Motivating CS Majors Using Real-World Data, Games and Visualizations Using BRIDGES

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CCSC-*NE* '22
April 2, 2022

This material is based upon support from NSF DUE-1726809, 2142381 and CCF-1652442.

Agenda

- Introduction [15 min]
  - Presentations
  - What is BRIDGES and how does it help?
- A First Example - Graph Tutorial [10 min]
- Activity: Interactive and Visual [Play with BRIDGES Tutorials] [10 min]
- Break [5min]
- Making it Real : A Tour of BRIDGES [15 min]
- Activity: Discussions [15 min]
- Workshop Survey, Opportunity to Participate [5 min]

Introductions: Who are We?

BRIDGES to Improve CS Education through Engagement

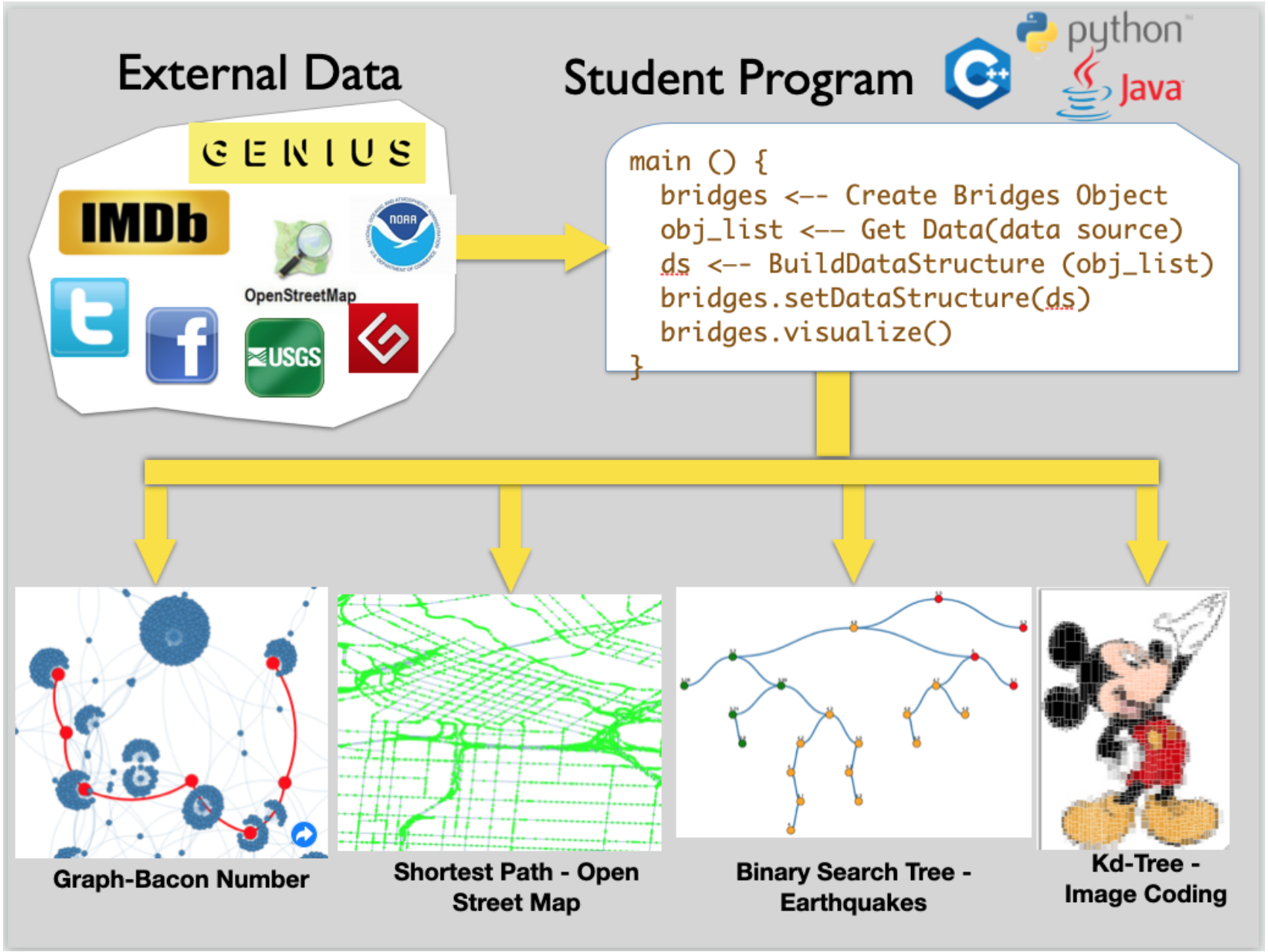
