CS21: INTRODUCTION TO COMPUTER SCIENCE

Prof. Mathieson

Fall 2018

Swarthmore College

Outline Sept 5:

Make sure to sign in again
(for both registered AND waitlist students)

- Introductions
- Areas of computer science
- Nonograms followup

- Intro to **python3** and the interpreter
- Variables, values, assignment
- Types and conversion: **int**, **float**, **str**
- **input, print** built-in functions

Reminder: visit 249 (my office) as part of Lab 0!

Areas of Computer Science

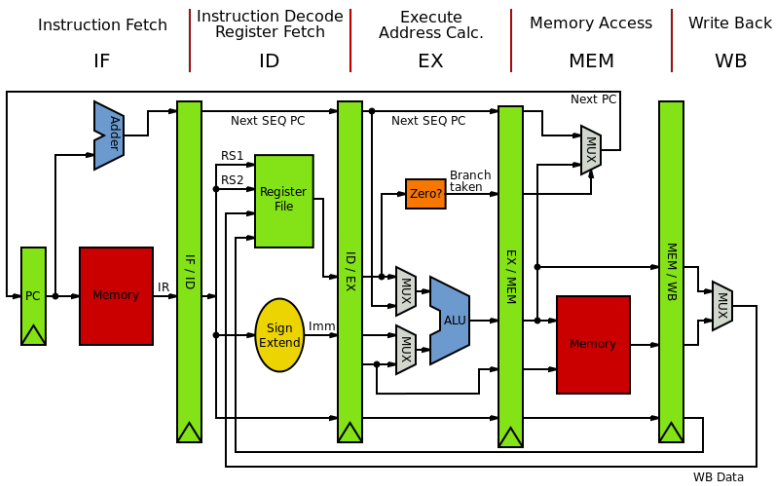
Computer Science Research Areas

- Artificial Intelligence
- Computer Architecture
- Computational Biology
- Databases
- Computer Science Education
- Computer Graphics
- Human-Computer Interaction
- Operating Systems
- Programming Languages
- Scientific Computing
- Cyber Security
- Theory

Credit: UC Berkeley EECS, https://www2.eecs.berkeley.edu/Research/Areas/CS/

Artificial Intelligence

Jeremy Hsu, IEEE Spectrum



Credit: Inductiveload on Wikipedia

Computer Architecture

Computational Biology

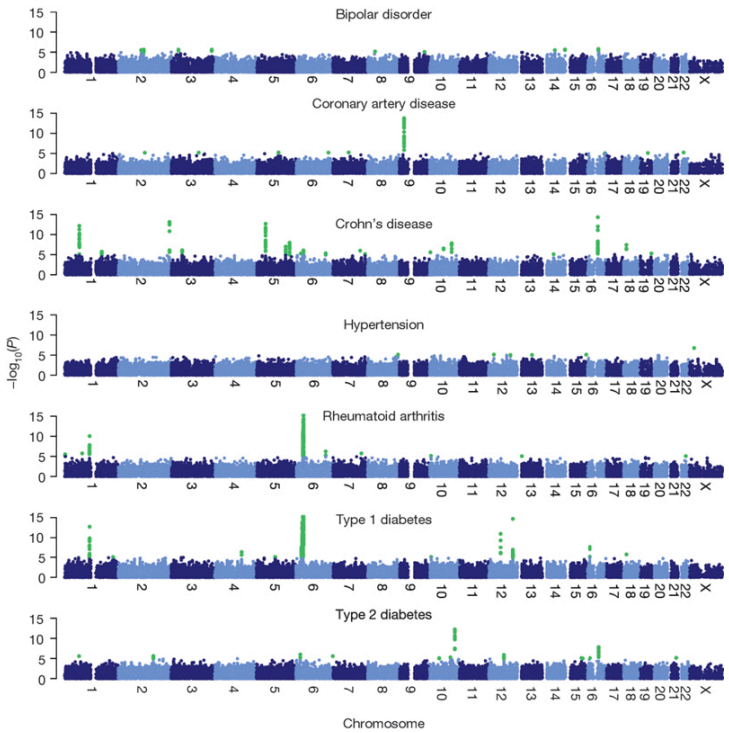


Figure credit: "*Genome-wide association study of 14,000 cases of seven common diseases and 3,000 shared controls*" by the Wellcome Trust Case Control Consortium

