

UC Berkeley EECS  
Sr Lecturer SOE  
Dan Garcia



# The Beauty and Joy of Computing

## Lecture #1 Welcome; Abstraction



**BJC: YOU'LL LOVE IT! HARD WORK, BUT FUN!**

Watch the student  
testimonials about the  
course, what it means to  
them, and how it has  
changed their lives.  
It's quite Inspiring!



[cs10.org](http://cs10.org)



# Computing in the News: BJC4NYC

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- We're working with the NYC school district to bring BJC to 100 NYC teachers by 2020!

(we were just mentioned by White House!)



[bjc.link/bjcwhitehouse](http://bjc.link/bjcwhitehouse)

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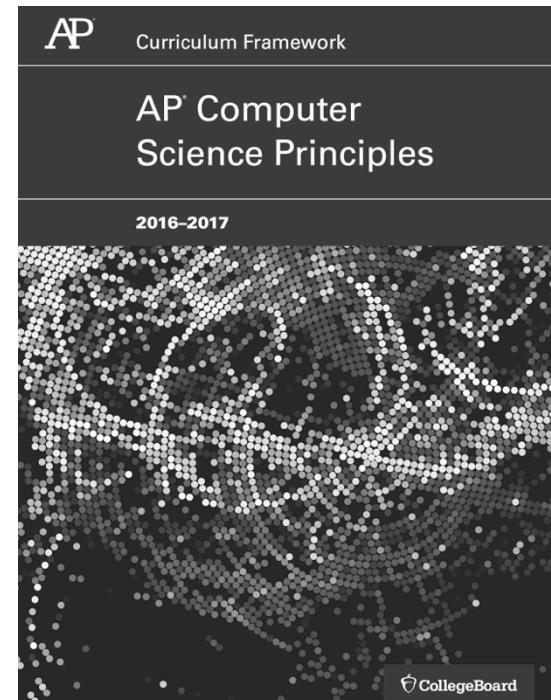
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# (AP) Computer Science Principles



## 7 Big Ideas

- Creativity
- Abstraction
- Data and Information
- Algorithms
- Programming
- The Internet
- Global Impact



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# (AP) Computer Science Principles

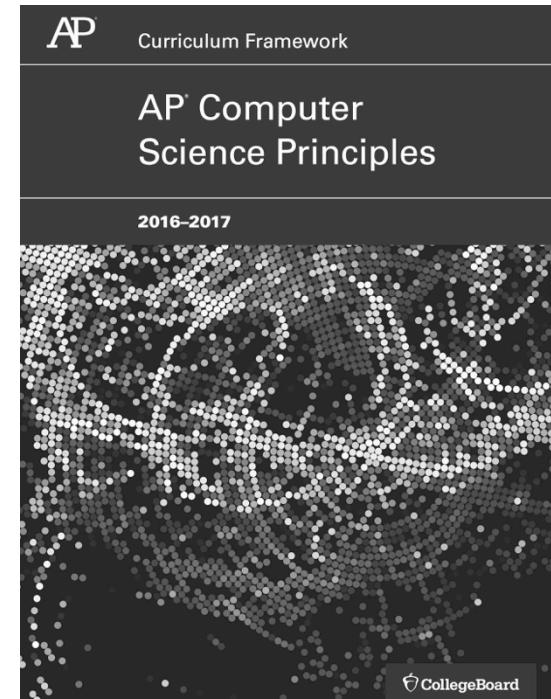


## 6 Computational Thinking Practices

- **Connecting** computing
- **Creating** computing artifacts
- **Abstracting**
- **Analyzing** problems & artifacts
- **Communicating**
- **Collaborating**



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# Beauty and Joy of Computing in one slide

## ▪ Big Ideas of Programming

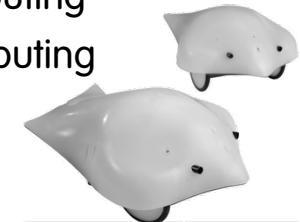
- Abstraction
- Algorithms (2)
- Recursion (2)
- Functions-as-data, I (2)
- Programming Paradigms
- Cloud Computing

## ▪ Beauty and Joy

- “CS Unplugged” activities
- If f2f, all lab work in pairs
- “Create” performance task
  - Of your own choice!!
- “Explore” performance task
  - Of your own choice!!

## ▪ Big Ideas of Computing

- Daily “computing in the news”
- How the Internet works
- Research Summaries
  - AI
  - HCI
- The Power of Data (big, small)
- Social Implications of Computing
- Saving the World w/Computing
- Cloud Computing
- Limits of Computing
- Future of Computing
- Robots...