Motivation

Attrition rates in early foundational courses are high (40-60%), need to improve student engagement, and demonstrate the potential of Computer Science to incoming freshmen/sophomore students

BRIDGES' approach

- Bring real-world datasets into the classroom.
- Visualizations of *student generated* data structures, interactions, algorithm performance/complexity.
- Student output shared (with friends, family) via web link

BRIDGES provides engaging Input and Output

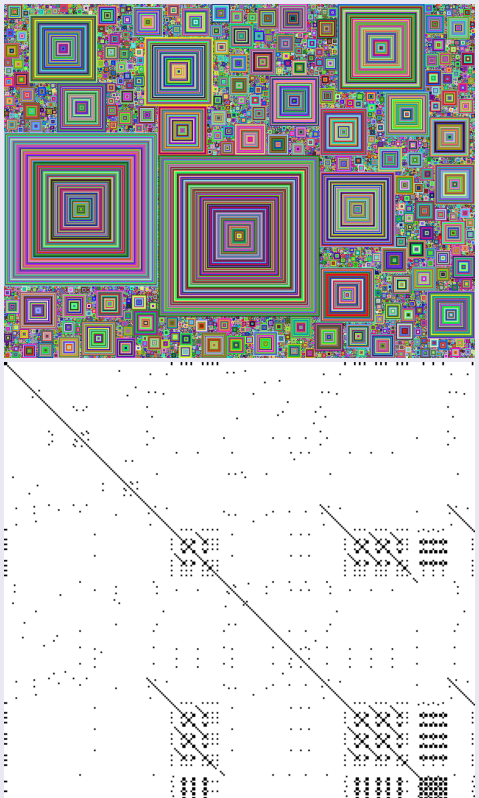


BRIDGES in CS1/CS2 Courses

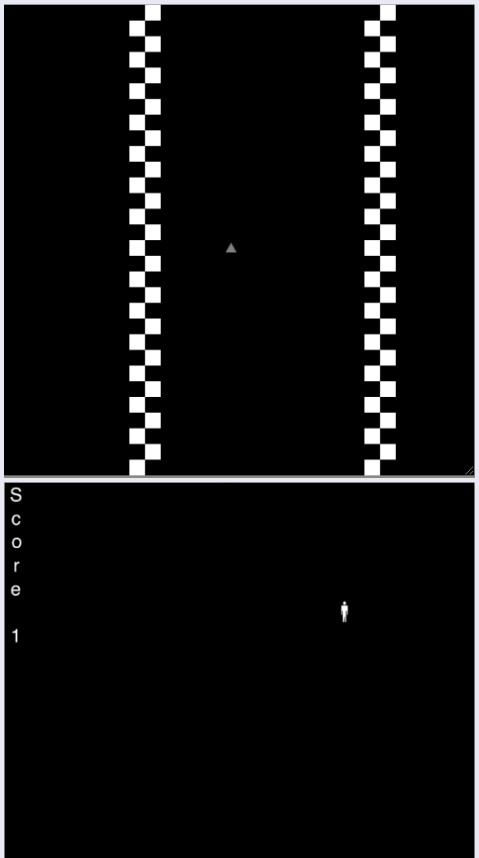
What is difficult in a CS1 course?

- Hello World is BOOOOOOOORING...
- We added two arrays of integers, I am soooo impressed...

