Lecture 3

CSE 331

Feb 5, 2021

Who is Algorithm named after?

Abū ʿAbd Allāh Muhammad ibn Mūsā al-Khwārizmī

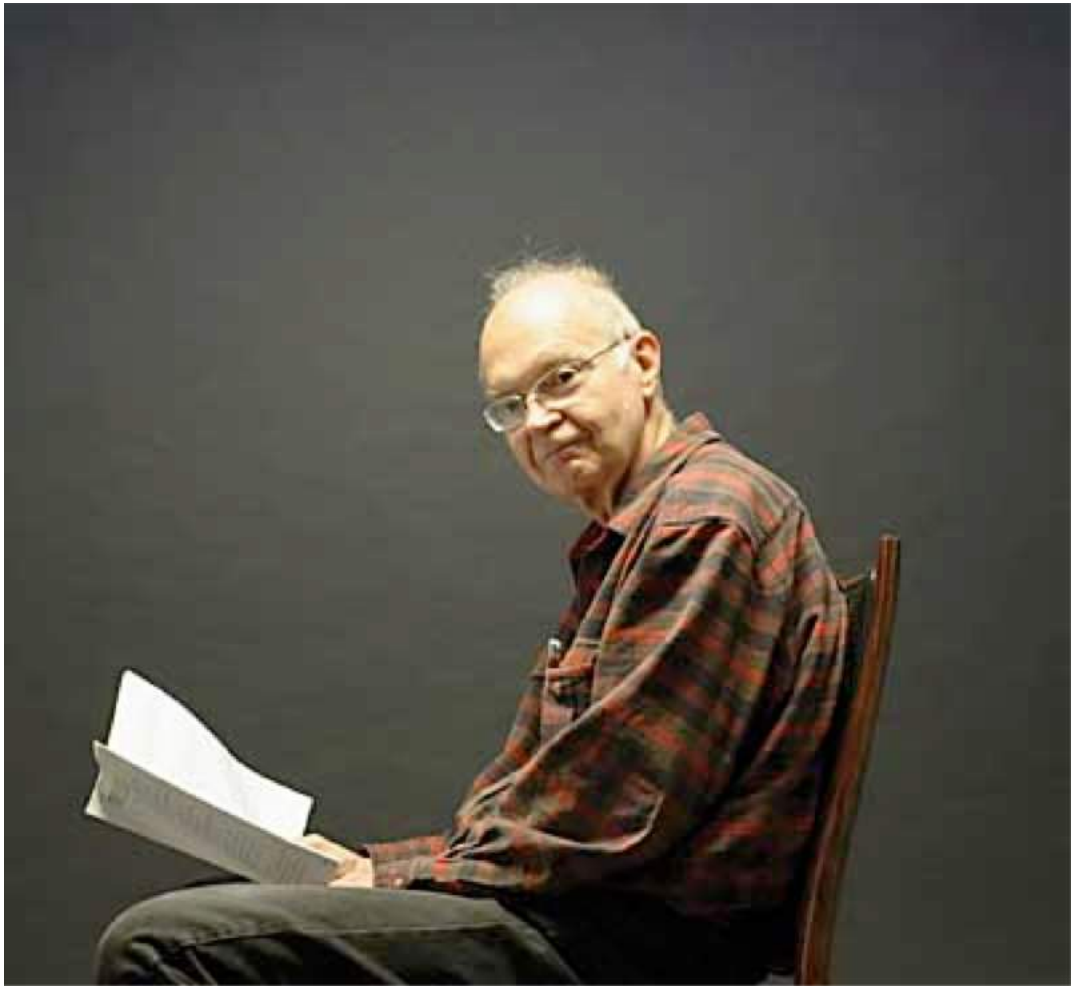
9th century Persian astronomer/mathematician

