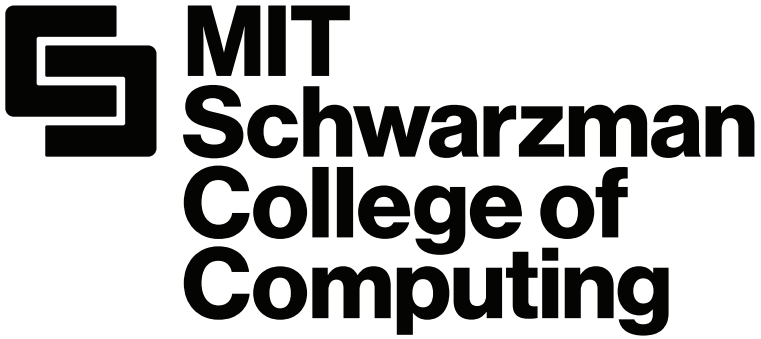


Building the MIT Schwarzman College of Computing

Dan Huttenlocher, Dean
Fall 2021

MIT Schwarzman College of Computing Mission

- Addressing opportunities and challenges of the computing age — from hardware to software to algorithms to artificial intelligence
- Transforming the capabilities of academia for this age

Supporting rapid growth and evolution of computing fields, notably CS & AI

- Rapid pace of change, particularly in AI
- Massive growth: at MIT ~45% of undergrads

Facilitating computing collaborations across departments and disciplines

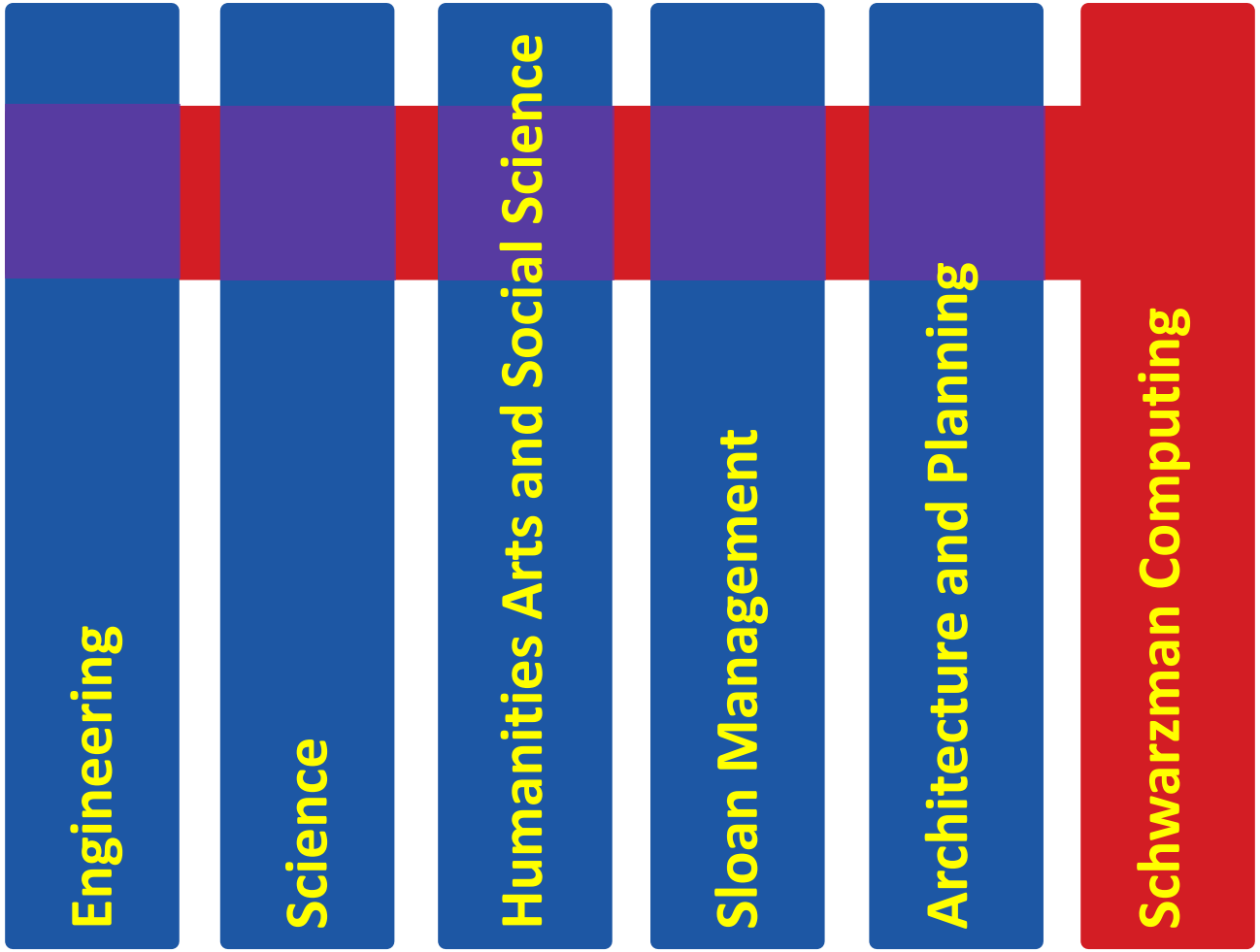
- Educating computing "bilinguals"
- Cross-cutting research activities