Graphical Patterns and Analysis



Games

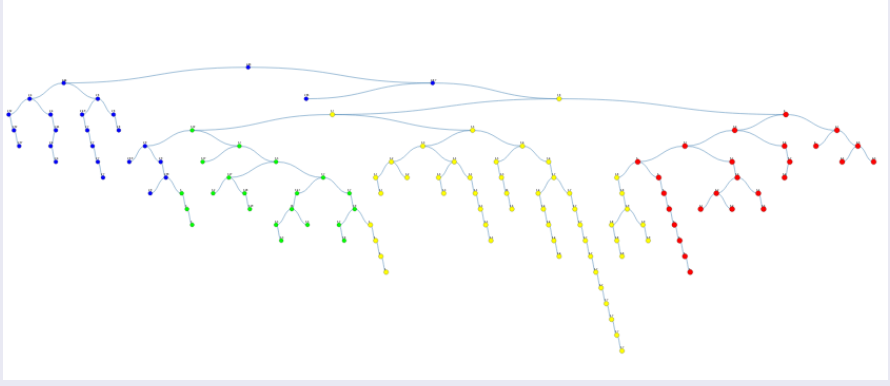


BRIDGES in Data Structures Courses

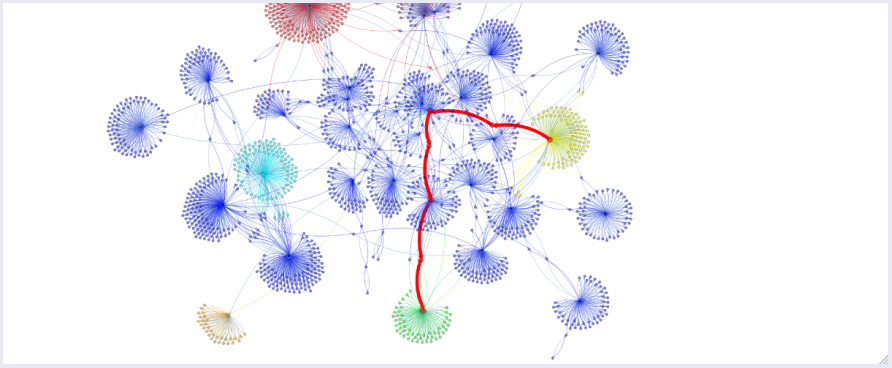
What is hard in a Data Structure course?

- Debugging is haaaard.
- I don't understand what the data structure looks like!
- Does any of this matter in the real world?
- Two examples below: Binary Search Tree with USGS earthquake Tweet data, Bacon Number problem wiht IMDB Data (BFS algorithm)

Indexing USGS Earthquake



Bacon Number [IMDB Data]

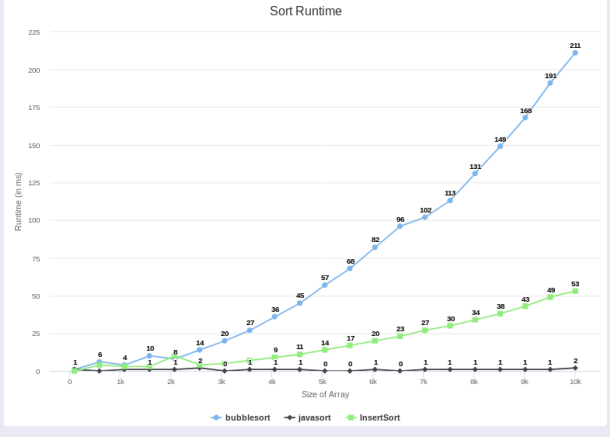


BRIDGES in Algorithms Course

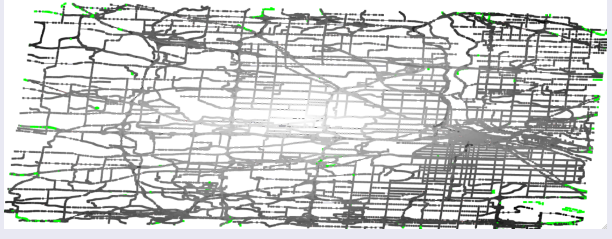
What is difficult in an Algorithm class?

- Complexity is confusing!
- I am never going to use any of these crazy things.
- Why is he still talking about complexity?
- BRIDGES provides **benchmarking** features and large datasets, so asto to demonstrate algorithm performance.

