Advanced Algorithms

April 16, 2026

Logistics

- Assignment due next Tuesday, April 21

- Meet with me to discuss / lock in final project topic
  - Will have time after class today (until 4)
  - Keep in mind **scope**

- Tuesday and Thursday next week **I will be gone**
  - **Tues**: workshop day! with Kartika in class. Attendance taken
  - **Thurs**: Online recorded lecture, no need to come to class.
  - Will be available by email, Zoom!


THE CS DEPARTMENT PRESENTS
HOT ONES 6
HOT SAUCE FOR PROFS
ANSWERS FOR STUDENTS
BRING THE HEAT!
Thursday
April 16, 2026
4:15PM
Estella 1051
Argue-Auditorium
Come watch CS Professors eat the HOTTEST sauces
while answering your BURNING questions!
MILD
SPICY
HOT
EXTRA

Recall: Online Algorithms

- Before: primary concern computational power
  - “Efficiently” solvable problems
  - NP-hard problems

- Now: difficulty is lack of information

- Online Model
  - Input / data arrives over time
  - Need to make irrevocable decisions without knowing future

Ski Rental Problem

- You want to go skiing as much as possible this season.
- But you don't have skis, and the season could end any day

- Every day you have the option of:
  - **Renting** skis: $50 per day
  - **Buying** skis: $500 one time cost

- Should you **rent** or **buy** skis? When?

BLTN algorithm

Secretary Problem

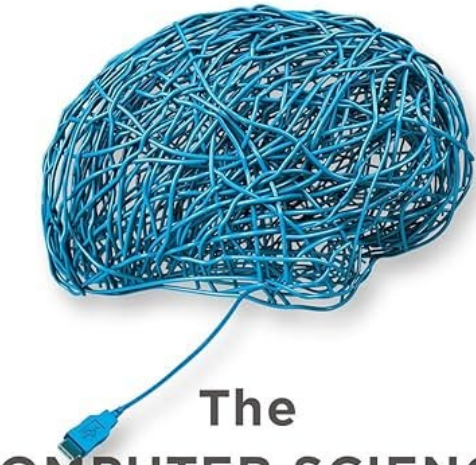
- You are hiring a secretary, and you want the best person for the job

- N candidates arrive one by one, revealing their quality after being interviewed

- After each candidate arrives, you must either:
  - **Hire** that candidate
  - **Reject** that candidate forever

