course will be absorbed into a new course, CS 374 (proposal documents submitted at the same time as this document), as part of a revision of all Computer Science majors and the Computer Science minor. CS 374 will retain from CS 373 much of the material on regular languages and finite automata, as well as the topics on computability and limits of computation. Material that has been significantly minimized is that on context-free languages.

The prerequisite statements of several courses will be affected by this proposed revision. These courses are CS 421-Prgrmg Languages & Compilers, CS 427-Software Engineering I, CS 446-Machine Learning, CS 447-Natural Language Processing, CS 476-Program Verification and CS 477-Formal Software Devel Methods. As part of the entire revision package, we have submitted course revision forms for each of the courses affected by the discontinuation of CS 373.

No majors or minors outside of the Computer Science department will be affected by the elimination of CS 373.

Proposed By: Lenny Pitt Date: August 28, 2015

**\*Note: Additional approvals are required.** An authorized official of each non-controlling, cross-listing department must endorse the revisions(s). In addition, if the cross-listing involves a different college, a dean of that college must also approve. (Letter, e-mail, or note written below the Approvals block are all acceptable methods of approval endorsement.)

**COURSE REVISION FORM APPROVALS**      Course Subject and Number: CS 373

(Signatures required)

 _____ Department/Unit	<u>8/28/2015</u> _____ Date
School (if applicable)  _____ College	_____ Date <u>9/14/15</u> _____ Date
Graduate College (Requests for Graduate Credit)  <b>Kathryn A. Martensen</b> _____ Provost	_____ Date _____ Date

**ADDITIONAL APPROVALS**

The space below may be used for additional approvals involving cross-listed courses – cf. footnote \* above – in lieu of letters or e-mails. Indicate department or college after signature and provide date.

Revised 8/2012



## NEW COURSE OUTLINE

Departments/units should complete this form, obtain all necessary approvals and submit to their College Office to establish a new course. The outline will be reviewed by the College and forwarded to appropriate campus offices for additional approval.

All gray boxes on this form, except gray check boxes, are expandable text fields. Place your cursor in the box and start typing.

Instructions and guidance to complete certain numbered items in this form are contained in *Proposing New Courses* (<http://provost.illinois.edu/programs/cps/proposingcourses.html>) and *Procedures for Presenting New or Revised Graduate Courses* (<http://www.grad.illinois.edu/courses-procedures>).

Proposed Effective Term:  Fall  Spring  Summer – 2016

Department/Unit Name: CS

Department/Unit ORG Code: 1434

1. Course Subject and Number: CS 374
2. Course Title (limit to 30 characters): Intro to Algs & Models of Comp
3. Course description (Include subject matter, and any special course requirements such as field trips, special equipment, etc. Exclude other course information of any numbered items below; the Office of the Registrar will include it in the *Course Catalog* entry. It should read like a publication abstract and ideally be limited to about 75 words.):

Analysis of algorithms, major paradigms of algorithm design including recursive algorithms, divide-and-conquer algorithms, dynamic programming, greedy algorithms, and graph algorithms. Formal models of computation including finite automata and Turing machines. Limitations of computation arising from fundamental notions of algorithm and from complexity-theoretic constraints. Reductions, undecidability and NP-completeness.

4. Course prerequisites (prerequisite statements are not enforced through the Banner system):  
CS 225; MATH 225 or MATH 415
5. Is there a restricted audience for this course? (Audience restrictions may only be placed in the Class Schedule. Do not include in prerequisite statement.)  
 Yes  No      If yes, please specify the restrictions (e.g., “for majors only” or “junior standing required”): \_\_\_\_\_

## COURSE JUSTIFICATION

6. **Please attach the course syllabus.** The syllabus should include basic and recommended texts (author, title, year of publication) as well as a list of the principal topics covered in this course, number of examinations, contact hours, work required of students, and basis for determining grade.



Note: Courses offered for both undergraduate and graduate credit require completion of Item 14.

**C. Graduate credit only**

500-level: \_\_\_\_\_ \* graduate hours

Note: Courses offered for graduate credit require completion of Item 14.

