

# Changes to the CS major

December 9, 2008

Presenter: Lillian Lee

Chair of the CS Faculty Curriculum Committee, est. May 2008:

Ken Birman	Jon Kleinberg
Johannes Gehrke	Steve Marschner, DUS
Joe Halpern	Andrew Myers
Dan Huttenlocher	Bart Selman
Bobby Kleinberg	Éva Tardos, Dept. Chair

Approved by vote of the entire CS faculty on November 19th, 2008

Updates: <http://www.cs.cornell.edu/ugrad/CSMajorTransition08-09.htm>

## About us...

The research of the Cornell CS department is generally ranked in the **top 5** in the USA (e.g., National Research Council report)...

... even though we have at least 10% fewer faculty than our top-five peers (“48” vs. “54, 58, 96, 100+”)

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- ▶ We hope you are proud to be a member of the department (or want to join).
- ▶ We hope you have faith in our vision of how to educate students for the future of the field.

... but actually, it's about you

The plan in this presentation is to *simultaneously*:

- ▶ Explain our motivations
- ▶ Present the changes
  - ▶ ...including a last (?) fine-tuning **yesterday** (Monday) to help with 2111 transition issues
- ▶ Sketch our future plans
  
- ▶ Provide reassurance and guidance
- ▶ Answer your questions
- ▶ Solicit your feedback and suggestions (administrative issues, vector menus, this presentation — dry run for the town hall meeting — etc.)

## Main motivation

The “old” major: emphasis on fundamentals across all of CS.

Now: we believe that many sub-fields have now matured enough to allow for focused undergraduate study.

*Our aim: **provide students flexibility** to pursue sub-fields of interest more deeply, **while ensuring that they are well-prepared** both in these areas and for the future, in CS and in general.*

- ▶ Many requirements (significantly) relaxed to “make room”
- ▶ New structure (prob/stats and *vectors*) applied to ensure adequate preparation

a full prob course => room in 2800 => move crucial stuff from 3810 to 2800/4820  
 => 3810 -> elective (but must be taken if you took the "old" 2800)  
 sci. comp. -> elective; 2111 dropped (planned: 4-credit intensive 2110 alternative)  
 NEW: 2111 partially fulfills the new "MAJ" elective

Course	Cr	Sem	Gr	Advising Notes
FWS				Freshman Writing Seminars
FWS				
Lib Stds				Liberal Studies: 6 courses; min 4 or 2 crs must be 200-level or higher. Courses must be chosen from at least 4 of the six groups.
Lib Stds				
MATH 1910	4			Calculus Requirement
MATH 1920	4			Math 1110-1201/220-2210 is also acceptable
MATH 2940	4			
PHYS 1112	4			
PHYS 2213	4			
PHYS 2214 or CHEM 2060	4			
CHEM 2090 <sup>1</sup>	4			
CS 1113 or 1110 or 1112 or 1114	4			Introductory Programming
CS 1130 or 1132 <sup>2</sup>	1			
CS/ENGRD 2110 <sup>2</sup>	3			Distributn Requirements
	D2			D2-Engrd
	DS			D3-Engrd (Info to Engr)

Course	Cr	Sem	Gr	Advising Notes
CS-2111	4			new: Probabm-Probab-66-2444
CS 2600 <sup>1</sup>	3			Discrete Structures. Pre: CS 1113 or 1110 or 1112 or 1114
CS 3110	4			Data Structures and Functional Programming Pre: CS 2110
CS-3020, 4210, or 4220	4			Scientific Computing. Pre: Math 4210 or Math 2940, and CS 1110
CS 3410 or 3420	4			Digital Systems. Pre: CS 2110
CS-3610	3			Theory of Computing. Pre: CS 2800
CS 4410	3			Operating Systems. Pre: CS 3420 or 3410.
CS 4820	4			Theory of Algorithms. Pre: CS 2800 and 3110