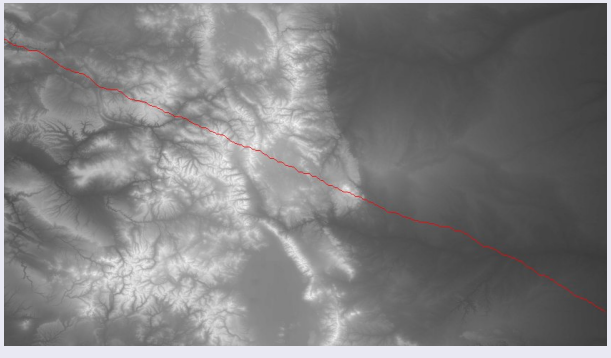
Sorting Benchmark



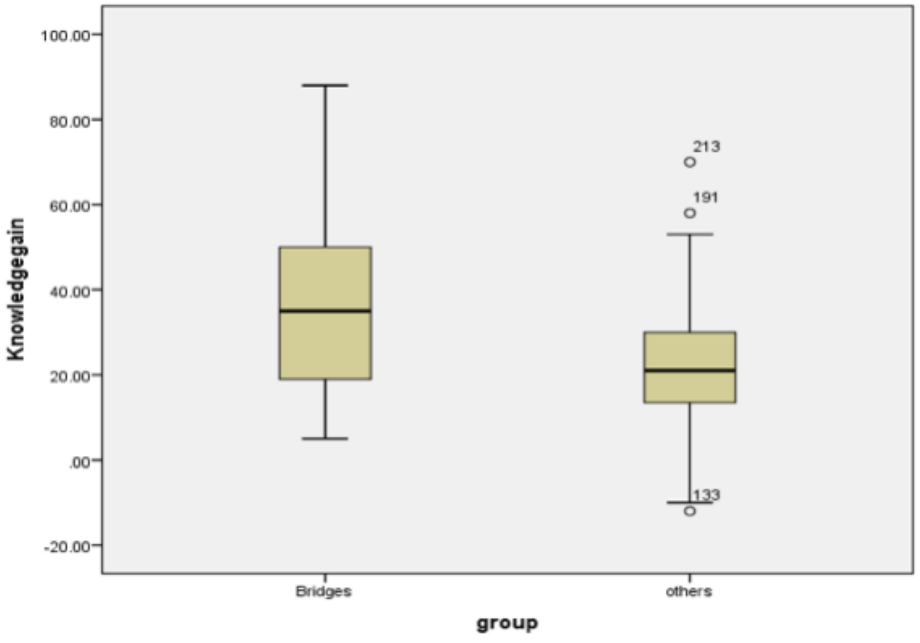
Shortest Path (OSM)



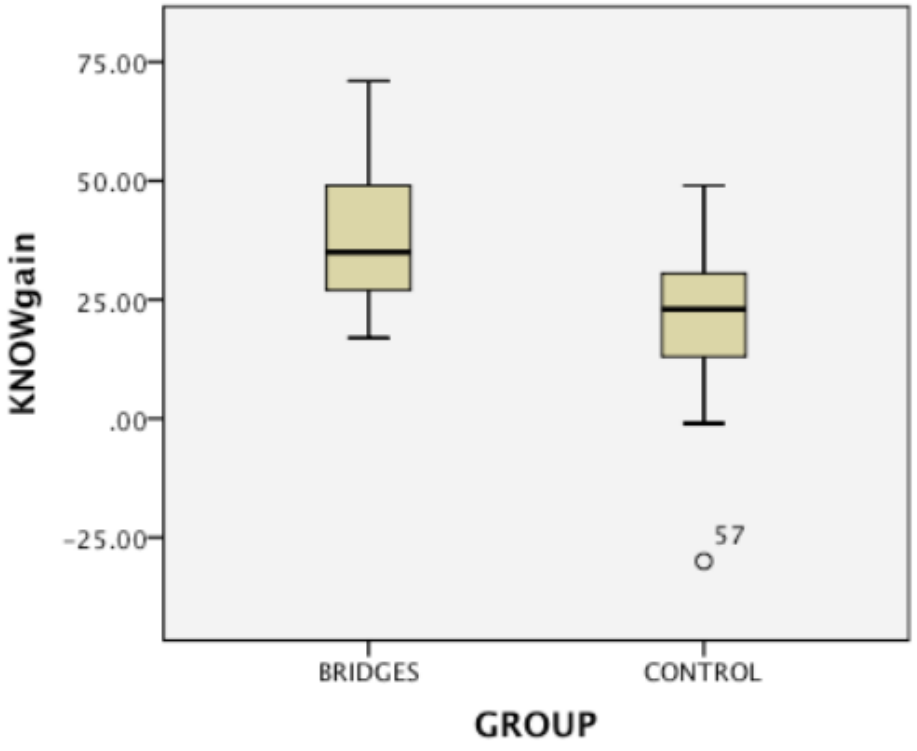
Mountain Path (DP)