Databases

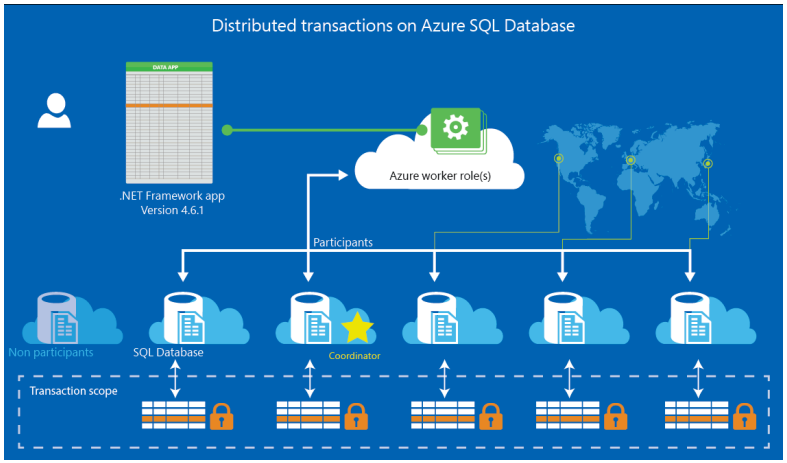
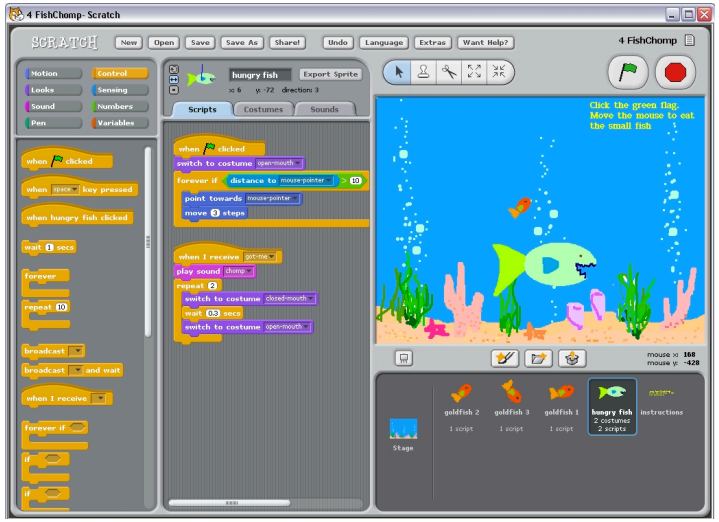
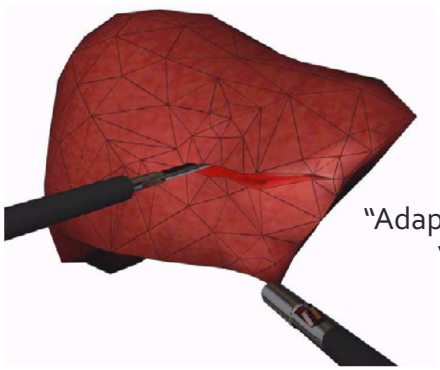


Figure credit: "Distributed transactions across cloud databases" – Microsoft Azure Database



Computer Graphics



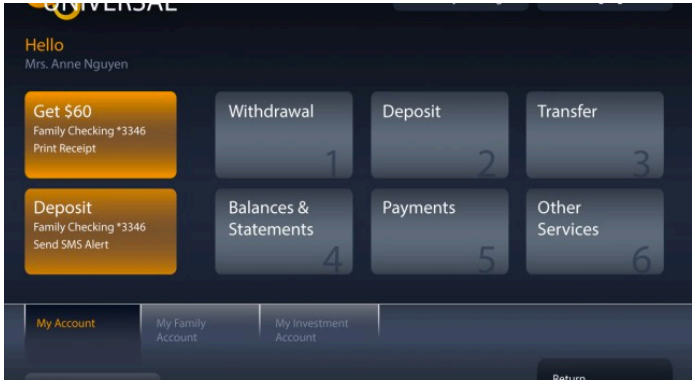
"Adaptive tissue modeling"
Vidal *et al*, 2006