Focusing on social, ethical, and policy issues in computing

- Blending humanist, social science, policy, and technical expertise
- Responsibilities and opportunities

MIT Schwarzman College of Computing

Schwarzman College and the Five Schools at MIT



MIT Schwarzman College of Computing

The (Brief) History of the College

Broad involvement across MIT (despite Covid-19 pandemic)

- Oct 2018 – Announcement
- Feb 2019 – Provost computing Task Force, launch event, Dean selection
- Aug 2019 – Task Force reports, Dean arrives
- Dec 2019 – Units named in Task Force reports become part of the College
  EECS reorganization into Faculties of EE, CS, AI+D
  ORC and CCSE elect to become part of the College
- Jan 2020 – College organization put in place

Academic and Research Units

Academic

- Electrical Engineering & Computer Science Dept. (EECS) *
  - Faculties of EE, CS AI+D
- Operations Research Ctr. (ORC) **
- Inst. Data, Systems & Society (IDSS)
  - Statistics & Data Science Ctr. (SDSC)
  - Technology Policy Prog. (TPP)
- Ctr. Computational Science & Engineering (CCSE)

Research

- Computer Science and Artificial Intelligence Lab (CSAIL)
- Lab for Information and Decision Systems (LIDS)
- Quest for Intelligence
- MIT-IBM Watson AI Lab *
- Jameel Clinic: AI & Health

* Jointly part of School of Engineering and Schwarzman College of Computing
** Jointly part of Sloan School of Management and Schwarzman College of Computing

MIT Schwarzman College of Computing

Restructuring the EECS Department

Largest Department at MIT (~120 plus 25 new “core” positions), now part of College of Computing as well as School of Engineering

Three “Faculties”, No Boundaries

Based on major academic areas

- Electrical Engineering (EE)
- Computer Science (CS)
- Artificial Intelligence and Decision-Making (AI+D)

Each area coordinates teaching and faculty recruiting

- Every professor self-identified with one or more Faculty, associated with their teaching
  - Approximately 1/3 in each
- New Faculty of AI+D combines areas historically from CS and EE, defined broadly (e.g., including signal processing, decision systems)
- Currently planning curricular reform

Strategic Search Areas for Shared Faculty

- Appointed in a department across MIT and in the College of Computing
- 25 new such shared faculty positions

Social, Economic, and Ethical Implications of Computing and Networks – initial hire with Sloan School

Computing and Natural Intelligence: Cognition, Perception, and Language – initial hires with Brain and Cognitive Science

Computing in Health and Life Sciences – initial hire with Chemical Engineering

Computing for Health of the Planet (Climate)

