Ignoring the Obvious

The search for the perfect comps
What?

- The new comps system for computer science
- The process we went through to create it
- Our experience so far
Why?

- The system is working great so far.
- The story may be instructive (either a model or a cautionary tale—you decide) as we start examining our curriculum.
- We imagine that maybe, somewhere, there are other people not entirely satisfied with their comps systems.
CS at Carleton: early history

- 70’s – an increasing number of courses
- Early 80’s – the concentration
- 1987 – the major
- 1993 – the move from Goodsell to the CMC
Old old comps: 1987-1994

- Working closely with a faculty advisor, each student planned and executed a project.

- Public presentation.

- Sometimes software, sometimes a research paper, sometimes both.
Old old comps: the good

- Wide open choice of topics
- Lots of faculty attention
- Experience developing a research plan
- …
Old old comps: the bad

- Tremendous trouble getting students to meet deadlines
- Lots of faculty time per student
- Number of majors rose fast during the 90’s
Old comps: 1995-2003

- Modeled after the successful math comps system
- Public presentation on topic chosen by faculty
- Exam covering the required courses
Old comps: the good

- Oral presentation practice, with revisions
- Exam was good for a second pass at the core material, and especially good for the grad-school bound
- Faculty time required was significant, but manageable
Old comps: the bad

- Presentations were generally more shallow than the math talks
- Not integrative – CS is theory plus practice, and the practice was missing
- As CS major grew, more and more burden fell on math faculty
- Minimal final celebration
Project-based comps redux

- Students wanted to make something. CS majors love making computers do interesting and valuable things.
- …but…
- Accountability – tiny carrot, no stick
- 30 majors in 2003, with 3.5 CS FTE
Doldrums

- Talk, talk, talk
- Hiram’s model: add special projects to junior/senior electives
- Help from Chemistry and Econ
- The distinction bottleneck
Dumping the assumptions

- Teams
- Advisors choose projects
- Shave the curriculum elsewhere to give advisors teaching credit
The obvious

- Computer science, both theoretical and applied, is almost always done in teams. A collaborative creative process is good for the students, and is the natural mode of work within the discipline.

- Duh.
But there were still problems...

- Distinction
- Student resistance to groups
- Reduced student choice
- Losing the test
- Paying for the teaching credit
- Fall/Winter residency & special cases
- Too much coding, not enough theory
Creeping towards solutions

- Advice from other schools: peer evaluations in software engineering courses
- Advice from our students: talk/test was not popular, choice was not so important
Comps timeline: Spring term, Junior year

- April: topics and advisors are announced
- May: Students submit project preference
  - rank order
  - team preferences
- May: Project teams selected
- Summer: Students are given readings, other prep work (minimal)
Comps timeline: Fall term, Senior year

- Students register for comps as a course
  - T/Th or twice a week
  - half-hour meetings
- Midterm break: design document due
  - development plans
  - software design
  - project goals finalized
Comps timeline: Winter term, Senior year

- Mid-February: individual oral exams
- End of February/beginning of March: all deliverables due
  - software, web site, documentation
- Last Saturday in term: final presentations and catered lunch
  - open to family and friends
How did it go?

- Faculty and students unanimously approved
  - “I’m extremely glad that I got to be a part of this experiment and [I’m] very proud of the results.”
  - “Our project was exciting, challenging, led to a real feeling of accomplishment, and provided a great way to use a lot of the information that we accumulated in our other classes.”
  - “I could hardly be happier with my comps experience... I got to make something that I’m really proud of.”
Emergent Leaders

- In each group, emerged...
  - student personnel leader
    - kept project moving, set priorities
  - student technical leader
    - broad and deep understanding, integrator, troubleshooter
  - (sometimes these were the same student)
Student Specializations

- Theory-minded students pursued directions of interest
  - E.g. search engine: linear algebraic page categorization

- Others discovered new strengths and interests
  - E.g. motion planning: user interface
Unexpected “real world” learning

- Campus web server went down
  - Was the search engine group responsible?
  - Meeting arranged with students and ITS webmaster to discuss “throttling back” strategies

- Students learned how to manage relationships in a large organization
Importance of Course Releases

- Allowed advisor to spend time with students when problems arose
  - Twice-weekly meetings
  - Troubleshooting
Slacker Recovery

- During fall term, one student did not contribute well
  - Observed by advisor and peers
  - Meeting with advisor to discuss specific strategies
- Student recovered, submitted passing work
  - “Threat” of individual interview crucial
In one group, technical leader kept finishing everyone else’s work.

Personnel leader approached advisor: How to throttle back technical leader?

Solution: She should point out that each student would have “hour of reckoning”

Worked!
More on Interviews

- Second (uninvolved) faculty member enormously productive
  - Sanity check in rating students
  - Helped colleagues see how much learned
  - Second faculty member could ask simplistic questions
## Final Presentations

### Validation Results

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About Instructions for Testers Statistics

Enter your query, select your heuristic, and ogie away!

"Dave Musicant"

- Word Occurrence
- Word Frequency
- Word Frequency w/ PageRank
- Text Tags
- Text Tags w/ Phrasing
- Text Tags w/ Phrasing and PageRank
- Tags, Frequency, and Rank w/ Phrasing

Ogle Carleton

508 results [1.75 sec] using simple v5

Dave Musicant's Home Page (100%)
based in Chicago.

Chemistry Annual Report (54%)
review inspired Dave to spearhead an effort, with Jerry Meling and biology's John Tymoczko, to institute a biochemistry concentration at the college. For some years we have offered a special major in biochemistry, but with growing student interest, and the lack of resources to support a full major, a concentration in biochemistry seemed to make good sense. Happily, this effort was successful and the concentration will be available to students beginning next year. Dave will serve as

Carleton College Chemistry (39%)
Berkeley. Dave enjoyed a lighter teaching load this year, with a course release during Winter Term. He taught Organic Chemistry I during the fall and Biological Chemistry and Advanced Laboratory III during the spring. Biological Chemistry continues to be a popular course, with 30 students enrolled this
Motion planning demo
Challenges: “Distinction” difficult

- Observations / peer evals / interviews helped
- Nonetheless: students cannot be linearly ranked
  - stellar software work vs. outstanding theoretical analysis
  - “finger in every pot” vs. focused excellence
Challenge: Theory / Practice Mix

- Project topics included theory and practice
  - Most (not all) students focused on software
    - “It was excellent. I learned a ton about working with others on a major project, on reading and assimilating others’ code, and on designing, implementing, and testing a massive program in general.”
- We need to direct more focus on theory
  - Have students present ideas to each other
Challenge: Exceptions

- **Student who cannot be on campus**
  - Discouraged, but when necessary: individual projects?
    - Old system?
- **Student who fails**
  - Opportunity during spring term to set right?
  - Individual project if attempting after leaving campus?
- **Student who cannot / will not perform in a group**
Wrapup / discussion

- We and students are thrilled
- Course release is crucial
- Many ideas here came to us from other programs on campus (thank you!)
- Suggestions on how to handle challenges?
- Thoughts on whether any of these ideas apply across the curriculum?