Students in BRIDGES sections gained more knowledge



Fall 2014



Spring 2015

Students in BRIDGES sections performed better in follow on core CS

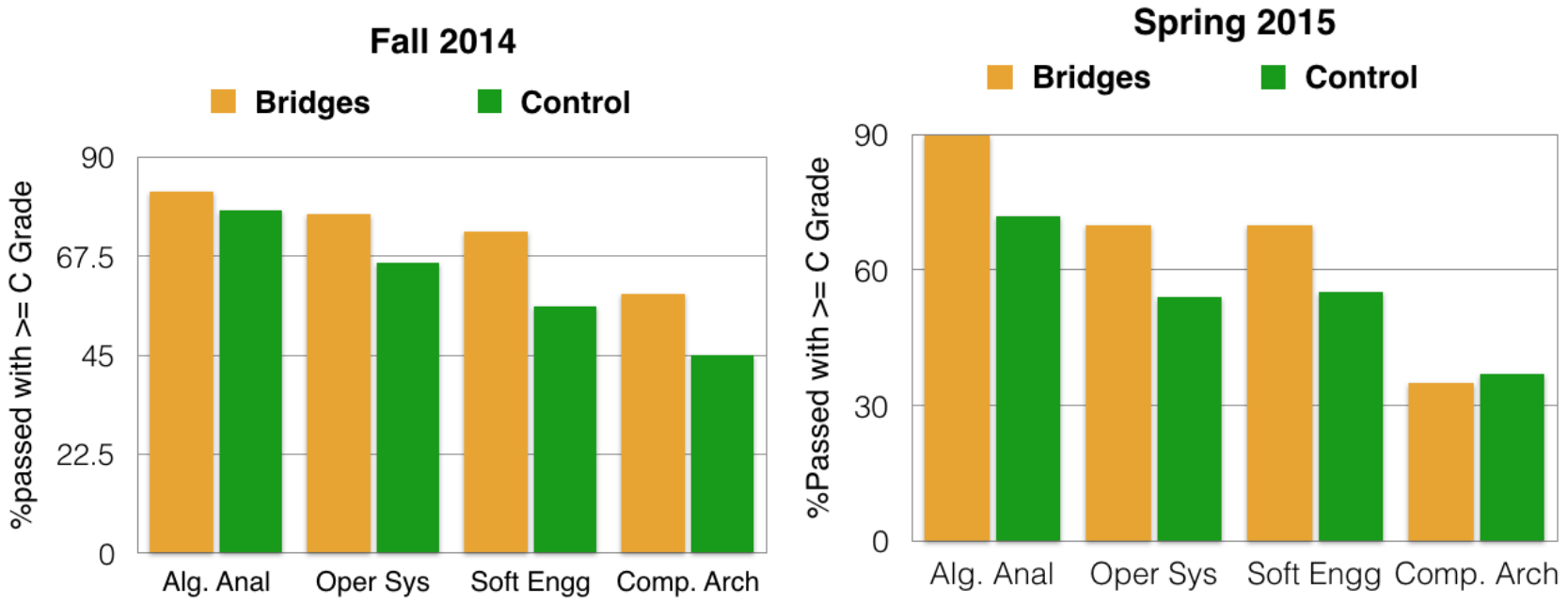
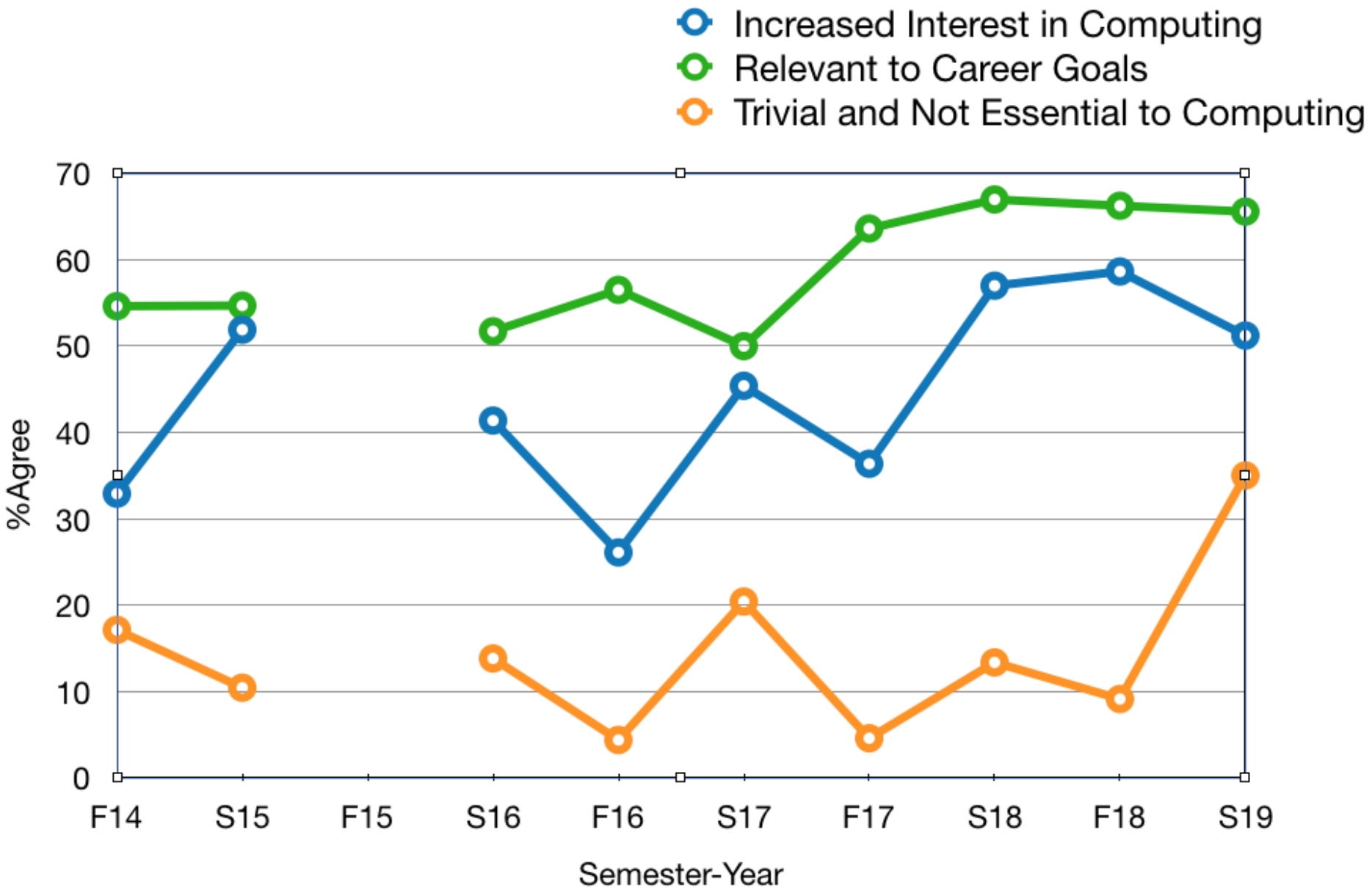
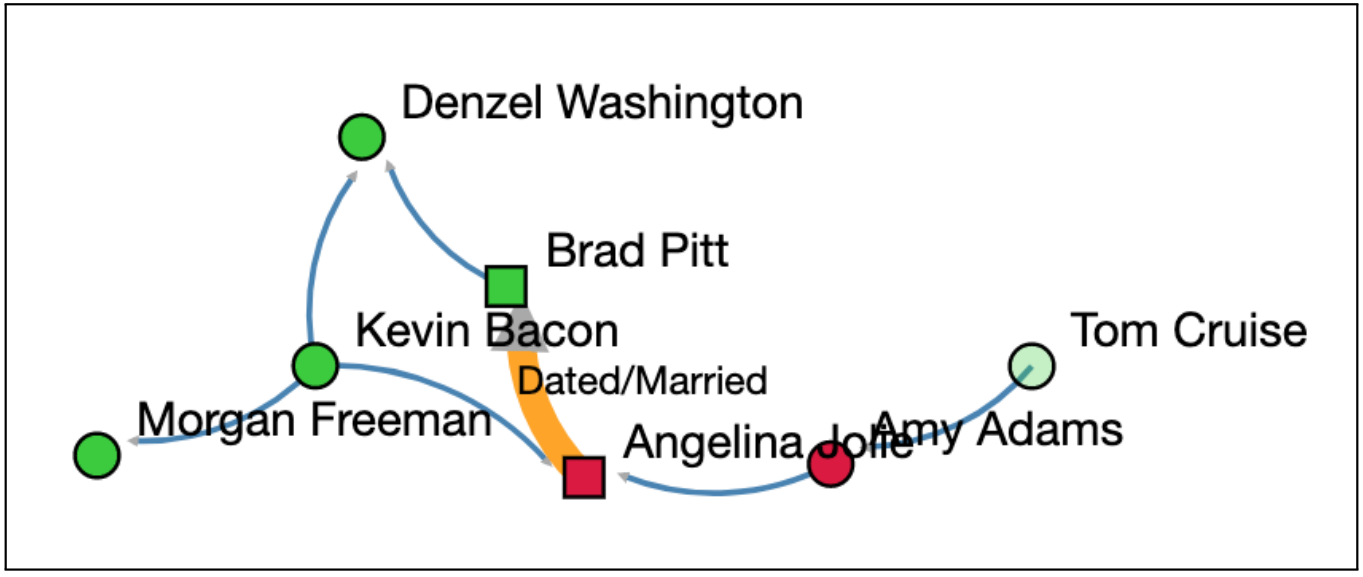