825 AD: “On Calculation with Arabic Numerals”

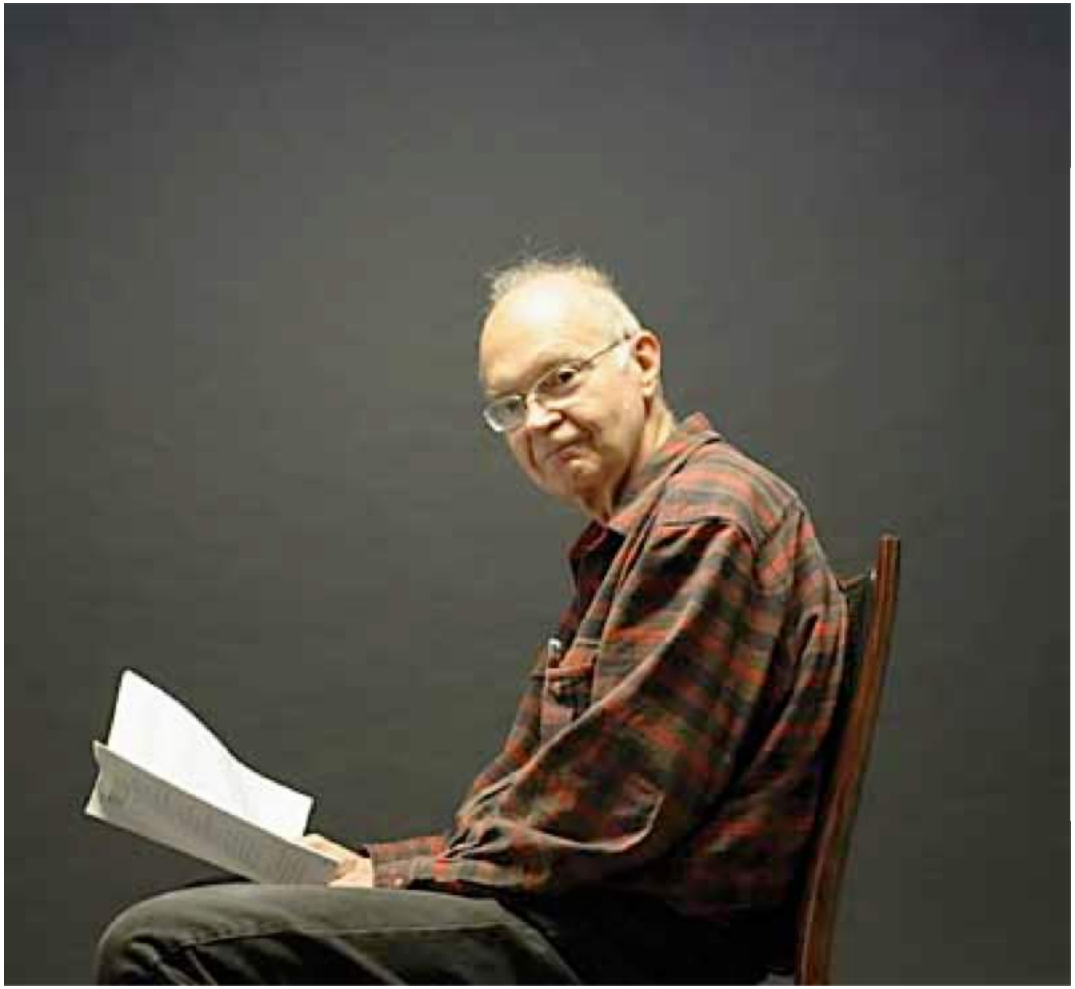
Latin translation 12th century

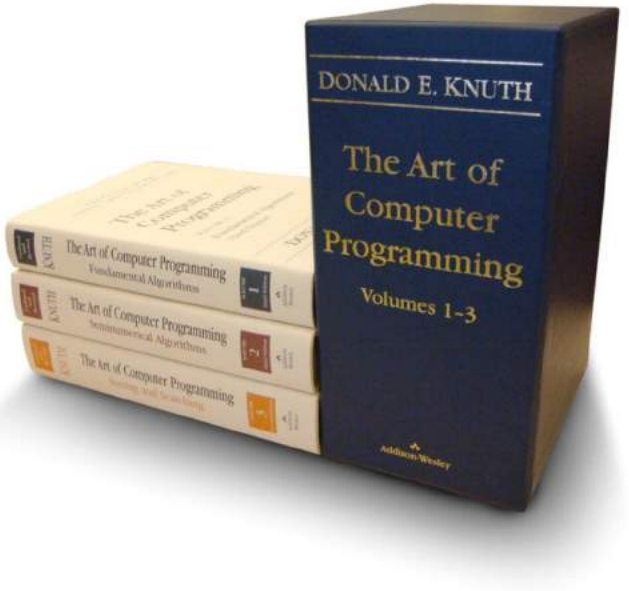
“Algorithmi de numero Indorum”

What are Algorithms?