Computing and Human Experience (Humanities)

Quantum Computing

Complementing and expanding strength in strategic areas

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New Cross-Cutting Program Areas

Across MIT departments, labs, and centers

Common Ground for Computing Education

- Multi-department collaborations to meet needs beyond single one
- Develop blended and integrated computing classes and curricula
- Key aspect of educating computing “bilinguals”

Social and Ethical Responsibilities of Computing (SERC)

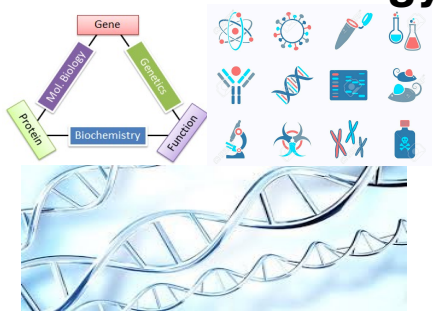
- Build habits of mind and action regarding impacts of computing, incorporating multiple perspectives
- Computing for public good

Educating “Computing Bilinguals”

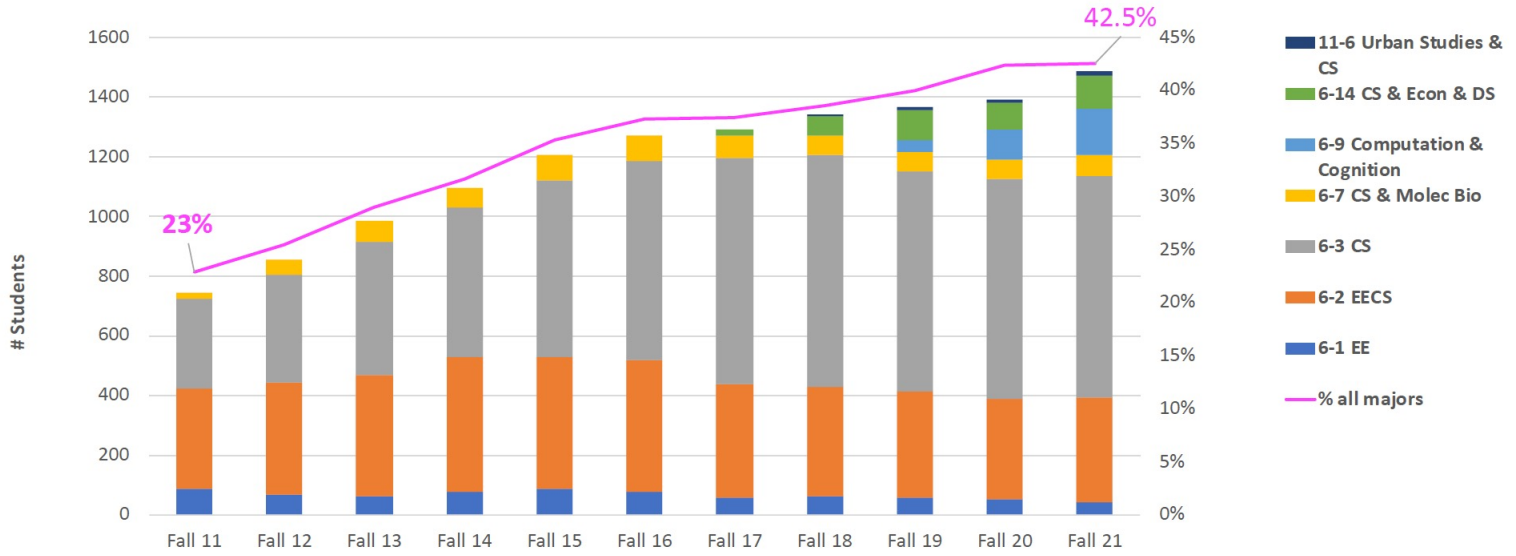
- Infusing coordinated computing education across disciplines
- Blended majors – beyond simply combining two, such as double major or major and minor (requires faculty engagement between programs)
- Common Ground – subjects that bring together forefront of computing with problems and methods from various domains
- Ties to SERC – integrated education on social and ethical aspects of computing (one component of SERC mission of teaching, research, and engagement)

