MAA PIC Math and the Best Jobs in the 21st Century

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Best job of 2014? Mathematician

– from CareerCast.com, a job search website

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What are some non-academic career for mathematicians?
Career: Data analyst/Analytics consultant

- Google
- Nike
- Cleveland Cavaliers
- Youngstown Police Dept
Career: Operations researcher

- UPS
- Airlines
- Hospitals
- Military

Carol Meyers
Lawrence Livermore Labs

Eric Murphy
Pentagon
Career: Technology consultant

- Raytheon
- General Dynamics
- Lockheed Martin
- Boeing

Aaron Peterson
Raytheon
Career: Financial analyst

- Goldman Sachs
- RBS Global Banking
- Capital One
What the employers have said

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▶ develop good communication skills
▶ do an undergraduate research project or a summer internship
▶ learn about another discipline
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Career: Software engineer

- FAST Enterprises
- Google
- Epic
- MathWorks
- Palantir

Remi Fuhriman, Epic
Career: Medical scientist

- Bristol-Myers Squibb
- Pharsight Pharmaceutical
- Center for Disease Control

Helen Moore
Applied BioMath
Career: Cryptanalyst

Lauritz Petersen
NSA
Career: Actuary

Jared Collings
Regence
Career: Computer graphics imaging

- Pixar Animation Studios
- Disney
- Digital Domain
- Adobe

Tony DeRose
Pixar
Summary

▶ The world is becoming more math-oriented, and there are opportunities for people who understand math:
  ▶ Analytics consultant
  ▶ Technology consultant
  ▶ Software engineer
  ▶ Financial analyst
  ▶ Medical scientist
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- Technology consultant
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Students should prepare by:

- learning to code
- developing good communication skills
- doing an intensive research project or a summer internship
Sample problem:

**Background:** Youngstown, Ohio has seen a dramatic decline in its city population and a shift in the location of the population over the past forty years. However, the police department was still using a division of the city into police beats that was created decades ago. You are given crime data from the past year from the police department.
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**Problem:** Propose a new model for more equitable divisions of the city into police beats.
Imagine a course based on solving such problems
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- prepares students for careers
That course is MAA PIC Math!
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**PICMath**

Preparation for industrial careers in mathematical sciences
That course is MAA PIC Math!

PIC Math prepares math students for industrial careers by offering a course that engages them in research problems from industry.

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Components:
- summer 3-day faculty training workshop
- spring semester course for students
- student conference
Results

Participation data (2014/15 − 2016/17)

▶ 107 faculty members
▶ 101 U.S. universities/colleges
▶ in 32 states and D.C.
▶ 14 PhD, 23 MS/MA, 63 BS/BA, 1 Associates degree
▶ 10 HSIs and 6 HBCUs
▶ over 1400 undergraduate students
▶ 40% female
▶ 21% underrepresented ethnic groups
▶ 147 papers co-authored by undergraduates
▶ over 150 conference presentations by undergraduates
▶ over 100 industrial partners have provided problems and consultants
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Student comments:

▶ Female student at SUNY Geneseo: “I gained so many valuable skills in problem solving and working with a team. This opportunity was truly a stepping-stone for my career in mathematics.”

▶ Female student at Virginia State Univ (HBCU): “The PIC math helped me get my first job. The experience of successfully working in groups, and problem solving were key components in my interview.”
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▶ Tom Wakefield, Youngstown State Univ: “The students were so committed to the project and excited to work on a problem with practical implications.”
MAA PIC Math

Logistics:

- Class: 5-15 undergraduates
- Learning: Active learning (students learn by doing)
- Collaboration: Students work in groups
- Industry: Students solve problems from industry
- Resources: Course material provided
- Assessment: Students write a paper and give a talk
Logistics:

- 5-15 undergrad students in class
- Student learn by doing (active learning)
- Students work in groups
- Students solve problems from industry
- Course material provided
- Students write a paper and give a talk
Resources for teaching the course

- Syllabus and course schedule
- Written research problems from industry
- Videos of industry mathematicians explaining a problem
- Videos of professors explaining the solution to the problem
- Student papers solving the research problem
- Videos of students presenting their research
Sample problem 2:

**Background:** Kongregate is an online browser-based video game website. They are combating ratings fraud by players using fake accounts to influence the ratings of games substantially.
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**Problem:** Using data provided by Kongregate, develop an algorithm to help determine whether a submitted account is real or fraudulent.
Sample problem 3:

**Background:** The Field Museum is the science museum in Chicago. They implemented a crowdsourcing project designed to classify a large sample of microscopic plants, and obtained hundreds of thousands of pieces of data. While most of the crowdsourced data were usable, some were not.
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**Background:** The Field Museum is the science museum in Chicago. They implemented a crowdsourcing project designed to classify a large sample of microscopic plants, and obtained hundreds of thousands of pieces of data. While most of the crowdsourced data were usable, some were not.

**Problem:** Come up with criteria for determining what data are usable and what data should be rejected.
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- Field Museum of Chicago
- Coca Cola
- Habitat for Humanity
- Colorado Dept of Transportation
- Heart Artery and Vein Center of Fresno
- Los Alamos National Lab
- Greensboro NC Police Dept
- Massachusetts General Hospital
- City of Kansas City
- AIG Insurance
- National Security Technologies
- Applied Geographics
- Water Utility Group
- Sandia National Lab
3-day summer faculty workshop
3-day summer faculty workshop

Discussion topics:
3-day summer faculty workshop

Discussion topics:

► non-academic careers and internships
► types of problems that arise in industry
► how to help students develop skills valued in industry
► guidance on developing industry connections
► preparation for spring PIC Math course
► how to mentor students in research
Thank you!

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