

CloudCoder: Building a Community for Using and Sharing Programming Exercises

Jaime Spacco
Andrei Papancea
Knox College

Matthew Hertz
Canisius College

Paul Denny
University of Auckland

David Hovemeyer
York College of Pennsylvania

Kelly Rivers
John Stamper
Human-Computer Interaction Institute,
Carnegie Mellon University



tl;dr

- CloudCoder is a free, open-source, web-based **programming exercise system**
- Multiple languages:** C/C++, Java, Python, Ruby
- It has a **repository of free exercises** (contributions welcome)
- Ask us for a **demo server account**
- Did we mention that it's **free**?

<http://cloudcoder.org>

Programming exercises!

- Automatically-evaluated exercises are useful in introductory programming courses[1]
 - For learning **syntax**
 - For learning **basic concepts** (variables, decisions, loops, etc.)
 - For extra **practice**
 - For **assessment**
- They can be **incorporated easily** into an existing course **without major changes**
 - Use them to supplement readings, for quizzes, for practice, etc.

We need another system?

- Many **existing systems**: CodingBat, PracticeIt!, CodeLab, etc.
- We didn't know of one which
 - Was **open source**
 - Was **community-supported**
 - Had **freely-redistributable exercises**
 - Allowed self-hosting and **full access to student data**
 - Supported **in-class assessment** (i.e., quizzes)
 - Supported C/C++

Requirements

- Students need **just a web browser**
 - No plugin** required: client is 100% HTML/CSS/JavaScript
- System runs on **two Linux servers**
 - One (network-facing) for webapp and database: EC2 micro instance works well
 - One (network connected) to build and test submissions: can be any PC connected to network
- Relatively easy installation

Need for a community

- Thesis: for a programming exercise system to be as useful as it can be, it needs a *community*
 - To **provide exercises** that can be freely reused and improved
 - To **share experience** about how to use exercises most effectively

Exercise repository

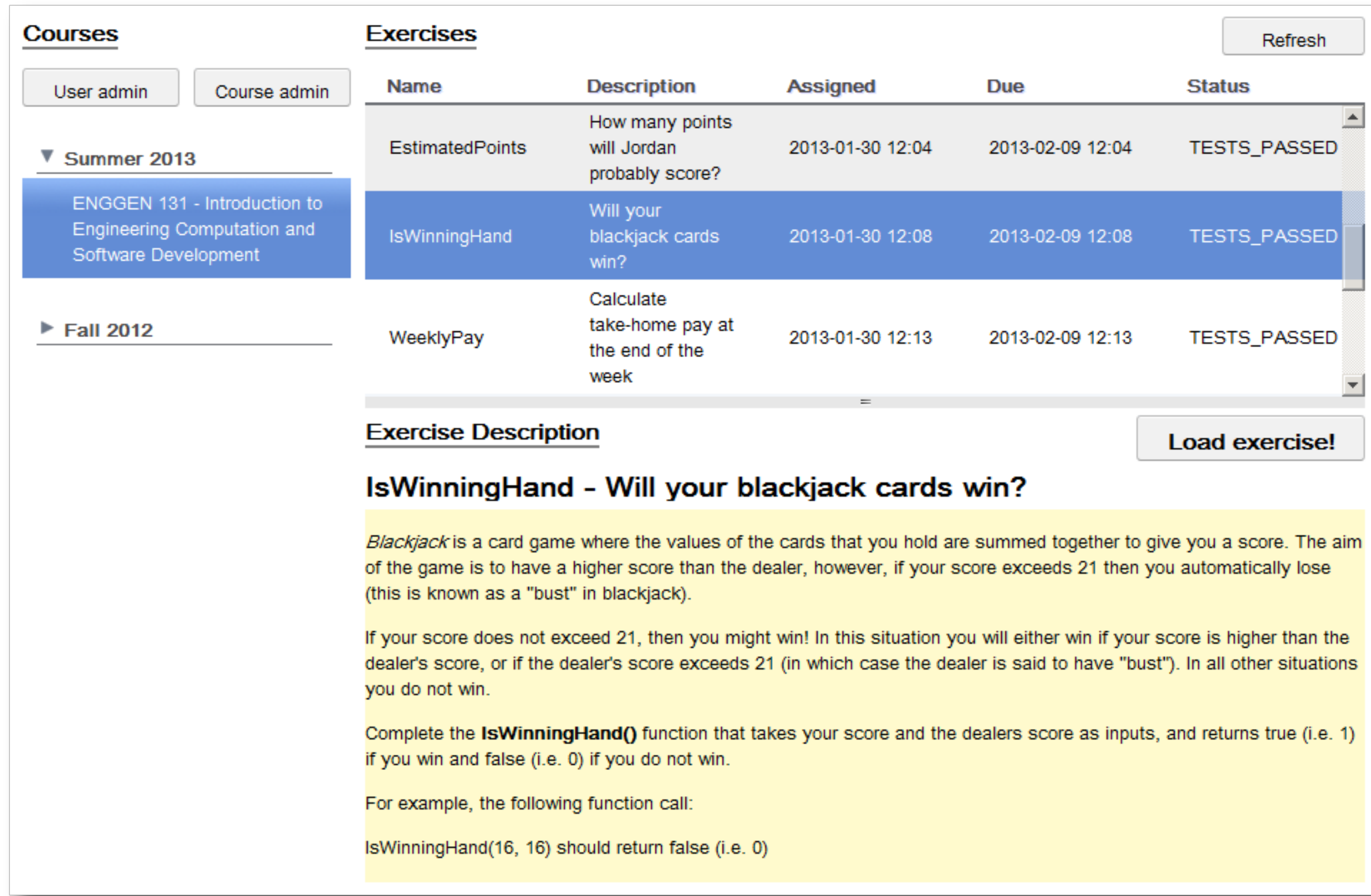
- Writing good exercises is a challenge: but **many hands make light work**
- More generally: preparing curriculum materials is labor intensive
 - We spend a lot of time preparing materials that are used only in one course at one institution
 - Effective mechanisms for sharing materials could make all of us more efficient