Don Knuth

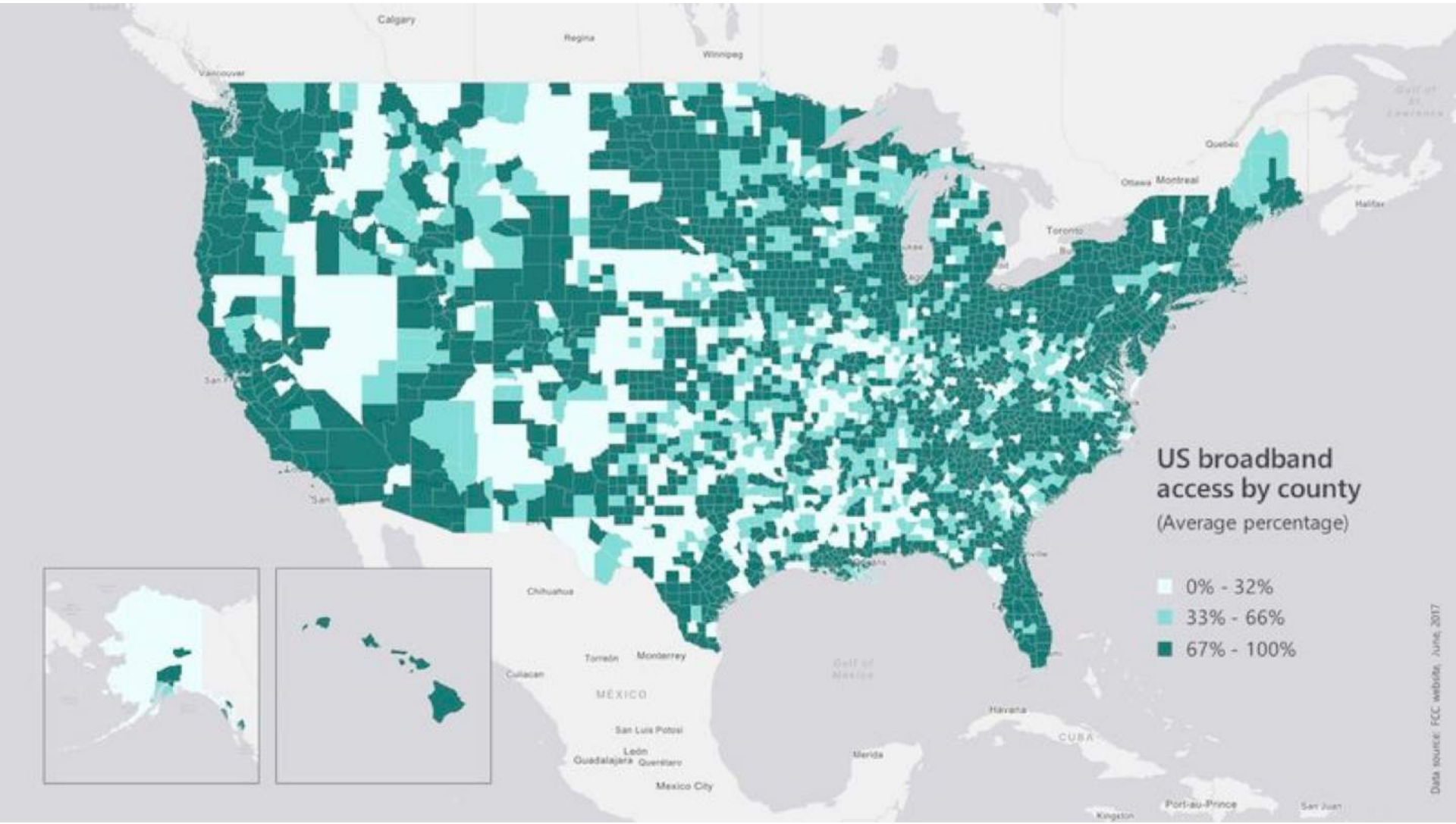



DONALD E. KNUTH
The Art of Computer Programming
Volumes 1-3
The Art of Computer Programming
The Art of Computer Programming
The Art of Computer Programming
Addison-Wesley

