Getting CS undergraduates to write

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Contexts

Computer Science
- Über-nerd culture: we write programs, not English
  - That's how we were taught!!
- Real world does not work that way
- Current generation less willing to put up with it
  - Geeks are not what they used to be :-(

Qatar
- Less of a writing culture

2010
- (SMS), Twitter, YouTube, ...
Why does it matter?

How junior software developers spend their time at Microsoft

Andrew Begel (Microsoft Research) and Beth Simon (UCSD): Novice Software developers, all over again, International Computing Education Research Workshop, 2008.
Getting them to write at CMU-Q

Experiments in a few classes
- Uncoordinated
- Possibly other classes too

Help us be more strategic
Our objectives

- **Writing to assess reading**
  - Understand contents
    - What is being said, not individual words
    - Get better at reading exam questions

- **Get students in the habit of writing**
  - Reading and writing are important to career
15-129: CS Immigration

Overview

- Expose students to the world of Computer Science
- Help them integrate with the CMU culture

- Revamped on the Qatar campus
  - Better adapted to the background of the student accepted to CS in Qatar
  - This means more work, not less, for the students!

- Pass/Fail based on points collected
  - 8 weeks mini, 2 lectures per week

- Four general components/requirements
  1. Attend 7 CS area talks given by experts
  2. Student presentations on other CS areas
  - Uber-Nerds do not need to present to or even deal with "people"!
  3. Webpage setup and design, with all work conducted uploaded there on time
  4. Other voluntary CMU-based activities for which they obtain extra points
Used as a means rather than an end
During expert talks (core of Immigration)
  Problem: Students have no clue what OS, SE, Networking, AI...etc. are
    ■ Shy to ask, and can be disconnected
  Solution: Encourage students to explore the area before listening to talk.
  Problem: They don't on their own!
  Solution: Requesting that they
    ■ research area
    ■ summarize/paraphrase, insert links
    ■ 3-5 questions they have
    ■ upload all this on their webpage
Unexpected outcome: seeing their "natural" form of writing which sheds light on the more basic capabilities (without help) that students possess
# 15-103: Principles of Computation

## Overview

Introduce freshmen to the basic pillars of CS (7 week mini)

- Data representation
- Algorithms as the unifying concept
- Algorithmic paradigms/parallelism
- Logic/correctness/verification of algorithms
- Analysis of algorithms: empirical and theoretical models of complexity
- Intractability and uncomputability

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<table>
<thead>
<tr>
<th>We expect the students to “take home”:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o What Computer Science is about</td>
</tr>
<tr>
<td>o How these pillars are interrelated</td>
</tr>
<tr>
<td>o How the (core) CS curriculum relates to these pillar</td>
</tr>
</tbody>
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Revamped!
15-103: Principles of Computation

Addressing language issues

- Promote "language precision" and "precise descriptions"
- Relation between language and computation
  - Relation between language and logic
    - Logic as semantics
  - Language as an object of computation
    - Natural language processing
- Read/watch CS-related articles and lay-videos
  - TED videos - 2001 A Space Odyssey
  - Scientific American articles
- 300 word summaries to motivate "deep reading"
  - "Tell a non-CS person", Wikipedia article
- Published on student's web site (from 15-129)
15-199: Discovering Logic

Intro to logic for CS freshmen (7-week mini)

Writing
- Hw 1: read book and write a letter to a friend or Amazon review
- Hw 2-5: small essay questions
- Final paper: reread the book and write a new essay
- (individual presentations)

Outcome
- Writing skills well above expectations
- From beautifully developed essays to shallow/unsupported arguments
  - Seems to be a function of personal maturity
  - Benefit from previous writing-intensive courses (15-129, 15-221)
15-212: Principles of Programming

Advanced problem solving course
  ● Reading/writing was 20% of each assignment

Reading to connect course topics to real world
  ● Essays, blogs, light scientific papers, popular science
    ○ Scientific papers judged "boring"

Writing to assess the reading
  ● Technical questions, open questions, student's opinion

Assessment
  ● Does essay make sense? Are answers thoughtful?
  ● Are arguments well-structured?
  ● Was any part plagiarized?
15-221: Technical Communication

(Nael's presentation)
15-302: Technology Field Research in Developing Communities

Writing
- Research assignment - researching field research location
- Media plan - plan for dissemination of research results
- Team plan - plan of action for conducting research
- Automated Tutor - analysis of projects via reading

Outcome
- Extensive help and direction needed with first draft
  - Focusing on assignment requirements
- Team collaborative writing
15-502: Tech. & Global Development

Objective: Enhance students' writing and presentation skills

Assignments
- Research - research a proposed project
- Campaign - design and implement plan to promote project
- Capacity building - plan for given projects
- Case study - critically read and analyze a case

Outcomes
- Extensive help needed in addressing assignment requirements (even when rubrics given)
- Extensive help needed reading assignments
## Writing development

<table>
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<tr>
<th>Stage</th>
<th>Expectations</th>
<th>Acquired skills</th>
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</thead>
</table>
| Freshmen   | Low expectations
             High variance in capabilities                        |                 |
| Sophomores |                                                           |                 |
| Junior     |                                                           |                 |
| Seniors    |                                                           |                 |
Strategic writing

- We recognize the importance of writing in the CS curriculum
  - We have incorporated writing in our classes
- Now, we need to make it strategic
  - Develop methodology to grade writing productively for students
  - Develop writing exercises that target CS writing genres and skills
Questions?

Comments?

Reactions?