Google-CAHSI Problem Solving Courses at Kean

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- Lecturer at Kean University
- Fall 2018 and Spring 2019: Instructor for 2 pilot Google-CAHSI problem solving courses:
  - Introduction to Problem Solving (PS 1)
  - Computational Thinking in Problem Solving (PS 2)

CAHSI

- Computing Alliance of Hispanic-Serving Institutions.
- Founded by a consortium of HSIs.
- NSF funded project.
- Dr. Ann Gates at the University of Texas at El Paso (UTEP) is the PI.

CAHSI Core Purpose

- Create a unified voice to consolidate the strengths, resources and concerns of HSIs and other groups committed to increasing the number of Hispanics in all computing areas.

CAHSI

- Kean University is the Northern Hub for CAHSI.

- For additional information about CAHSI, visit http://cahsi.cs.utep.edu/ and/or contact Dr. Patricia Morreale, pmorreal@kean.edu, or Nancy Amador, namador@kean.edu, at Kean.

Google-CAHSI PS Courses

- Google has partnered with CAHSI to create and pilot 3 new problem-solving courses.

- The courses developed by CAHSI faculty, teach frameworks for problem-solving and include real-world problems designed by Google engineers.

Google-CAHSI PS Courses

- The courses are team-based.
- The courses are not lecture driven.
- Reflection and feedback are integral components of instruction.
- Assessment is non-traditional.

Google-CAHSI PS Courses

- Introduction to Problem Solving (PS 1)
- Computational Thinking in Problem Solving (PS 2)
- Algorithmic Thinking in Problem Solving (PS 3)

Introduction to Problem Solving (PS 1)

- **IDEAL** problem-solving approach:
  - **I**dentify the problem
  - **D**efine the goals
  - **E**xamine the options
  - **A**ct on a plan
  - **L**ook back and Learn

Introduction to Problem Solving (PS 1)

- Students apply the IDEAL framework to solving problems in class. They practice:
  - Asking questions that help clarify parts of a problem which are unclear or unknown.
  - Rephrasing problems to verify understanding.
  - Working collaboratively as part of a team.
  - Presenting and defending solutions to problems
- Problems include simple one answer riddles, and open ended small and large problems, some designed by Google software engineers.

Introduction to Problem Solving (PS 1)

- As the course progresses, students solve bigger problems.
- As assessments, students complete written reflections of varied lengths on the problem solving activities completed in class. The assessments focus on the *process and not on the solution*.
- Students also self-assess their progress as problem solvers using rubrics developed for the courses.

Computational Thinking in Problem Solving (PS 2)

- Students apply Computational Thinking, the IDEAL problem solving framework and Duke's 7 steps problem solving approach to solving computational problems.

- Solutions to problems can be in the form of pseudocode or code in a programming language.

- The focus is again on the *process rather than the solution*.

Computational Thinking in Problem Solving (PS 2)

- The student activities focus on:
  - Breaking down a large problem into manageable parts.
  - Applying appropriate strategies to solving problems.
  - Deriving solutions to problems using computational thinking and the Duke's 7 steps.
  - Articulating and defending solutions to problems.
  - Reflecting on and assessing progress as a computational thinker in problem solving.

Algorithmic Thinking in Problem Solving (PS 3)

- Students apply more advanced problem-solving strategies (such as McKinsey 7-steps) to solving more challenging problems in computer science and business.
- Problems solved are characterized by incomplete, vague, and possibly inconsistent specifications.
- Emphasis is on problems that have practical and real world relevance.

Algorithmic Thinking in Problem Solving (PS 3)

- Solutions to problems require knowledge learned across multiple Computer Science courses, especially Data Structures.

- Course provides students an opportunity to practice skills needed for white board interviews.

Google-CAHSI PS courses at Kean

- PS 1 and PS 2 are offered as one credit stand alone courses.
- The courses count as free electives towards student's degree (not applicable to CS or IT electives).
- PS 1 has no prerequisites.
- PS 2 requires completion of CPS 1231 (Kean's first course in Java Programming).

Google-CAHSI PS courses at Kean

- PS 3 is offered as a two credit course.
- Data Structures is a pre-requisite course.
- PS 3 is recommended for students soon to be interviewing for jobs. Helpful in honing skills required for white board interviews.

Google-CAHSI PS courses at Kean

- The courses have been well received by students.
- For Fall 2019, we are exploring incorporating content from the Problem Solving courses into our gateway courses for CS and IT majors: CS0, CS1 and CS2.

Other pilot universities

- Include the content of the courses in existing general "Welcome to the Major" survey courses.

- One university counts combinations of PS 1 and PS 3 or PS2 and PS3 as a one 3 credit major elective for CS and IT majors.

Google-CAHSI PS Courses

- Course materials for the Google-CAHSI problem solving courses are being revised and finalized.
- Upon completion, the materials will be made available to the public.
- For additional information on the Google-CAHSI Problem Solving pilot click on this link

PS 1 - Riddle

- There are 20 gloves in a drawer: 5 pairs of black gloves, 3 pairs of brown, and 2 pairs of gray. You select the gloves in the dark and can check them only after a selection has been made.
  - What is the smallest amount of gloves you need to select to guarantee at least one matching pair?
  - What is the smallest amount of gloves you need to select to guarantee at least one matching pair of each color?

Source: https://math.stackexchange.com/questions/264226/puzzle-involving-selecting-gloves

PS 2 Problem

- Ciphering Problem: Working in teams, students:
  - Google information regarding Ciphers and a historical event where they were use.
  - Analyze and discuss a 3 step mapping provided for a Cipher and apply it to a encoding a message.
  - Develop their own cipher algorithm and document it in pseudocode.
  - Code and test their algorithm (The code is not the focus. Some instructors skip this step).
  - Discuss and revise the algorithm, as needed.
  - Reflect on the problem solving process.

Source: https://docs.google.com/document/d/17WFcLISIkOvVsiTAQb2et95-ORs4E-1WpZnRYvbeFBs/edit

Thank you!

Please feel free contact me at

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