ELECTIVES				
Course	Cr	Sem	Gr	Advising Notes
CS	3+			CS Electives: (Select three non-core CS 4000+ courses (3+ credits) CS 3810/3610 all owed and CS/ENGRD 3220 also accepted unless CS 4210/MATH 4220 also applied. CS 4999 NOT allowed.
CS	3+			
CS	3+			
CS	2+			CS Project: 4121/4821/4411/4450/4851/4701/5195/4101/5450/4870
	Tech			Tech
	Tech			Tech
	Spcl			Spcl
	Spcl			Spcl
	Spcl			Spcl
	MAJ			MAJ
	APRV			APRV
	APRV			APRV
				Major Approved Elective: At least 3 credits total, anything approved by advisor
				Advisor Approved Electives: At least 6 credits total, anything approved by advisor

- TECHNICAL WRITING COURSE
- PROBABILITY COURSE: One of ENTRY 4060, ECE 3100, EOOD 3190, ENGRD 2700 or MATH 4710 (Taking a 3000+ level course strongly is recommended.)

No double counting: No course may be used twice in College Requirements, CS Core, or Electives (e.g. ENGRD 2700 may not be used toward the Engrd distribution "and" as a Technical Elective.)

Notes: PE = \_\_\_\_\_

<sup>1</sup>Note: Students can receive credit for Chem 207 or Chem 211 if taken before Fall 2007. Students must enroll in Chem 2060 after Summer 2007.

<sup>2</sup>Note: Students entering in Fall 2007 and beyond are required to take CS 1130 or CS 1132.

<sup>3</sup>Note: The CS Department expects to offer a 4-credit intensive alternative in the future, possibly by spring 2010.

<sup>4</sup>Note: Students that took CS 280/2800 prior to Spring 2009 must take CS 381/3810.

Extra Courses → 6 slots: convenient for minor (slightly diff. for Arts)

'X' to left of course signifies course is on transcript & satisfies requirement

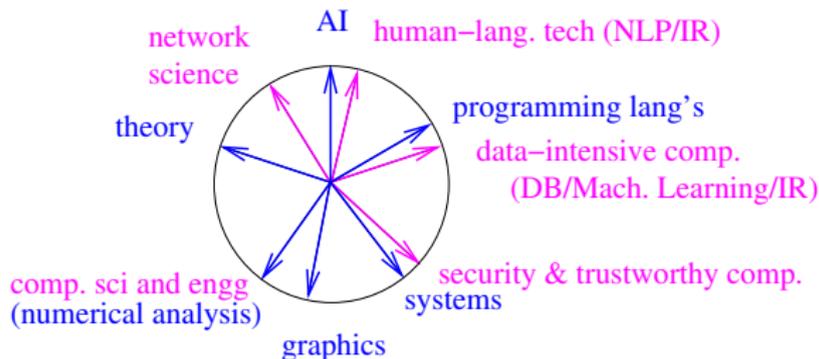
VECTOR(s): All CS majors must complete at least one vector.

See "Declaration of Vector" form for details about vectors and to declare your vector.

Vector Name: VECTOR NAME Completed? Yes or No

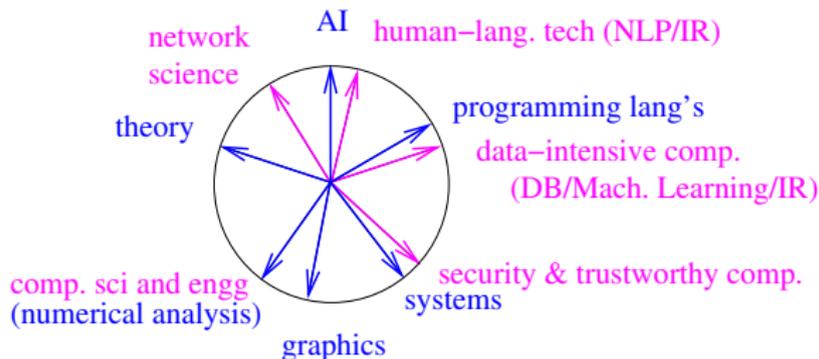
Vectors: “directions of study” that needn’t be linearly independent (cf. GATech’s “tracks”, Stanford’s “tracks”)

