UC Berkeley’s CS 10
The Beauty and Joy of Computing

• 2009Fa : 16 students (half course)
• 2010Fa : 90 students (full course)
• 2011Sp : 90 students (full course)
• 2011Su : 29 high school teachers
• 2011Fa : 240 students (full course)
• 2012Sp : Confirmed … online too!

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The “Passion, Beauty, Joy, Awe” movement

- Need to articulate, emphasize the “wonder and awe” of computing

PBJA\textsubscript{1} session @ SIGCSE 2008
- Crisis in computing, what can help in K-12, working w/student groups

Rebooting Computing Summit
- Subtitle: “Magic & Beauty of CS”
- Working group: K-8 FUNdamentals

PBJA\textsubscript{2} session @ SIGCSE 2009
- Crisis update, Listening to our students, Relevant projects to them

PBJA\textsubscript{3} session @ SIGCSE 2010
- Curriculum, PD, community, industry fighting “there’s an app for that”

PBJA\textsubscript{4} session @ SIGCSE 2011
- 3 others in K-12 share vision

Lessons Learned
- Essential skills
  - Abstraction
  - Collaborative development

- Metaskills
  - Fundamentals
  - The ability to learn
  - Passion, beauty, joy, and awe
comes around the corner

Create and share your own interactive stories, games, music, and art

Check out the 2,128,597 projects from around the world!

To create your own projects:

Download Scratch
BYOB adds functions, generic lists, \( \lambda \)

- **BYOB (Build Your Own Blocks)**
  - developed by Jens Mönig with design input and documentation from Brian Harvey & others at Cal
  - Leverages awesomeness of Scratch (design, simplicity, multi-media, community of users)
  - Adds enough so Scratch can be used in CS0 and CS1

Building a For Loop and calling it. Can you do this in your language?
CS10 in one slide

- Big Ideas of Programming
  - Abstraction
  - Algorithms (2)
  - Recursion (2)
  - Functions-as-data, \( \lambda \) (2)
  - Programming Paradigms
  - Concurrency
  - Distributed Computing

- Beauty and Joy
  - “CS Unplugged” activities
  - All lab work in pairs
  - Two 3-week projects in pairs
    - Of their own choice!!
  - One 3-page paper
    - Of their own choice!!

- Big Ideas of Computing
  - HowStuffWorks
    - 3D Graphics
    - Video Games
    - Computational Game Theory
  - Research Summaries
    - AI
    - HCI
  - Apps that Changed the World
  - Social Implications of Computing
  - Saving the World with Computing
  - How Twitter Works (guest lecture)
  - Cloud Computing
  - Limits of Computing
  - Future of Computing
Format & Textbooks

- **Format (7 hrs/wk * 14 wks)**
  
<table>
<thead>
<tr>
<th>Mon</th>
<th>Wed</th>
<th>Fri</th>
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<tr>
<td>Lecture</td>
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<td>Discussion</td>
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<td>Lab</td>
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- **Selected Reading**
  - Taken from great book ("Blown to Bits" by Abelson, Ledeen & Lewis) + articles + videos
  - Current events EVERY DAY (e.g., IBM’s Watson vs Jeopardy)

- **All resources FREE**
  - Even clickers!

The Beauty and Joy of Computing
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Peer Instruction in Lecture

- Increase real-time learning in lecture, test understanding of concepts vs. details
  - Improves interactivity greatly!
- Ask multiple choice question
  - 1-2 minutes to decide
  - 2 minutes in pairs/triples to reach consensus. Teach others!
  - 2 minute discussion of answers, questions, clarifications
CS10 curriculum leads

- Dan Garcia
  - Lecturer SOE

- Luke Segars
  - TA, Grad Student

- Brian Harvey
  - Lecturer SOE

- Colleen Lewis
  - TA, Grad Student

...many others @ Cal!
Justin Barnes (L) & Ian Birnam (R)

- Ian: “The class itself was amazing … I had a really fun time … Building our own projects was great … The lectures were really interesting … I never really got into computing but because of this class now I’m really interested in computing and being a possible CS major. … Anyone even remotely interested in computers should take it!”

- Justin: “The class is incredibly engaging. The atmosphere is unlike anything I’ve ever taken here. I would recommend it to any friend. I’m a senior, but honestly, if I had taken this class earlier, I would have considered CS as a major.”
45% Women, ~57% of top 22 students!

Women GPA: 3.06
Men GPA: 2.87

% Women:

% Women in Top 22:

2008Fa CS3L
2009Sp CS3L
2010Fa CS10
2011Sp CS10

The Beauty and Joy of Computing
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Summary, Reflection

- **CS10 is complete, available. Reviews**
  - UC Online pilot!
    - “Does it scale?” … yes!
    - 6-week summer course
    - “1-6-1” professional dev
      - 29 high school teachers took our summer 2011 PD
  - NSF CE21 to train 100+ teachers!
    - If interested, contact us!

- “It's a great way to think and expand your mind as well as important and interesting information to know--not to mention that our guest speakers, professors, and department in general here at Berkeley are all outstanding.”
- “It is an excellent introduction to the basic concepts of computer science, and the programing language is easy to learn and understand.”
- “even as a non-major i would highly recommend it to those who want to learn about computing”
5 Pilots chosen by CollegeBoard,
## 5 Pilots: Comparison

<table>
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<th>Size</th>
<th>Contact Hrs</th>
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<tr>
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<td>Living in a Computing World</td>
<td>Lightbot + Scratch</td>
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<td>UCSD</td>
<td>Fluency w/ Information Technology</td>
<td>Alice + Excel</td>
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<td>CS Principles</td>
<td>Processing</td>
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<td>The Beauty and Joy of Computing</td>
<td>BYOB based on Scratch</td>
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Summary: design constraints of CS10

- UC Berkeley’s first course for majors (CS61A) expects programming experience & recursion
  - CS10 hits that in week 5, the same time as the old course
- What should ugrads know about computing?
  - History, CS+X, apps that changed the world, hot research
  - Computing is really fun, de-mystification
- Passion, Beauty, Joy & Awe
  - Take every step to make attractive to women, URM
  - Let them choose projects and paper relevant to them!
- Make all resources free, available (Berkeley way)
  - Videos, notes, exercises, clickers, book!
High School Collaborators

Ray Pedersen
- Albany HS

Eugene Lemon
- Ralph Bunche HS

Josh Paley
- Gunn HS