MIT Blended CS Majors

6-7: CS & Molecular Biology



- Launched in 2011
- 71 students Fall 2021



New Majors:

6-14: CS, Economics & Data Science

- Launched in 2017
- 111 students Fall 2021

6-9: Computation & Cognition

- Launched in 2019
- 156 students Fall 2021

11-6: Urban Science & Planning with CS

- Launched in 2019
- 17 students Fall 2021

Counts are student declarations of “primary major”; all majors are about 6% higher, or ~45%

MIT Schwarzman College of Computing

Common Ground for Computing Education

Multi-departmental collaborations across MIT

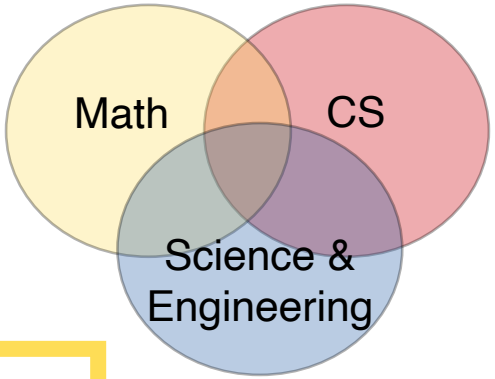
- Coordinated education for “computing bilinguals” across disciplines
- Classes and curricula created and offered jointly by two or more departments – meeting “common” needs
- Three current focal areas, plus coordination with SERC
  - Fundamentals of Programming and Computational Thinking
  - ML/AI/DataSci/Algorithms in Science, Engineering and Social Science
  - Fundamentals of Computational Science and Engineering (CSE)
- Standing Committee ~30 faculty from all five schools and Open Learning

Premises of the Common Ground

- Departments are powerful for discipline-specific education, but cross-cutting approach is important for meeting the objectives
- Collaborations between faculty across departments are a key aspect of educating “computing bilinguals” – expertise and integration
- Value to and support of departments critical: for students (due to requirements) and for sustainability (due to staffing)
- Beyond individual subjects, a coordinated and academically coherent cross-cutting curriculum is important for students and employers