"Zootopia"
Disney, 2016

Scratch Programming - EngagingEducators.com

Computer Science Education

Human-Computer Interaction



Universal ATM Interface by Kristin Suzanne Bessette

Programming Languages

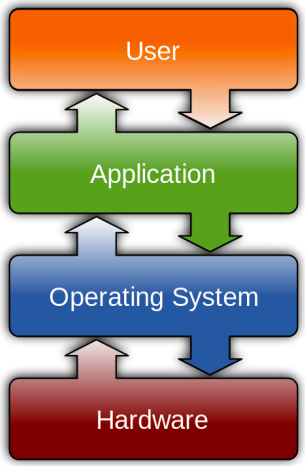
python™

Java™

R

MATLAB

WebGL™



Mac OS X

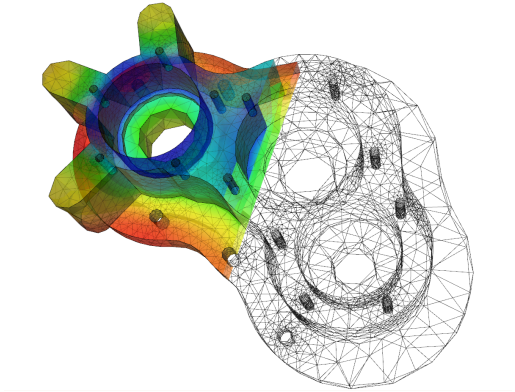
Linux™

Microsoft® Windows™

Wikimedia Commons (by Golftheman)

Operating Systems

Scientific Computing

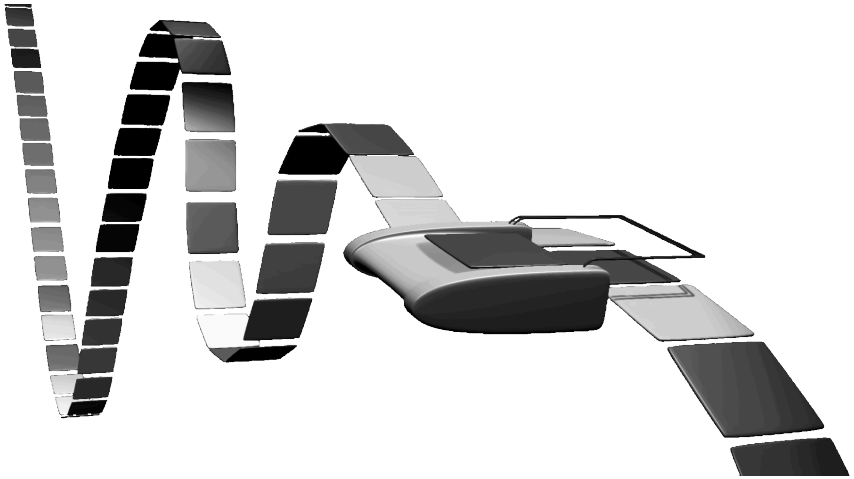


"A numerical solution to the heat equation on a pump casing model using the finite element method." – Wikipedia

Credit: Hugh Boyes (2014)

Cyber Security

Theory



"An artistic representation of a Turing machine. Turing machines are used to model general computing devices." – Wikipedia

Nonogram followup

Handout example

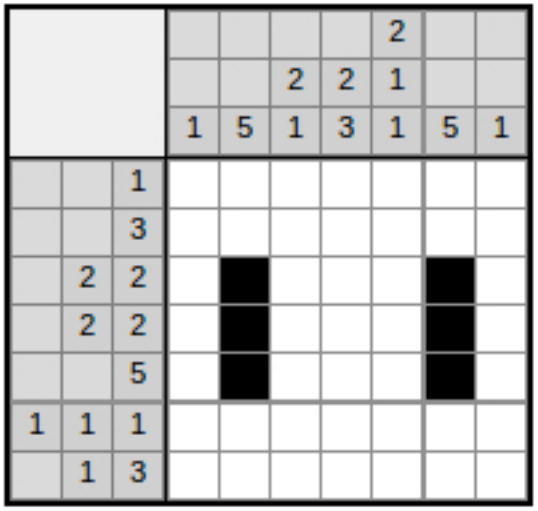
							2		
					2	2	1		
			1	5	1	3	1	5	1
		1							
		3							
	2	2							
	2	2							
		5							
1	1	1							
	1	3							