**D. Professional credit only**

600- and 700-level: \_\_\_\_\_ \* professional hours

**E. Both Graduate and Professional credit**

\_\_\_\_\_ \* graduate hours and \_\_\_\_\_ \* professional hours

Note: Courses offered for both graduate and professional credit require completion of Item 14.

\* For A-E, if a course is offered for varying amounts of credit please select one of the two options:

Variable credit: this course is available for a range of credit hours (e.g., 1 to 3 hours)

Differential credit: this course is only available for two distinct credit-hour options (e.g., 1 or 3 hours)

In addition, complete Item 15.

14. For any course awarding graduate credit, please justify why it should, in terms of level of content, previous knowledge required, relevance to current research, methodology, etc. (See *Graduate College Policy for Proposed New and Revised Courses that Carry Graduate Credit* for criteria to judge graduate courses.): \_\_\_\_\_
15. For any course requesting variable or differential credit, please justify why the amount of credit varies and specify the work required for the additional credit: \_\_\_\_\_
16. May this course be repeated? (See *Procedures for Presenting New or Revised Graduate Courses* or Provost's *Proposing New Courses* for guidance in completing Parts A - C.)
- Yes  No      If yes, please fill out A - C below:

**A. Course Type**

Indicate the **one** type of course the proposed course matches:

Honors     Subject mastery/skill proficiency     Individualized instruction

Research or ongoing study     Special topics, seminars     Applied experiences

**B. Repeatable – same term**

May students register in this course more than once (duplicate registration) in the same term?

Yes  No    If yes, for how many total hours (fill all fields: NA = not applicable; U = unlimited)?

\_\_\_\_\_ undergraduate;    \_\_\_\_\_ graduate;    \_\_\_\_\_ professional

check if “if topics vary” is an added qualifier

**C. Repeatable – separate terms**

May this course be repeated in separate terms?

Yes  No    If yes, for how many total hours (fill all fields: NA = not applicable; U = unlimited)?

\_\_\_\_\_ undergraduate;    \_\_\_\_\_ graduate;    \_\_\_\_\_ professional

check if “if topics vary” is an added qualifier

17. Are there credit restrictions?

Yes  No If yes, please specify the restrictions (e.g., for MATH 221: "Credit is not given for both MATH 221 and MATH 220."): \_\_\_\_\_

18. Grading Type:

Letter grade

S/U (Any course offered for zero hours of graded credit must include S/U grade mode.)

Both If Both is selected, which should be the default mode?  Letter grade  S/U

DFR If DFR is selected, please justify the use of the grade: \_\_\_\_\_

### CROSS-LISTING

19. Is this course to be cross-listed?

Yes  No If yes, please complete A and B and take notice of C:

A. Indicate the subject and course number of the cross-listing(s) (please note, all cross-listed courses must be offered at the same numerical level): ECE 374

B. Please give the justification for establishing the cross-listing: It is a required course in both curricula, and both departments will contribute resources towards its delivery

C. Note: Additional approvals are required to establish a cross-listing. An authorized official of each non-controlling department must endorse the cross-listing. In addition, if the cross-listing involves a different college, a dean of that college must also approve. (Letter, e-mail, or use of the Additional Approvals signature block at the end of this form are all acceptable methods of endorsement or approval.)

### ADDITIONAL COURSE INFORMATION

20. Does this course replace an existing course?

Yes  No If yes, please list the course to be discontinued and note that submission of a Course Revision Form is necessary to remove it from the Course Catalog: CS 373

21. Does the addition of this course impact other courses (i.e., prerequisite or credit restriction statements)?

Yes  No If yes, please list the course(s) affected, and note that submission of Course Revision Form(s) are necessary to update the impacted course(s): CS 473

22. Does the addition of this course have any impact on your department's current curriculum (i.e., Programs of Study catalog, concentrations, minors, etc.)?

Yes  No If yes, please specify the curriculum and explain: As explained in the justification section, the course will replace CS 373 and CS 473 in the present curriculum.