Knuth's Definition

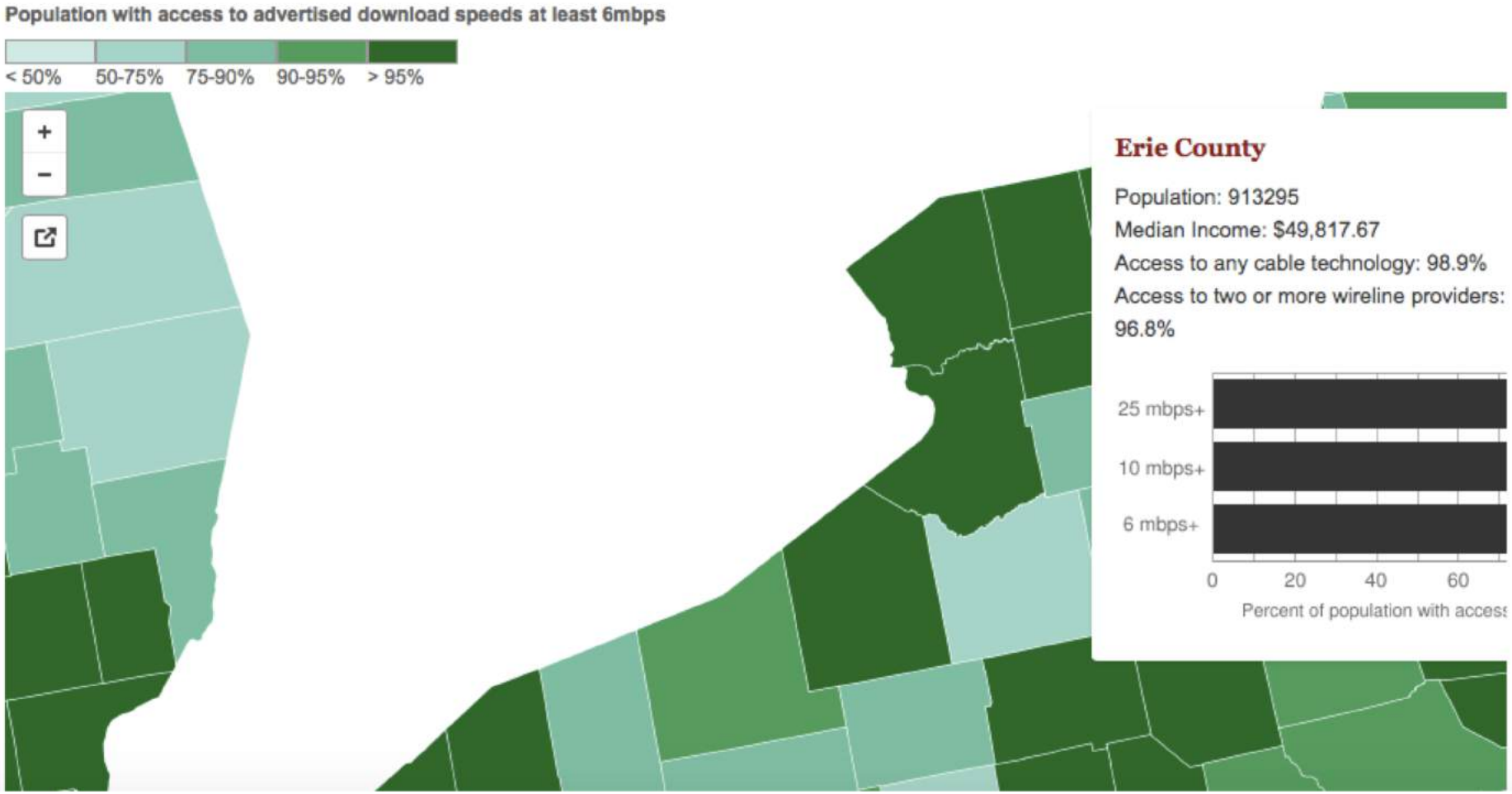
An algorithm is a finite, definitive, effective procedure with some input and some output