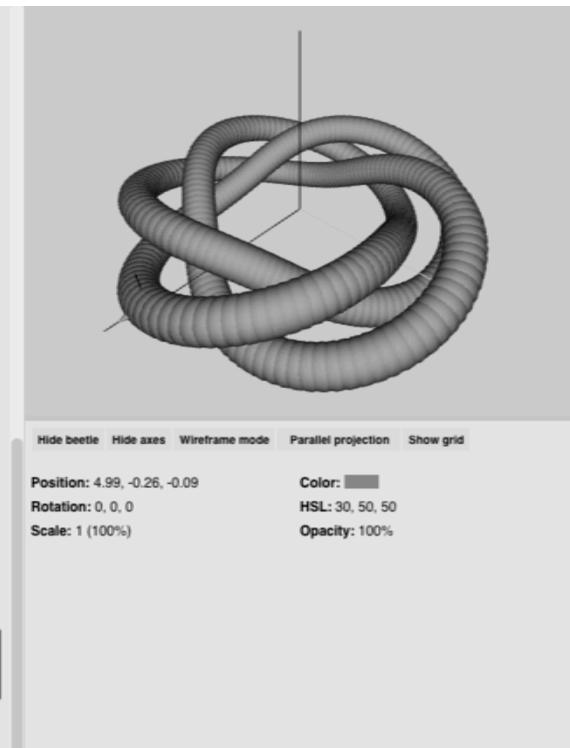
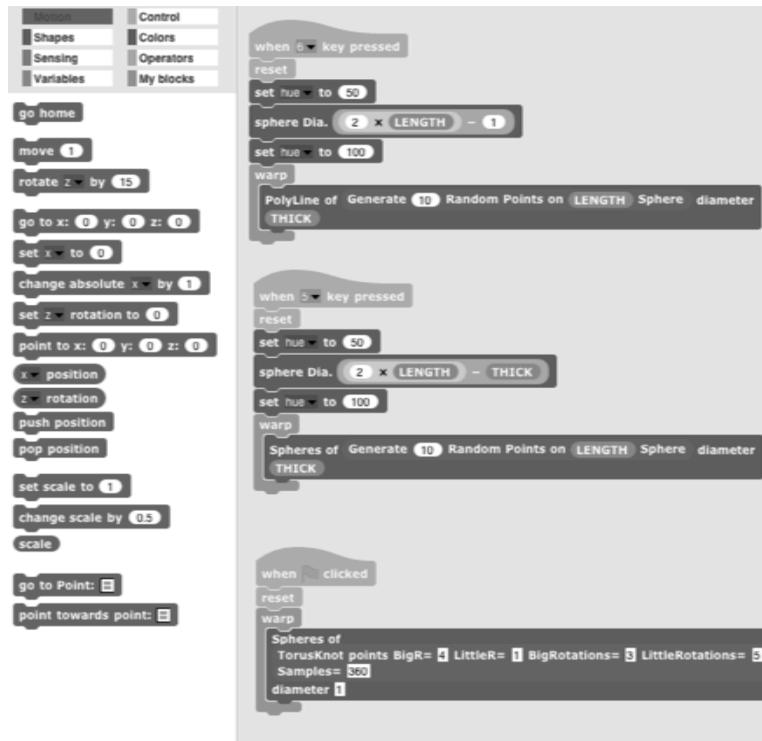
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# Incredibly easy-to-learn coding in Snap!



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# (Cal) Format & Textbooks

- Format (7 hrs/wk \* 14 wks)

Mon	Tue	Wed	Thu	Fri
Lecture	Lab	Lecture	Lab	Discussion
	Lab		Lab	

- Selected Reading

- Taken from great book ("Blown to Bits" by Abelson, Ledeen & Lewis) + articles + videos
- Current events EVERY LECTURE (e.g., IBM's Watson vs Jeopardy)

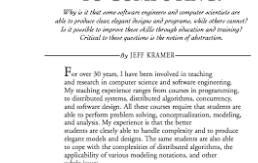
- All resources FREE

- Even clickers!

- Pair Programming!



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## contributed articles



## contributed articles



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# (Cal) Piazza for asking Qs & getting help

The screenshot shows a Piazza course page for "CS 10". The top navigation bar includes "piazza", "CS 10", "Questions", "Statistics", and a user profile for "Dan Garcia". A search bar and "Add Question/Note" button are also present.

The main area displays a question titled "When are TA / professor office hours?". The question was posted by an administrator and last updated by Luke Segars 2 days ago. It has 3 views and 1 follow.