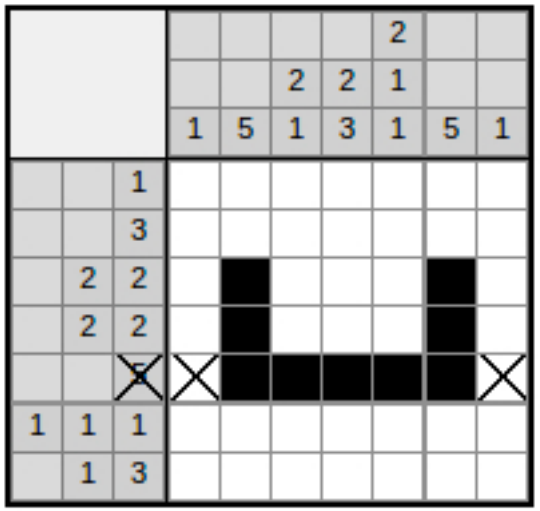
Image credit: www.nonograms.org

Systematic solving of a nonogram

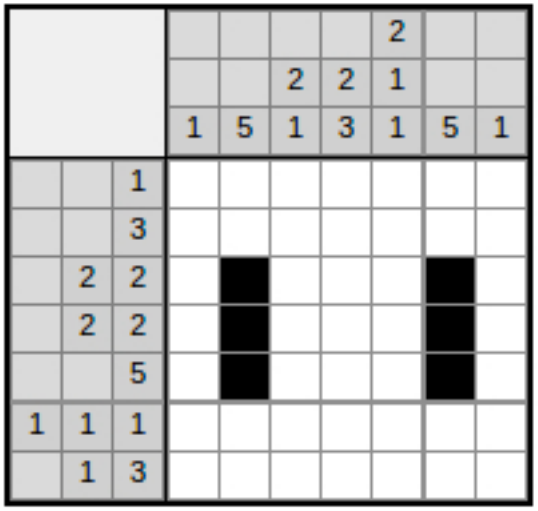
						2		
				2	2	1		
			1	5	1	3	1	5	1
		1							
		3							
	2	2		■				■	
	2	2		■				■	
		5		■				■	
1	1	1							
	1	3							

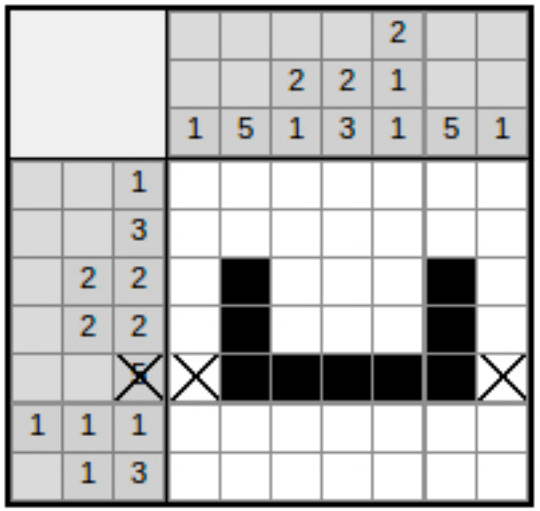
Systematic solving of a nonogram

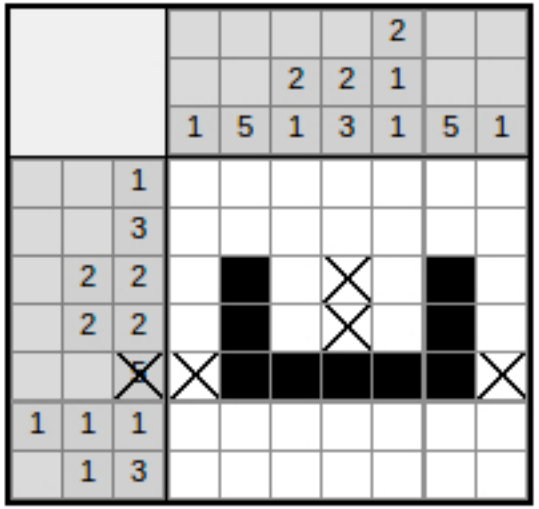




Systematic solving of a nonogram







Solution

						2		
				2	2	1		
			1	5	1	3	1	5	1
		1				■			
		3			■	■	■		
	2	2		■	■		■	■	
	2	2	■	■				■	■
		5		■	■	■	■	■	
1	1	1		■		■		■	
	1	3		■		■	■	■	

Algorithm for checking row solution

true solution

2	3	1

E E F F E E E F F F E E F F

user solution

INPUT

Algorithm for checking row solution

true solution

2	3	1

user solution

x = 0 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

x = 0 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

x = 1 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

x = 2 (variable to keep track of F blocks)

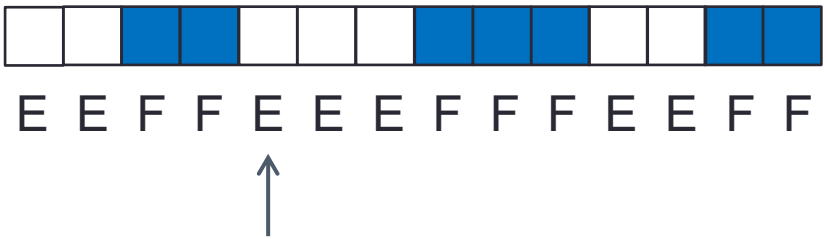
Algorithm for checking row solution

true solution

2	3	1

user solution

2



user solution

x = 0 (variable to keep track of F blocks)