Broadband access



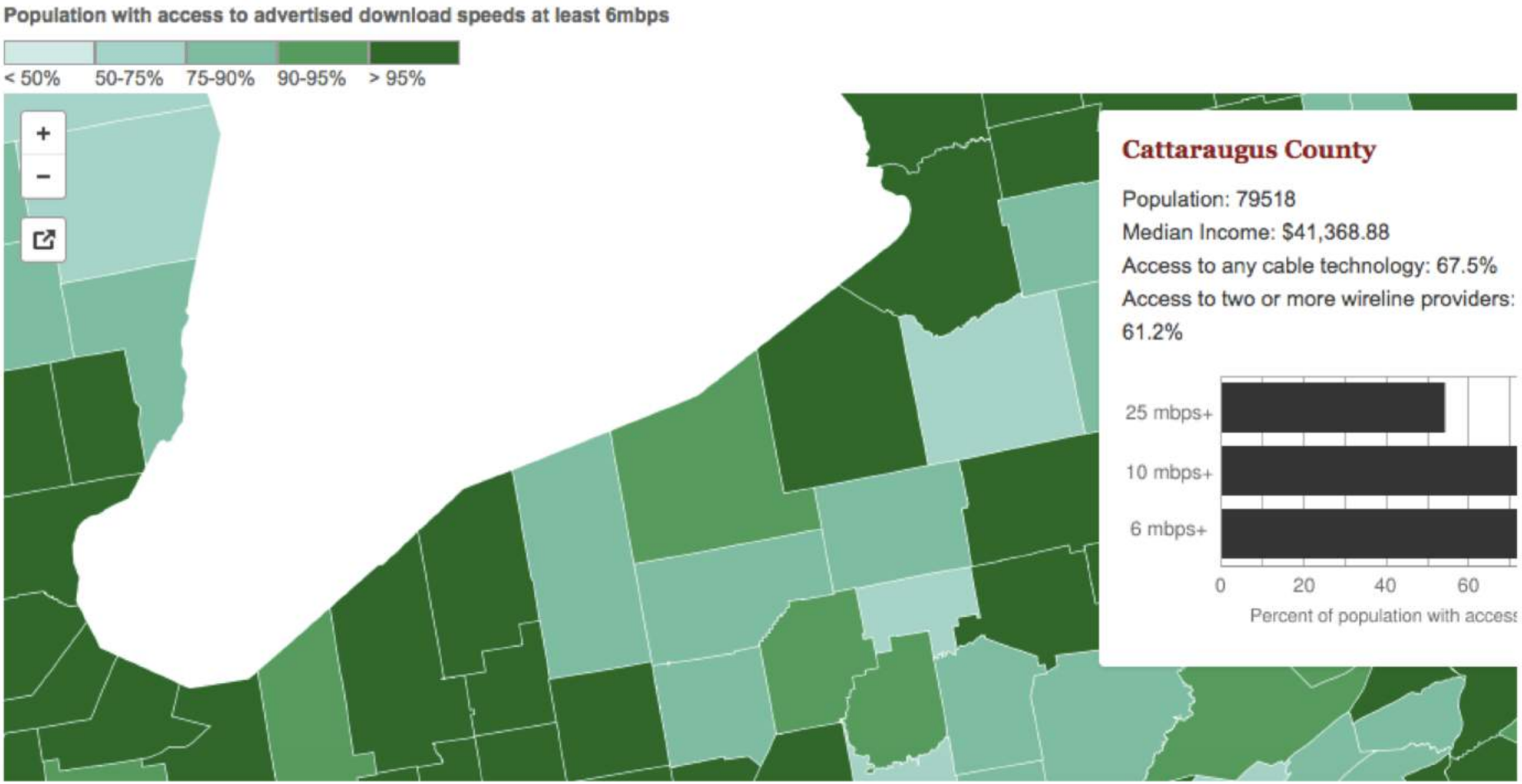
https://assets.bwbx.io/images/users/iqjWHBFdfxIU/iZSjibxE1KJs/v1/800x-1.jpg