Here’s a *projection* of the **topic-oriented** vectors onto 2-d — imagine having flattened out a coffee filter:



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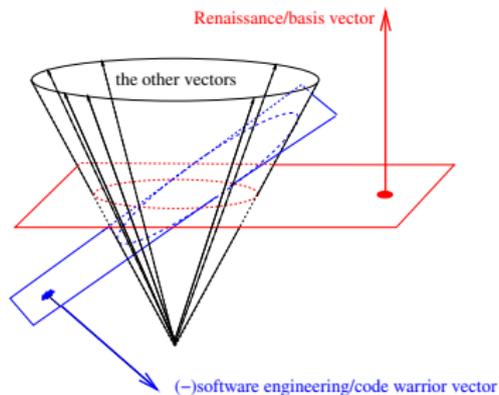
Here’s a *projection* of the **topic-oriented** vectors onto 2-d — imagine having flattened out a coffee filter:



The set of vectors is *mutable* and *extensible*: we may add comp. bio., human-computer interaction ... (But we won't change things *too* often.)

# Cross-cutting vectors (Really we should talk about cross-cutting *planes*, but you get the idea.)

After folding the coffee filter back up, we see:



- ▶ **The Renaissance/basis vector: Emphasizes breadth and beyond-core fundamentals that support multiple pursuits**
  - ▶ The closest to the “old” major (which was good!)
- ▶ **Software engineering/code warrior: Provides extensive implementation and software engineering experience**
  - ▶ Relevant to certain employment options

We hope to have vectors noted on transcripts.

## Important example definition: the Renaissance/basis vector

*Notation:* To succinctly include MEng/grad classes, we use Fxxx (or F7xx, etc.) for a Four or Five or, um, Six-thousand level Full-Fledged elective:<sup>1</sup> 3+ credits, no 4999s, no required courses.

**Renaissance/basis vector:** Four courses numbered CS Fxxx, CS/ENGRD 3220, or CS 3810, such that

- ▶ at least one of the "hundredths digits" is either 2 or 8 (representing scientific computing and theory, respectively) [key enabling content, as required by the old major]
- ▶ two different hundredths digits are represented [enforces breadth]

**Example:** 3220/4210/4220/3810/4810 (in  $\approx$  three years)/4830/4850, 4700 (472), 4780, 5150 (501), ~~4701 (473)~~, ~~4999~~, ~~4820~~

**Rule of thumb:** aim to obtain the Renaissance/basis vector along with any other vector(s) of interest.

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<sup>1</sup>If we had meant only 4000-level courses, we would have written "4xxx".

## Scheduling (see webpage for more info)

Here's one of several leisurely paths for *most* single vectors (sometimes OK to take 3110 junior year, depending on vector core):

soph		junior		senior	
FA	SP	FA	SP	FA	SP
2110	3110	3410	4820	4410	vec-elec
2800	prob	vec-core	vec-core	vec-elec	[Renai.]
		vec-prac			

- ▶ With care and the right timing, one can actually pick up most vectors with only senior-year classes. *We don't recommend planning this way; try out vector courses your junior year to determine which you like.*
- ▶ **Systems-interested students** needing to take 4410 (414) in the junior year must take the prerequisite (3410/3420) in the sophomore year.

## An example achieving **three** vectors

- AI ○ data-intensive □ Renaissance/basis

Colors indicate scheduling: **sophomore** **junior** **senior**

(Other example triples include systems/code warrior/Renaissance, etc.)

COLLEGE REQUIREMENTS				
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Lib Stds				
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PHYS 1112	4			
PHYS 221S	4			
PHYS 2214 or CHEM 2090	4			
CHEM 2090	4			
CS 1113 or 1110 or 1112 or 1114	4			Introductory Programming
CS 1130 or 1132 <sup>c</sup>	1			
CS/ENGRD 2110 <sup>d</sup>	3	FA		Distribution Requirements
ENGRD 2700	D2		SP	D2=EngrD D3=EngrI (Intro to Engr)

TECHNICAL WRITING COURSE:  
 PROBABILITY COURSE: One of BTRY 4080, ECE3100, ECON3190, ENGRD 2700, MATH 4710 (Taking a 3000+ level course strongly recommended)

No double counting: No course may be used twice in College Requirements, CS Core, or Electives (e.g. ENGRD 2700 may not be used toward the EngrD distribution "and" as a Technical Elective.)