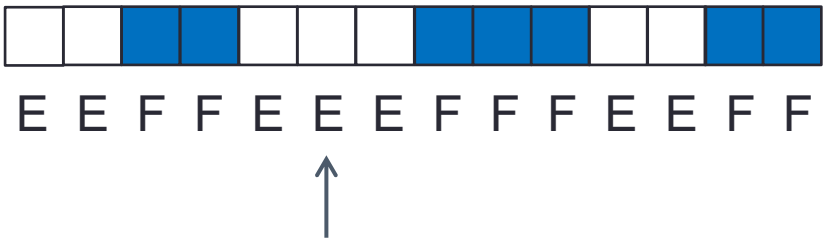
Algorithm for checking row solution

true solution

2	3	1

user solution

2



user solution

x = 0 (variable to keep track of F blocks)

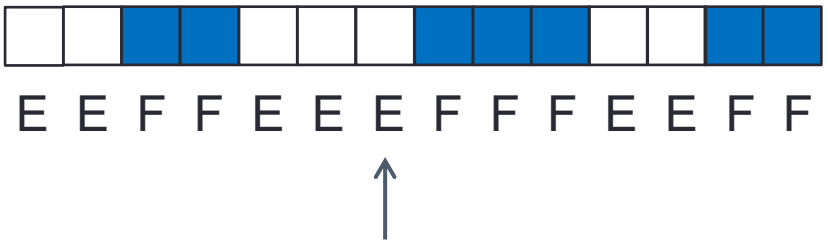
Algorithm for checking row solution

true solution

2	3	1

user solution

2



user solution

x = 0 (variable to keep track of F blocks)

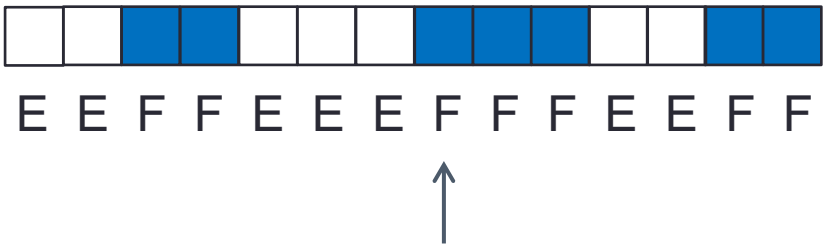
Algorithm for checking row solution

true solution

2	3	1

user solution

2



user solution

x = 1 (variable to keep track of F blocks)

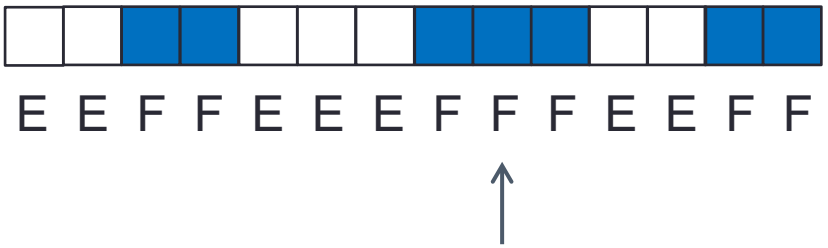
Algorithm for checking row solution

true solution

2	3	1

user solution

2



user solution

x = 2 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

2

user solution

x = 3 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

2	3

user solution

x = 0 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

2	3

user solution

x = 0 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

2	3

user solution

x = 1 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

2	3

user solution

x = 2 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

user solution

2	3	2

user solution

x = 0 (variable to keep track of F blocks)

Algorithm for checking row solution

true solution

2	3	1

$\neq$

user solution

2	3	2

user solution

x = 0 (variable to keep track of F blocks)

OUTPUT: NO

Python interpreter: demo

Key CS concepts today

- *Variables* as a way to store *values*
- *Assignment operator (=)* is a way to change the value of a variable (not symmetric like equals operator in math!)
  - Variable name on the left, expression on the right
- The *type* of a variable is the type of the value it refers to
- We can *convert* a variable to a different type, but it does not change the value of the original variable

Functions for today

- type()
- input()
- int()
- str()
- float()

Types for the first few weeks

- int
- float
- str

x = 4

variable

value

assignment operator

print(y)

function

argument/parameter

Types

- int
- float
- str