Erie county is reasonably good



http://www.governing.com/gov-data/broadband-speeds-availability.html

One county over

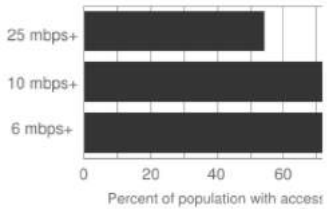


http://www.governing.com/gov-data/broadband-speeds-availability.html

Make broadband more available

Cattaraugus County

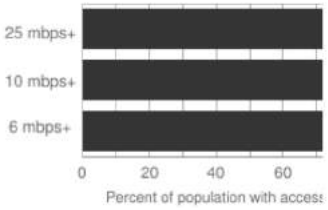
Population: 79518
Median Income: $41,368.88
Access to any cable technology: 67.5%
Access to two or more wireline providers: 61.2%



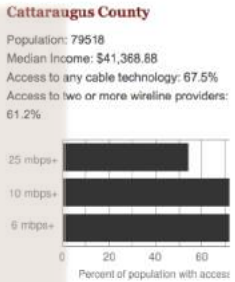
Say you are tasked to come up with the infrastructure

Erie County

Population: 913295
Median Income: $49,817.67
Access to any cable technology: 98.9%
Access to two or more wireline providers: 96.8%



Make broadband more available



Input requirements

Where are the customers located?

What are the bandwidth requirements?

How is the input represented?

What objective are we optimizing?

How should the connections be configured?

Output requirements

Problem Definition

Where should we lay down the physical stuff?

What algorithm should be use to do this?

Algorithm Design

Implement the scheme

How should we do testing and maintenance?

Decide whether this will be for-profit enterprise

What are technology should we use?