The question's response is from an instructor, stating: "We haven't established our office hours yet, but we'll make that information available as soon as possible. Check back here for an update by the second week of classes." This response was also last updated by Luke Segars 2 days ago.

Below the response, there are buttons for "Good Answer!" and "Ask a Followup". A "Start off a Students' Response" button is also visible.

At the bottom, there are sections for "AVERAGE RESPONSE TIME" (N/A), "SPECIAL MENTIONS" (Luke Segars answered When are TA / ... in 1.1 hr. 2 days ago), and "USERS ONLINE THIS WEEK" (3 Online Now: 1).



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# (Cal) Pro-student Grading Policies

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- **EPA**

- Rewards good behavior
- Effort
  - E.g., Office hours, doing every single lab, hw, reading Piazza pages
- Participation
  - E.g., Raising hand in lec or discussion, asking questions on Piazza
- Altruism
  - E.g., helping other students in lab, answering questions on Piazza

- **You have 3 "Slip Days"**

- You use them to extend due date, 1 slip day for 1 day extension
- You can use them one at a time or all at once or in any combination
- They follow you around when you pair up (you are counted individually)
  - E.g., A has 2, B has 0. Project is late by 1 day. A uses 1, B is 1 day late
- Late is 1/3 off/day



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# Abstraction

- **Detail removal**

- “The act or process of leaving out of consideration one or more properties of a complex object so as to attend to others.”

- **Generalization**

- “The process of formulating general concepts by abstracting common properties of instances”



Henri Matisse “*Naked Blue IV*”



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# Detail Removal



General Purpose Online Map



Selected Roads



Our Result

**Automatic Generation of Detail Maps**  
(courtesy Maneesh Agrawala @ UC Berkeley, among others)



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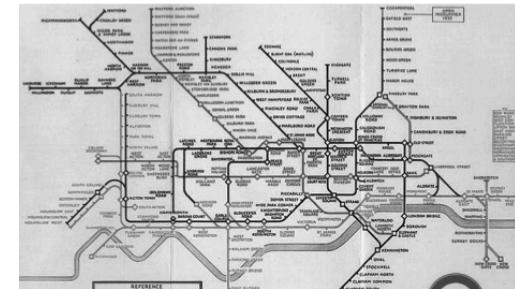


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# Detail Removal (in BJC)

- You'll want to write a project to simulate a real-world situation, or play a game, or ...
- Abstraction is the idea that you focus on the essence, the cleanest way to map the messy real world to one you can build
- Experts often brought in to know what to remove and what to keep!



The London Underground 1928 Map & Harry Beck 1933 map.



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# Generalization Example

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- You have a farm with many different animals.
- Different food for each
- You have directions:
  - To feed dog, put dog food in dog dish
  - To feed chicken, put chicken food in chicken dish
  - To feed rabbit, put rabbit food in rabbit dish
  - Etc...
- How could you do better?
  - To feed <animal>, put <animal> food in <animal> dish



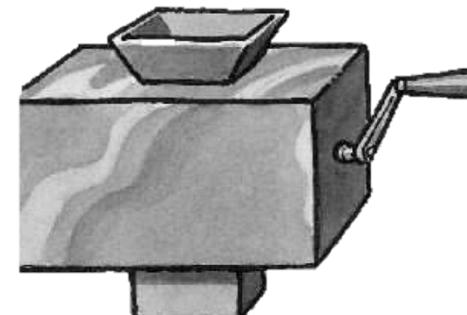
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# Generalization (in BJC) ... foreshadowing

- You are going to learn to write functions, like in math class:

$$y = \sin(x)$$

- You should think about what inputs make sense to use so you don't have to duplicate code



"Function machine"  
from *Simply Scheme* (Harvey)





# The Power of Abstraction, everywhere!

- **Examples:**
  - Functions (e.g.,  $\sin x$ )
  - Hiring contractors
  - Application Programming Interfaces (APIs)
  - Technology (e.g., cars)
- **Amazing things are built when these layer**
  - And the abstraction layers are getting deeper by the day!



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*We only need to worry about the interface, or specification, or contract  
NOT how (or by whom) it's built*

## Above the abstraction line

**Abstraction Barrier (Interface)**  
(the interface, or specification, or contract)

## Below the abstraction line

*This is where / how / when / by whom it is actually built, which is done according to the interface, specification, or contract.*



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# Summary

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- Abstraction is one of the big ideas of computing!
- It's how mankind has engineered some of the greatest structures and managed the complexity
- Two definitions
  - Detail Removal
  - Generalization



Someone who drove in 1930 could still drive a car today because they've kept the same Abstraction!  
*(right pedal faster, left pedal slow)*



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