Figure: Comparing long-term student achievement between students who used the BRIDGES toolkit in the Data Structures course vs. Control group. The evaluation was performed with 2 cohorts of students (Fall 14, Spring 15). Analysis performed Spring 2019.

Students using BRIDGES appreciate CS better



A First Example - Graph Tutorial



Activity : Real, Interactive and Visual [10 min]

- Look at other BRIDGES tutorials in your favorite programming language (C++, Java or Python).

A Tour of BRIDGES[15 min]

The BRIDGES Assignment repository

- A collection of assignments with descriptions, starter code, expected output solutions (provided on request by instructor)
- Repository Link

Activity

- Open up your laptops and try out some of the BRIDGES examples and their ouptputs from a sampling of BRIDGES assignments.
- **To Do:** Find an assignment that would work for you in your class.

Discussion [15 min]

Possible Discussion Topics

- What issues do you face in teaching (early CS) courses?
- Can tools like BRIDGES be helpful? What are the hurdles?
- What do you do to engage today's students?

Adopting BRIDGES

Why?

- Well tested: over 2000+ students, 20+ institutions
- Increased engagement
- A growing set of pre-designed assignments
- Full Support from the BRIDGES team
- Stipends available for adopters

How to adopt? Contact us!

- esaule@uncc.edu
- krs@uncc.edu
- payton@temple.edu

Support

This material is based upon support from NSF DUE-1726809, 2142381.

BRIDGES Participation - Opportunity

- BRIDGES under active development - funded by an NSF IUSE grants - **to disseminate BRIDGES to external users!**
- Need help in **adopting, contributing, and extending** BRIDGES.
- Build **engaging assignments** and data sources that also reinforce CS rigor.
- Use BRIDGES in the classroom, collect data and provide feedback; all evaluation materials provided through online Qualtrix surveys by project evaluator.
- **Stipends** available for instructor; alternately **TA support** can be provided.
- Full technical support provided, and interaction with Bridges team/community, monthly user meetings.
- We will hold **two 3-day summer workshops on BRIDGES** in Charlotte.

BRIDGES Workshop Survey (5 min)

BRIDGES Workshop Survey