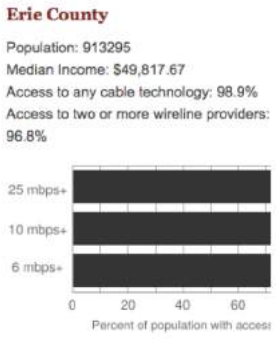
Get regulatory approval

Get funding

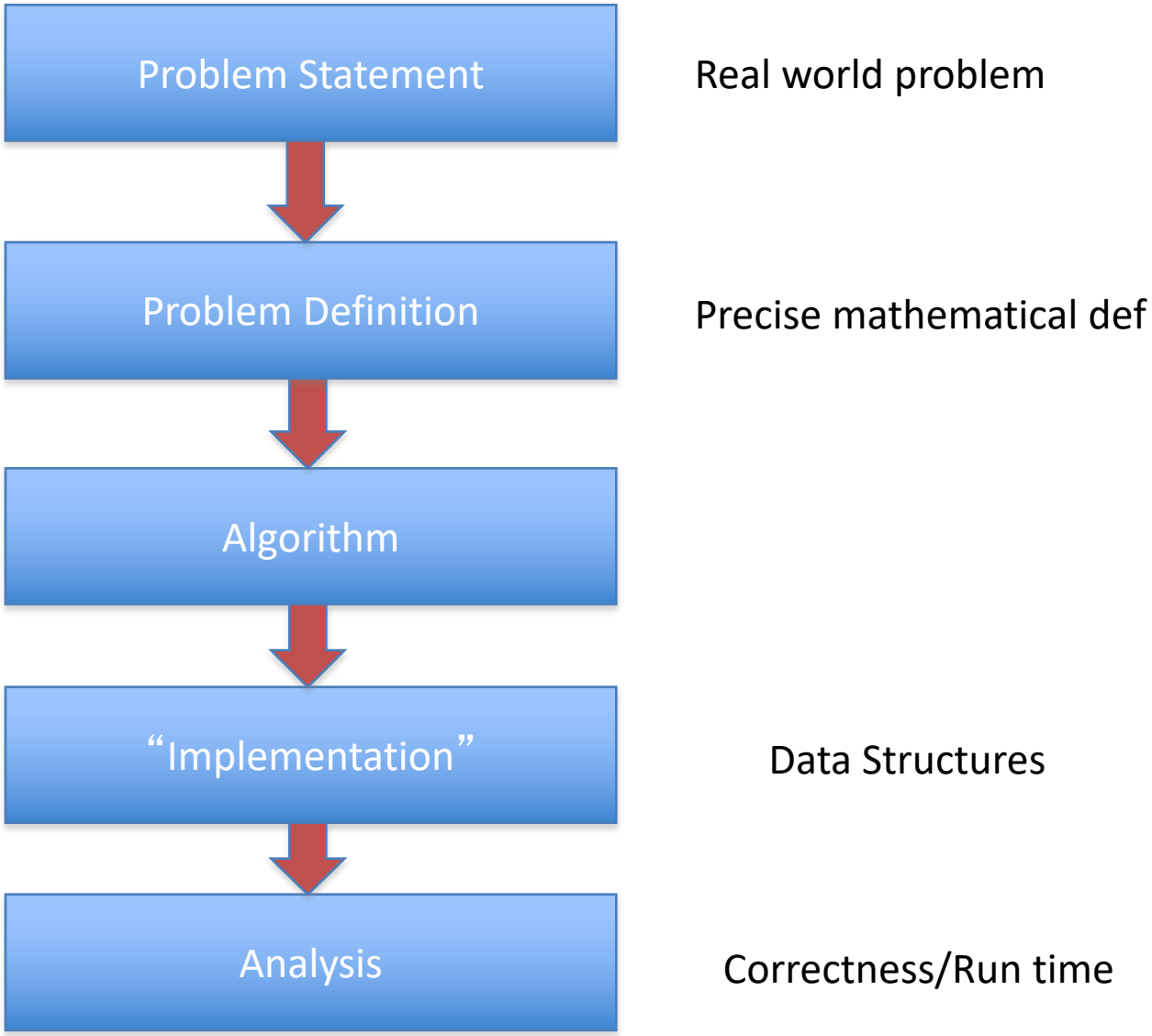
Hire people

Get access to physical space

Outreach



Main Steps in Algorithm Design



National Resident Matching

THE MATCH
NATIONAL RESIDENT MATCHING PROGRAM®

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MATCH CALENDARS | LOGIN/REGISTER

Preparing for #Match2018?

Frequently Asked Question

An NRMP ID is NOT Required for Submitting Your Applications

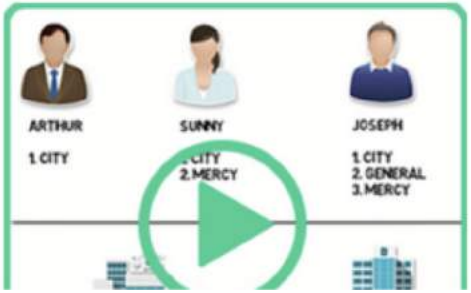
>> Learn more

WHAT'S HAPPENING

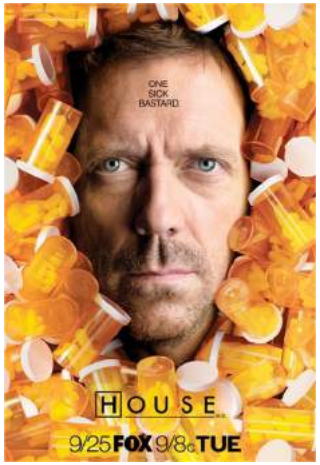
- Check the Eligibility of Applicants
- Registration Open for Adolescent Medicine, Medical Toxicology, and Headache Medicine
- Timely Residency Applicant Resources
- Registration Open for Colon & Rectal Surgery, Medical Genetics, Sleep Medicine, and Spinal Cord Injury

READ MORE

VIDEO: The Match Process for Applicants



(Screen) Docs are coming to BUF



What can go wrong?

The situation is unstable!

What happens in real life

Preferences

NRMP
National Resident Matching Program

Information

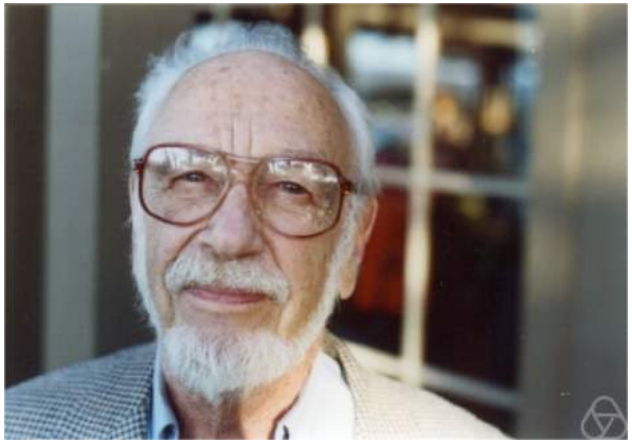
NRMP
National Resident Matching Program

Preferences

NRMP
National Resident Matching Program

NRMP plays matchmaker

Stable Matching Problem



David Gale

Lloyd Shapley

Questions/Comments?