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<sup>2</sup>Note: Students entering in Fall 2007 and beyond are required to take CS 1130 or CS 1132.

<sup>3</sup>Note: The CS Department expects to offer a 4-credit intensive alternative in the future, possibly by spring 2010.

<sup>4</sup>Note: Students that took CS 280/2800 prior to Spring 2009 must take CS 351/3510.

**SUBJECT TO CHANGE**

CS CORE				
Course	Cr	Sem	Gr	Advising Notes
CS 2800 <sup>4</sup>	3	FA		Discrete Structures. Pre: CS 1113 or 1110 or 1112 or 1114
CS 3110	4	SP		Data Structures and Functional Programming. Pre: CS 2110
CS 3410 or 3420	4	FA		Digital Systems. Pre: CS 2110
CS 4410	3	FA		Operating Systems. Pre: CS 3420 or 3410.
CS 4820	4	SP		Theory of Algorithms. Pre: CS 2800 and 3110

ELECTIVES				
Course	Cr	Sem	Gr	Advising Notes
CS 4700	3+	FA	<input type="checkbox"/>	CS Electives: Select three non-core CS 4000+ level courses (3+ credits). CS 361/3610 allowed and CS/ENGRD 3220 also accepted unless CS 421/MATH 4250 also applied. CS 4959 NOT allowed.
CS 4302	3+	SP	<input type="checkbox"/>	
CS 4740	3+	SP	<input type="checkbox"/>	CS Project: 412/432/441/4450,482/470/1,5150,5410,5450/4870
CS 4701	Project	2+	FA	
CS 4320	Tech	FA	<input type="checkbox"/>	Technical Electives: 3000s. (3+ crs) from application areas: CS; Bio; Chem; Math; Econ; Psych; etc. (only one of ENGRD 2700 or MATH 2530 accepted) At least two CS 4999. For other Indep.Studies, see 300 Upan
CS 5300	Tech	SP	<input type="checkbox"/>	
CS 4780	Tech	SP	<input checked="" type="checkbox"/>	
LING 3xxx	Spcl	FA	<input checked="" type="checkbox"/>	External Specialization: Three 3000+ courses (3+ crs) from some subject areas. CS courses, LING 4474, INFO 4302, INFO 3300, INFO 5300, & INFO 5300 are not eligible. SPCL: _____
LING 3xxx	Spcl	SP	<input type="checkbox"/>	
	Spcl			
CS 4321	MAJ	2	FA	Major Approved Elective: At least 3 credits total, anything approved by advisor
CS 2111		1	FA	
CS 3220	APRV		SP	Advisor Approved Electives: At least 6 credits total, anything approved by advisor
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Extra Courses				

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VECTOR(s): All CS majors must complete at least one vector.

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Vector Name: \_\_\_\_\_ Completed? \_\_\_\_\_ Yes or No \_\_\_\_\_  
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## What next?

Those who have taken 2800: remember that you must still take 3810. (counts towards CS electives, Renaissance/basis vector).

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**Seniors** have been working under the old rules for 7 of 8 semesters and haven't been able to do vector planning.

- ▶ They may switch with the Renaissance/basis vector only. (note the prob/stats requirement)
- ▶ We will *probably* assume the old rules by default.

**All others** choosing the new rules should file *vector applications probably sometime around mid-spring junior year*

- ▶ We can keep vector candidates apprised of relevant changes. (Require semesterly updates?)
- ▶ Sad fact: Forms promote student/advisor interaction.
- ▶ Students should do some advance planning, but should have time to explore before making (tentative) first selections.
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Ideas on making the administration smooth? Or vector updates?  
Other thoughts? Let us know!