Augmenting CS1 courses with a semester-long contest

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Outline

1. Context and motivation
2. Contest set-up
3. Results
4. Conclusions
Setting

- Two main first-year Computer Science courses at the University of Cape Town
  - CSC1015F: Introduction to Computer Science—problem solving and Python. ±850 students
  - CSC1016S: object-oriented programming and Java. ±580 students
- Compulsory for several degrees in the faculties of Science, Engineering, and Commerce.
- Students arrive with a wide range of programming competencies (mostly nil)
- Learners may not have had regular access to computers outside school
Two main first-year Computer Science courses at the University of Cape Town
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Contest winners from very small pool of students mainly from privileged secondary schools, participated in secondary school contests

Most students never exposed to contests
How to address this?

- Streaming students deepens divides
- Not accommodating students with prior programming skills leads to boredom and students leaving for other degrees
- Both are undesirable consequences
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⇒ Augment the CS1 courses with a contest component running throughout the semester
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Requirements/constraints and solutions

- R: time cannot be used as tie-breaker; time would discourage late-comers
- S: Allocate points to a problem, and deduct 1 point for each wrong submission
Requirements/constraints and solutions

- R: time cannot be used as tie-breaker; time would discourage late-comers
- S: Allocate points to a problem, and deduct 1 point for each wrong submission
- R: Problems have to be of varying level of difficulty
- R: Some have to match the course topics and others have to go beyond that
- R: Problem descriptions should be relevant to several degrees
- S: Rewrite the stories of existing contest problems
Adapting the problems: localisation

instead of ...

**Example (language detection)**

English, Spanish, German, French, Italian and Russian are the 6 most prominent languages in the countries of European Union.

... localised into:

**Example (hello hello)**

In South Africa and the rest of the continent, many languages are spoken, and it is a nice courtesy to be able to say ‘hello’ and understand someone saying ‘hello’ to you, or texting it to you. For instance, it is “MOLO” in isiXhosa, “HALLO” in Afrikaans, “SAWUBONA” in isiZulu, “BONJOUR” in French and “MARHABA” in Arabic.
Adapting the problems: engineering & localisation

instead of affluence known to few...

**Example (blowing fuses)**

Maybe you are familiar with the following situation. You have plugged in several electrical devices, such as a toaster, refrigerator, microwave oven, computers, ...

... the lived experience of everyone:

**Example (Smart homes)**

Eskom is trying hard to come up with ways to make people use less electricity, not by load shedding, but by user-mediated ‘load balancing’ through making the users more aware of their electricity usage.
Adapting the problems: name and abbreviation changes

From a SWERC’14 problem...

**Example (The Big Painting)**

Samuel W. E. R. Craft is an artist with a growing reputation.

... to another abbreviation:

**Example (Painting Pieces)**

Despite Cape Town being the hipster capital of the country, life as an artist for Claude Shivambu at the Universally Crafty Townians hangout isn’t easy.
Requirements/constraints and solutions

- **R:** ‘Late’ entrants should have a chance at winning prizes, to incentivise participation
- **S:** In addition to the top-5 and ‘first to solve’, a new category ‘first new person to solve’ the problem
Requirements/constraints and solutions

- **R:** ‘Late’ entrants should have a chance at winning prizes, to incentivise participation
- **S:** In addition to the top-5 and ‘first to solve’, a new category ‘first new person to solve’ the problem
- **R:** The average and struggling students should not be discouraged by the contest
- **S:** The contest runs on a separate course site in the course management system
- **R:** Seamless automated judging
- **S:** Repurpose automated marker for assignments
CSC1015FChallenge (2016): Leader Board

**Table Key**
- 30 -> Question B total 30 points
- Green -> First to solve this question
- Brown -> First new person to solve this question
- Blue -> Question solved
- Pink -> Attempted the question

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**Contest set-up**

- **Context and motivation**
- **Results**
- **Conclusions**
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Aggregate stats of the ‘challenges’

- **1016 Challenge in 2015**: all 10 problems released at once
- Resulted in ‘binge solving’
- **1015 Challenge in 2016**: three problems/fortight
- Steady engagement
- Most problems are being solved in first two days from their release, and then during public holidays, mid-term vacation, and near the deadline
1016 Challenge, 2015
1015 Challenge, 2016
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Conclusions and future

- Course-associated contest substantially lowered the barrier to exposure to programming contests
- A substantial pool of new candidates
- Re-run the 1016Challenge this year and compare with last year
- Problems & solutions available upon request
Thank you!

Questions?