<https://cloudcoder.org/repo>

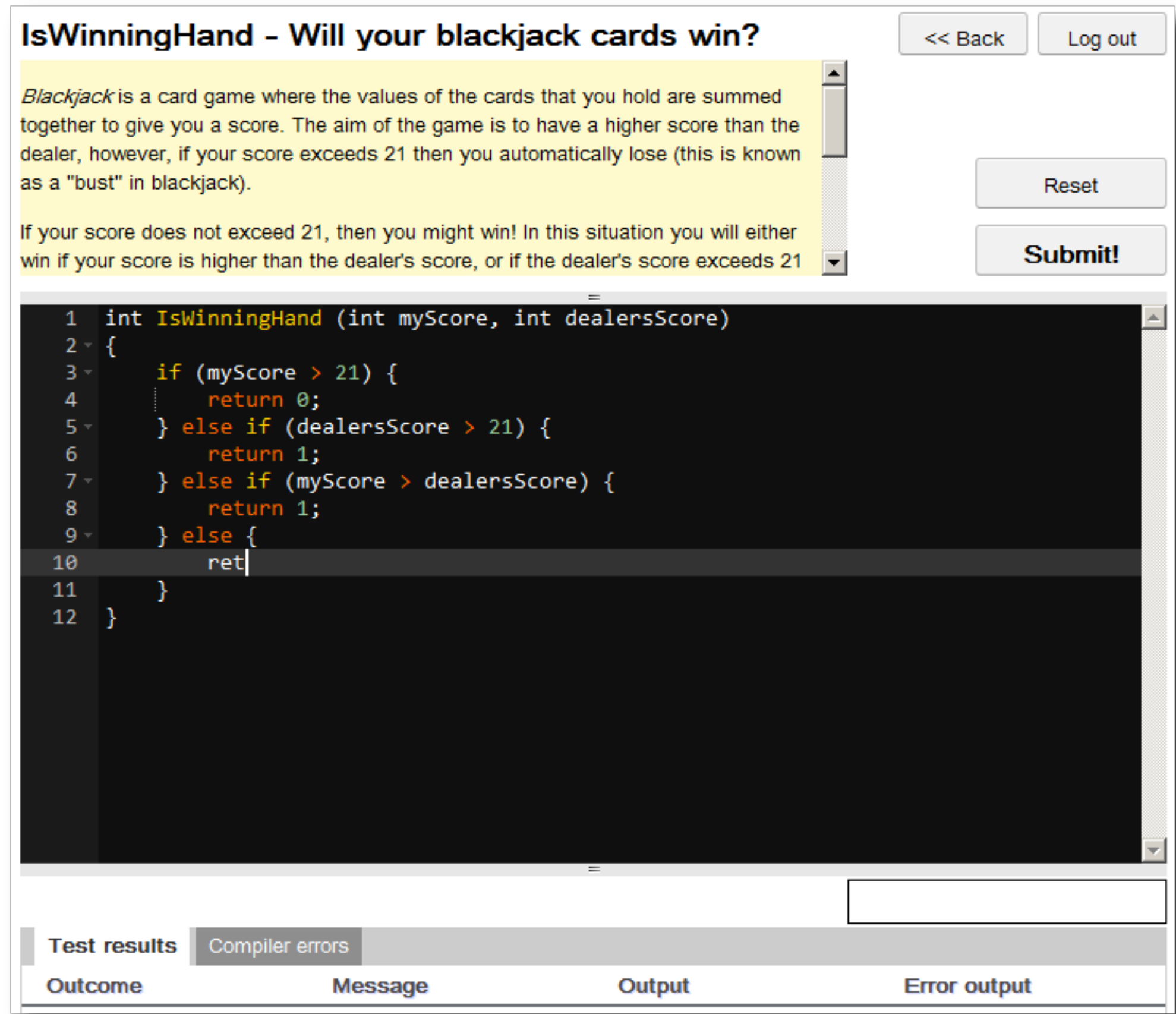
We need your help!