37% rule

Algorithms to Live By

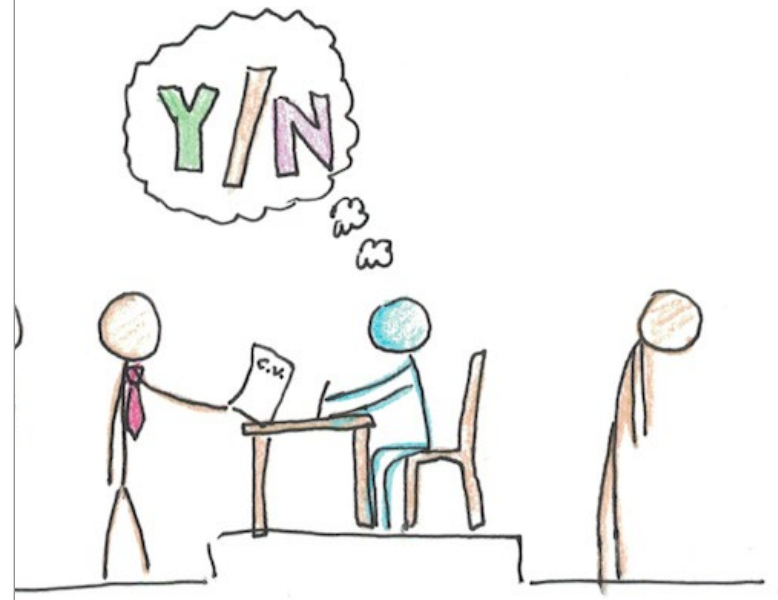


The COMPUTER SCIENCE of HUMAN DECISIONS

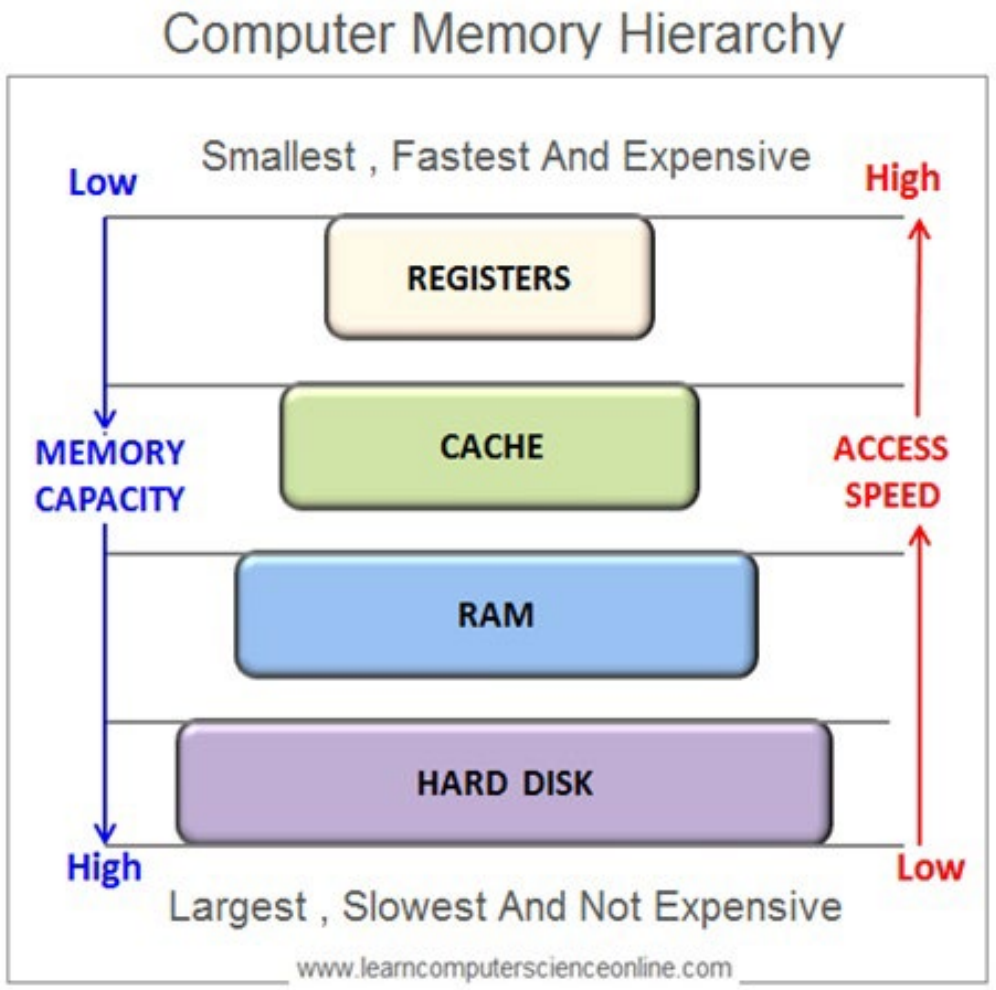
Brian Christian and Tom Griffiths

"Compelling and entertaining…Whether you want to optimize your to-do list, organize your closet, or understand human memory, this is a great read." —Charles Duhigg, author of *Smarter Faster Better*

PICADOR



Today: Online Caching / Paging



Analyzing Online Algorithms

- We define the optimal clairvoyant algorithm OPT
  - This algorithm knows the entire input in advance and can make decisions accordingly
  - The cost of this algorithm on input σ is OPT(σ)

- The competitive ratio c of an online algorithm ALG is:

  - Maximum over all inputs σ: $\mathrm{ALG}(\sigma)/OPT(\sigma)$

- This is very similar to approximation algos (consider $c = 2$)