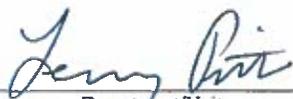
23. Has this course been offered as a special topics or other type of experimental course?

Yes  No If yes, please indicate the Banner subject, course number, section ID, term, and enrollment for each offering: CS 498 (special topics) section 374, spring 2014, 43 students; CS 498 Section BL1, FA14, 80 students; SP15, 385 students

24. Will this course be submitted for General Education credit?  
 Yes  No
25. Does this course require students to register in multiple schedule components (e.g., lecture and a lab)?  
 Yes  No
26. Is a special facility needed to effectively teach this class (e.g., lab, studio, or ITS room)?  
 Yes  No      If yes, please describe: \_\_\_\_\_
27. Will this course be offered on-line?  
 Yes, online only    Yes, online and traditionally    No
28. Faculty member(s) who will teach this course: Jeff Erickson, Chandra Chekuri, Lenny Pitt, Madhu Parthasarathy, Nitin Vaidya
29. Course proposed by: Lenny Pitt and Jeff Erickson    Date: August 27, 2015

**NEW COURSE OUTLINE APPROVALS** Course Subject and Number: CS 374

(Signatures required)

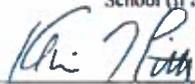


Department/Unit

8/27/2015

Date

School (if applicable)



College

Date

9/14/15

Date

Graduate College (Requests for Graduate Credit)

**Kathryn A. Martensen**

Digitally signed by Kathryn A. Martensen  
DN: cn=Kathryn A. Martensen, o=University of Illinois at Urbana-Champaign, ou=Office of the Provost and Vice Chancellor for Academic Affairs, email=kamartens@uiuc.edu, c=US  
Date: 2015.12.23 11:38:57 -0600

Provost

Date

Date

**ADDITIONAL APPROVAL(S)**

The space below may be used for additional approvals involving cross-listed courses. – see Section 19.C; – in lieu of letters or e-mails. Indicate department or college after signature and provide date.

Revised 8/2012

## Syllabus: CS 374

**Credit:** 4 hours.

**Textbook:** None required, extensive notes are available online from instructors of this and other courses. Notes from the latest offering can be found here: <https://courses.engr.illinois.edu/cs498374/lectures.html>.

**Exams:** two 75-minute exams, plus final exam.

**Contact hours:** Three lecture hours and two discussion hours.

**Work required:** Regular written homework and quizzes, plus exams

**Grade basis:** Typical: 70% exams and quizzes, 30% homework

### Topics Covered:

Hours	Topic
2	Intro to analysis of algorithms
4	Graph representations, traversal, topological sort
8	Finite automata and regular languages
4	Recursion, divide & conquer
6	Dynamic programming
6	Greedy algorithms, shortest paths, minimum spanning trees
4	Context-free grammars and languages
10	Turing machines, universality, reductions, and computability
8	Reductions/NP-completeness/Cook-Levin theorem
4	Hourly exams and review
56	<b>TOTAL</b> (this assumes four hours per week of new material and one hour per week of skills practice)

**Proposed by:** Lenny Pitt and Jeff Erickson

**From:** [Pitt, Leonard B](#)  
**To:** [Waranyuwat, Adva Steiner](#)  
**Cc:** [Herzog, Stephen M](#)  
**Subject:** FW: Endorsement of new CS/ECE 374  
**Date:** Sunday, August 16, 2015 6:25:03 AM

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Below is an email from ECE dept. head Bill Sanders, endorsing CS/ECE 374.

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**From:** Sanders, William H  
**Sent:** Friday, October 31, 2014 4:41 PM  
**To:** Pitt, Leonard B  
**Cc:** Erickson, Jeff G; Kudeki, Erhan; Beck, Jeannette Garinger; Carlson, Jennifer Merry  
**Subject:** Endorsement of new CS/ECE 374

Rob A. Rutenbar  
Abel Bliss Professor and Head  
Department of Computer Science  
University of Illinois at Urbana-Champaign

Dear Rob:

I am writing to confirm the support of the Department of Electrical and Computer Engineering for the new "Algorithms & Models of Comp" course, CS 374, which we would like to cross list as ECE 374. Computer Engineering majors will be taking ECE 374 as a required course for graduation. ECE is also willing and planning to help with the staffing of CS 374.