Screenshots

Main menu, choosing an exercise

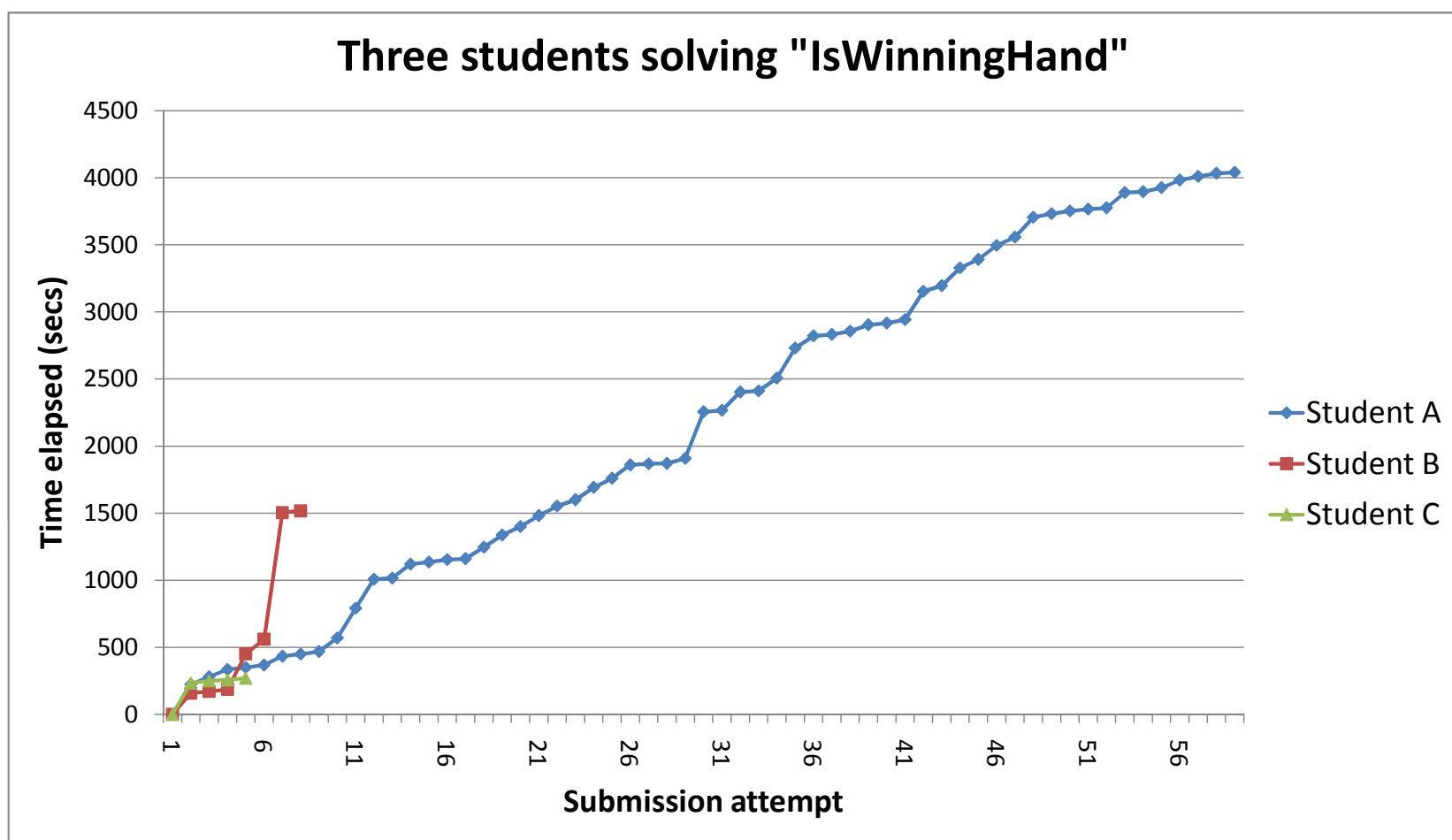


Working on an exercise



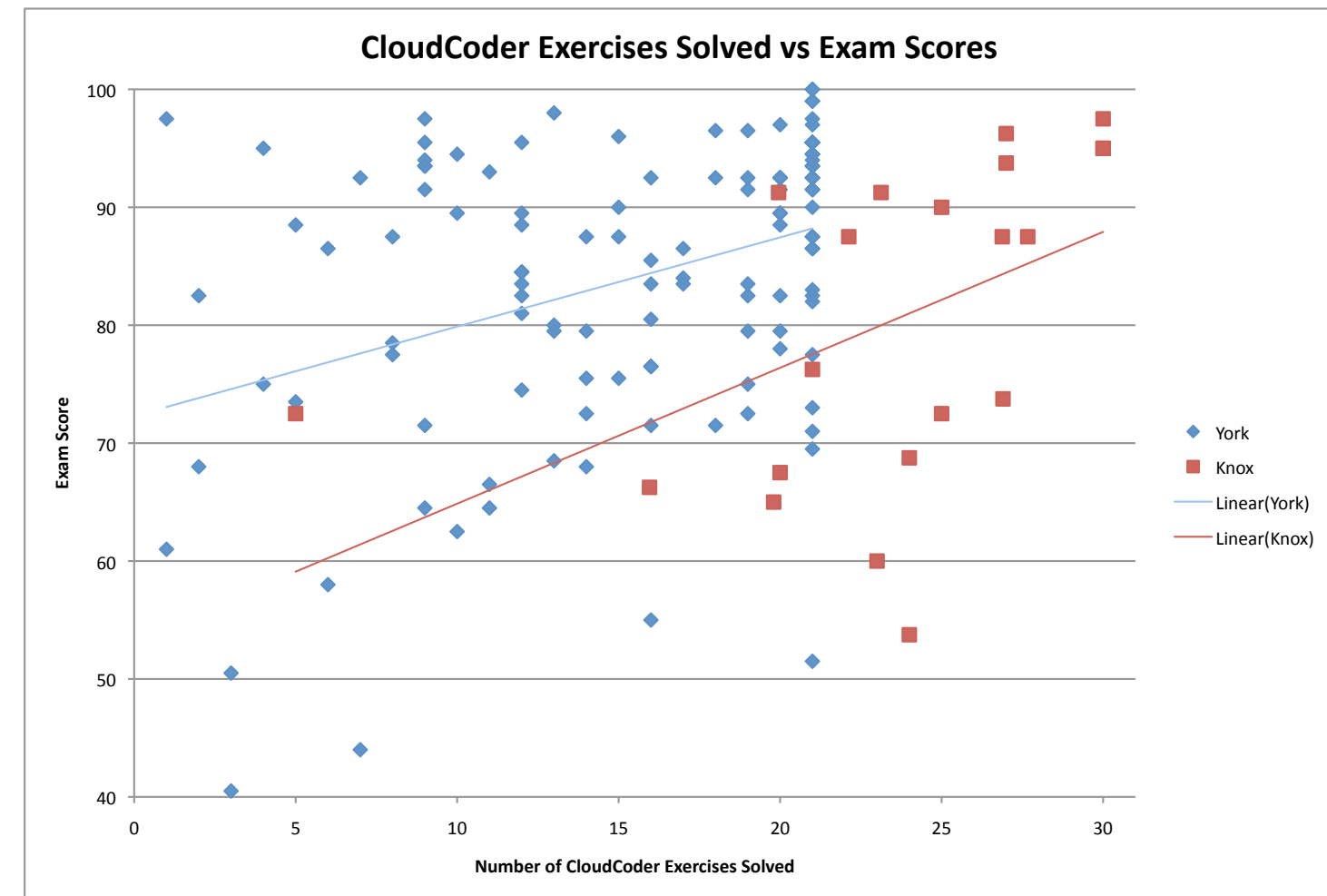
Research questions, preliminary data

- Can we detect students engaging in unproductive trial and error coding?



- Are exercises an effective “prescription” for students who are struggling?
- How can we motivate students to do practice problems?
 - Badges? Other forms of rewards/encouragement?
- What are student perceptions of exercises?
- Can exercises be reused effectively?
 - In different courses?
 - At different institutions?
- Can instructors find appropriate exercises to reuse?

- Do we see improved outcomes when students do exercises? Exams in CS 101 at York College and CS 141 at Knox College, Spring 2013



Moderate ($r \approx 0.36$ at York, $r \approx 0.48$ at Knox) correlation between number of CloudCoder practice exercises solved and exam score

- Can we add social features to the exercise repository to allow users to
 - Classify exercises? (tagging)
 - Rate exercises?
 - Improve existing exercises?
 - Recommend exercises?
 - Recommend sequences of exercises?

References

- [1] Kirsti M Ala-Mutka. A survey of automated assessment approaches for programming assignments. *Computer Science Education*, 15(2):83–102, 2005.

Support

Supported by a SIGCSE special projects grant, May 2012

Get involved!

We want to expand our user base for Fall 2013!

- We already have over 100 C/C++ and Java exercises to get you started!
- Are your exercises better than ours?
- What are you waiting for?

Check it out!

<http://cloudcoder.org>