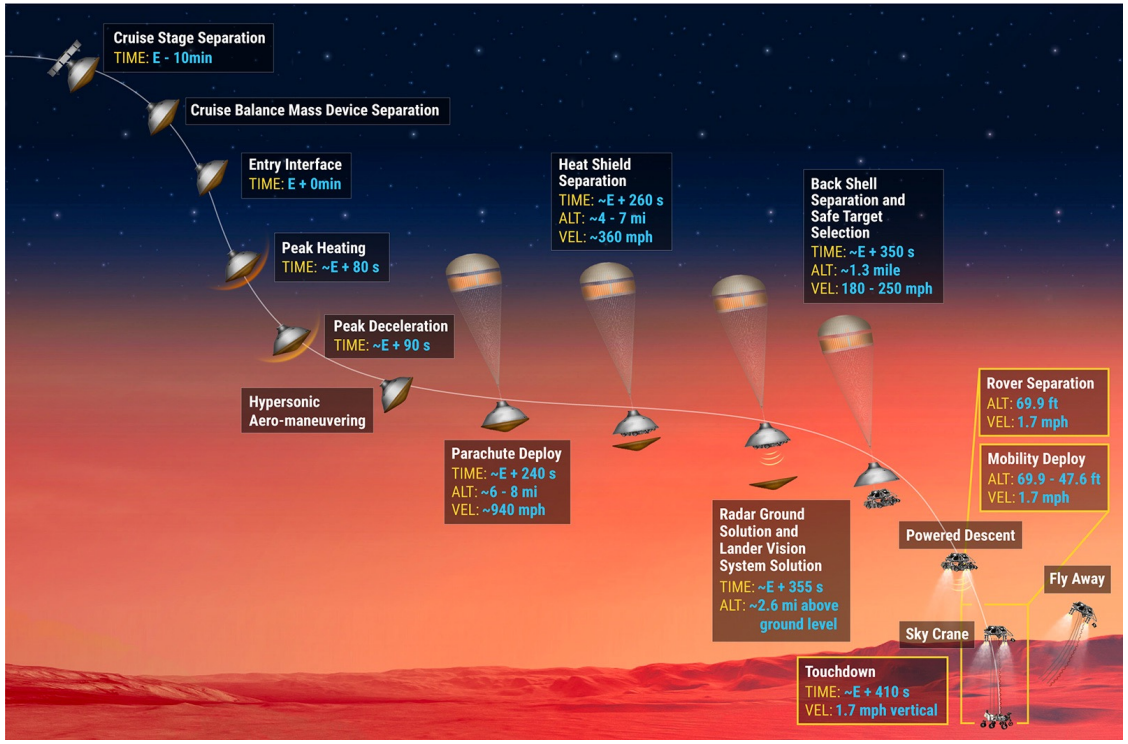
Common Ground Pilot

Introduction to Computational Science and Engineering



Alternate version of EECS class “Intro to Computational Thinking and Data Science”
(same pedagogy, including Python use)
(AeroAstro)
(Math / EAPS)

> “The perfect balance of physics, math, and computer science that I have been craving.”
> – Fall 2020 student



1. Models and discretization (3 psets)
2. Optimization methods (1 pset)
3. Statistics and inference methods (1 pset)

Applications to mechanics; robotics; climate science; chemistry; biology

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Common Ground Pilot

Modeling with Machine Learning

Spring 2021 Departments Teaching

- (EECS)
- (ChemE)
- (DMSE)
- (MechE)
- (CEE)
- (BioE)
- (NSE)
- (SCM)

Non-EECS majors have a huge interest in ML for modeling, as opposed to the inner workings of ML itself

Teaches non-majors to translate a problem into an ML formulation and find appropriate tools for solving it

Core Module (6 units) – EECS

Disciplinary Modules (6 units each) – five versions with above departments in 2020

Interpretability	Transfer	Sparse Data
Causality	Evaluation	...

