The ASU/Maricopa Mentoring Partnership

Eric Kostelich, ASU (kostelich@asu.edu)
Roberto Ribas, SCC (roberto.ribas@scottsdalecc.edu)

ARIZONA STATE UNIVERSITY

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Background: the ASU MCTP program

- Mentoring through Critical Transition Points (NSF DMS)
- **Program solicitation:** Provides funds to develop a system of mentoring devoted to points of transition in a mathematical sciences career path that are critical for success . . . [and] emphasizes department-wide activities
- Partnership with the Maricopa County Community College District (MCCCD) to mentor promising transfer students majoring in mathematics and statistics
- Also includes a summer research component at ASU
Some background

- **ASU**: ~ 83,000 students in Fall 2014, including ~ 13,000 taking some online course
- **MCCCD**: ~ 225,000 students, including ~ 5,500 taking mathematics at the level of precalculus and above (~ 55 sections of engineering calculus)
- *New York Times*, Oct. 3: 7.7 million students are enrolled in community colleges (45% of the total)
- Total undergraduate enrollment of *U.S. News* top 25 colleges: 0.218 million
- **Meta-challenge**: How to address the STEM skills shortage at large scale cost effectively
The Starbucks program

- Any Starbucks employee working 20+ hours/week is eligible
- Starbucks will pay full tuition for employees admitted to ASU Online as juniors or seniors
- Freshmen/sophomores are eligible for partial scholarships
- Starbucks claims over 70% of its employees are current or aspiring students
- ~4,000 have applied so far, ~1,000 have been admitted
- Five semesters per year (7.5 weeks each)
Goals and vision of the program

- Answer the #1 question: What can I do with a math degree (besides teach)?
- Provide substantive examples of connections between mathematics and other disciplines
- Reduce “transfer shock” from 2-year to 4-year STEM programs
- Provide research experiences and “project seminar courses” for interested students
- Offer a continuing and supporting mentoring environment
Some ongoing issues

- MCCCD students do not have “majors” per se—they pick one of three tracks (arts, sciences, business)
- STEM advising at ASU is done by full-time “academic success specialists” who do not have STEM backgrounds
- Tenure-track faculty have significant research demands
- Daily demands of a math program with 18,000 students in 650 course sections
- Must work within existing course, articulation, and curricular frameworks
- Efforts must be able to scale
Program specifics

- 3-week, half-day “pre-REU” program at Scottsdale Community College
- 2 tracks of 19 students each: one for 1–2 semesters of calculus, another for 2+ semesters of calculus
- Partnership with the Barrett Honors College at ASU
- 8-week summer REU program at ASU for ~15 2nd–3rd year undergraduates each year
- Optional 300-level “project seminar” courses at ASU intended to serve as a bridge to 400-level courses in numerics, PDE, probability, etc.
The “project seminar” format

- Adapt some aspects of the summer REU to a 3-credit course during the regular academic year
- Prerequisites are 3 semesters of calculus plus differential equations and linear algebra (sophomore/junior level)
- Goals: provide a “path forward” to advanced courses in mathematics and applications
- Use real data in a nontrivial way
- Anticipated topics so far: (1) Math and Climate; (2) Math and Cancer; (3) Math and Imaging; (4) Math and Networks
The math & climate course

- Co-developer of this course: Alex Mahalov
- **Principal focus:** The mathematics of urban heat islands
- **Motivation:** Rapidly urbanizing cities in arid climates have very warm nights, especially in summer
- Start with simple cases and hand computation, then work up to realistic domains and more sophisticated computer models
- **Real data:** on nighttime temperatures, electricity consumption
- **Possible future scenarios:** What happens in mid-century based on expected demographic trends? global climate change?
Instructors: Yang Kuang, Tracy Stepien, and E. K.

Main examples: Prostate and ovarian cancer, melanoma, glioblastoma

Exponential, logistic, Gompertzian growth models

Mathematical analysis of surgery and chemotherapy regimens—which is best to do first?

Overview of statistics, especially \( p \) values and their limitations
Prostate cancer example: modeling, data fitting, prediction


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Other common aspects

- Students have to read a research paper every week
- All students prepare a 15-minute talk and 5–10 page on a research paper (which includes some simulation/replication of results)
- MATLAB: scripts, functions, ode45, pdepe and plot
Other potential “seminar project” courses

- Metropolis algorithm, bootstrap sampling
- Game theory
- Kalman filtering
- Public-key cryptography
- Shotgun genome sequencing
- … Your ideas here!
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