Sincerely,

William H. Sanders

Donald Biggar Willett Professor and Head  
Department of Electrical and Computer Engineering  
University of Illinois at Urbana-Champaign

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

EP.16.49

Office of the Provost and Vice Chancellor  
for Academic Affairs

Swanlund Administration Building  
601 East John Street  
Champaign, IL 61820



December 23, 2015

Bettina Francis, Chair  
Senate Committee on Educational Policy  
Office of the Senate  
228 English Building, MC-461

Dear Professor Francis:

Enclosed is a copy of a proposal from the College of Engineering to revise the Bachelor of Science in Computer Science.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kathryn A. Martensen'.

Kathryn A. Martensen  
Assistant Provost

Enclosures

c: K. Pitts  
L. Pitt  
A. Waranyuwat



**Senate Educational Policy Committee  
Proposal Check Sheet**

**PROPOSAL TITLE** (Same as on proposal): \_\_\_\_\_

**PROPOSAL TYPE** (select all that apply below):

A.  Proposal for a **NEW** or **REVISED** degree program. Please consult the Programs of Study Catalog for official titles of existing degree programs.

1. Degree program level:

Graduate                       Professional                       Undergraduate

2.  Proposal for a new **degree** (e.g. B.S., M.A. or Ph.D.):

    Degree name, "e.g., *Bachelor of Arts or Master of Science*": \_\_\_\_\_

3.  Proposal for a new or revised **major, concentration, or minor**:

New or  Revised **Major** in (name of existing or proposed major): \_\_\_\_\_

New or  Revised **Concentration** in (name of existing or proposed concentration): \_\_\_\_\_

New or  Revised **Minor** in (name of existing or proposed minor): \_\_\_\_\_

4.  Proposal to rename an existing major, concentration, or minor:

Major                       Concentration                       Minor

    Current name: \_\_\_\_\_

    Proposed new name: \_\_\_\_\_

5.  Proposal to terminate an existing degree, major, concentration, or minor:

Degree                       Major                       Concentration                       Minor

    Name of existing degree, major, or concentration: \_\_\_\_\_

6.  Proposal involving a multi-institutional degree:

New                       Revision                       Termination

    Name of existing Illinois (UIUC) degree: \_\_\_\_\_

    Name of non-Illinois partnering institution: \_\_\_\_\_

Location of non-Illinois partnering institution:

State of Illinois     US State: \_\_\_\_\_     Foreign country: \_\_\_\_\_

- B.  Proposal to create a new academic unit (college, school, department, program or other academic unit):

Name of proposed new unit: \_\_\_\_\_

- C.  Proposal to rename an existing academic unit (college, school, department, or other academic unit):

Current name of unit: \_\_\_\_\_

Proposed new name of unit: \_\_\_\_\_

- D.  Proposal to reorganize existing units (colleges, schools, departments, or program):

1.  Proposal to change the status of an existing and approved unit (e.g. change from a program to department)

Name of current unit including status: \_\_\_\_\_

2.  Proposal to transfer an existing unit:

Current unit's name and home: \_\_\_\_\_

Proposed new home for the unit: \_\_\_\_\_

3.  Proposal to merge two or more existing units (e.g., merge department A with department B):

Name and college of unit one to be merged: \_\_\_\_\_

Name and college of unit two to be merged: \_\_\_\_\_

Proposed name and college of new (merged) unit: \_\_\_\_\_

4.  Proposal to terminate an existing unit:

Current unit's name and status: \_\_\_\_\_

- E.  **Other educational policy proposals** (e.g., academic calendar, grading policies, etc.)

Nature of the proposal: \_\_\_\_\_

Revised 10/2012