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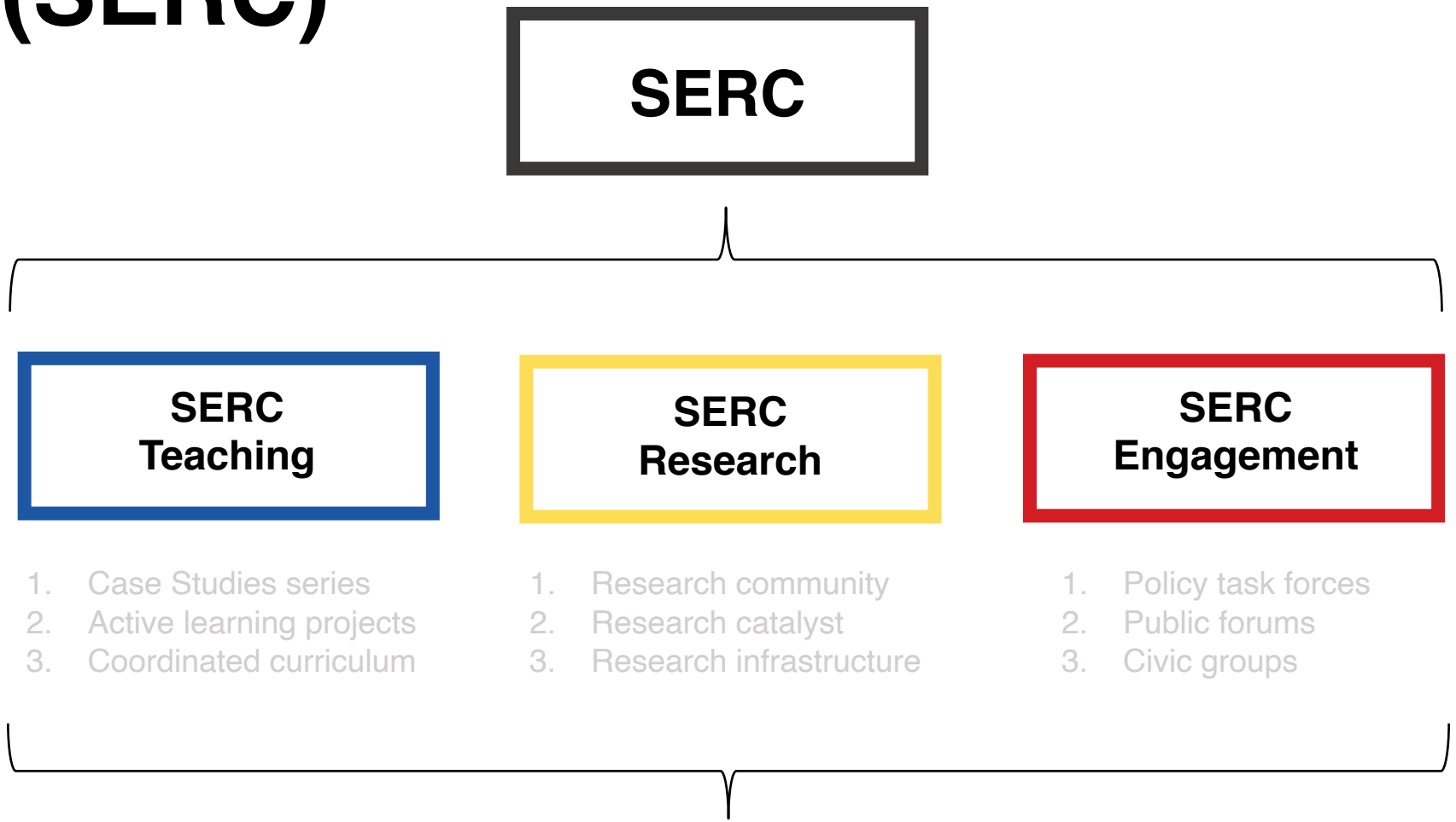
Social and Ethical Responsibilities of Computing (SERC)

- **Cross-cutting** focus on social and ethical questions.
- Steering and action groups focused on specific outcomes – **shared interests among different disciplines**.



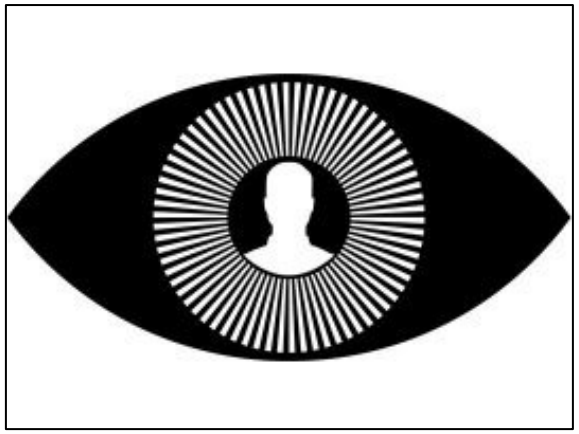
MIT Case Studies in Social and Ethical Responsibilities of Computing

The Case of the Nosy Neighbors

Johanna Gunawan, Northeastern
Woodrow Hartzog, Northeastern

Who Collects the Data? A Tale of Three Maps

Catherine D'Ignazio, MIT
Lauren Klein, Emory



The Bias in the Machine: Facial Recognition Technology and Racial Disparities

Sidney Perkowitz, Emory

The Dangers of Risk Prediction in the Criminal Justice System

Julia Dressel, Dartmouth
Hany Farid, UC Berkeley

All cases are freely available at **mit-serc.pubpub.org**

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