Matching Employers & Applicants

Input: Set of employers (E)
Set of applicants (A)
Preferences

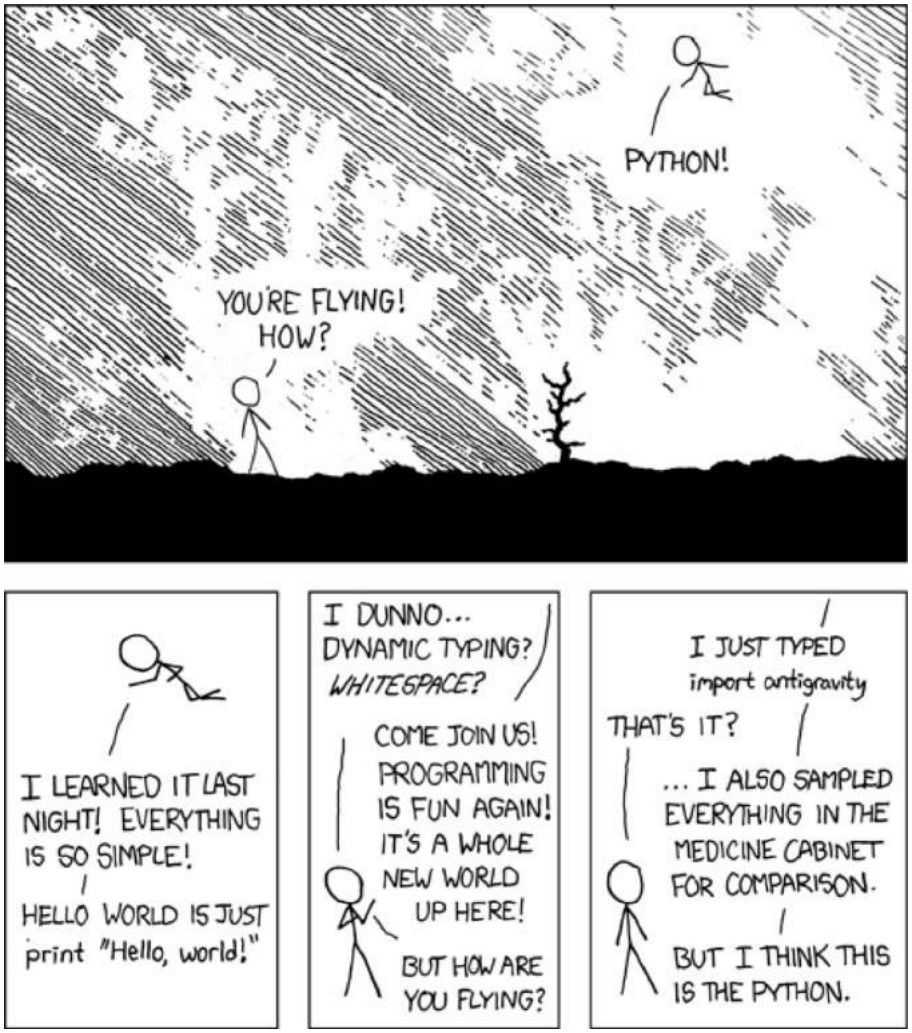
Output: An assignment of applicants to employers that is "stable"

For every x in A and y in E such that x is **not** assigned to y, either

(i) y prefers *every* accepted applicant to x; or

(ii) x prefers her employer to y

Simplicity is good



http://xkcd.com/353/

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What questions to think about?

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1) How do we specify preferences? Preference lists

2) Ratio of applicant vs employers 1:1

3) Formally what is an assignment? (perfect) matching

4) Can an employer get assigned > 1 applicant? NO

5) Can an applicant have > 1 job? NO

6) How many employer/applicants in an applicants/employers preferences? All of them

7) Can an employer have 0 assigned applicants? NO

8) Can an applicant have 0 jobs? NO