MSCS Mess

Access the Mess anytime online at http://www.stolaf.edu/depts/mscs/MSCS_Mess
Or subscribe to the mscsmess@stolaf.edu mailing list in order to receive a digital copy every Friday

Department of Mathematics, Statistics and Computer Science — 30 September 2011
St. Olaf College, Northfield, MN 55057 — Volume 40, No 3

This Week's Colloquium

Title: Psychometrics: You Do the Math

Speaker: Ben Babcock
Psychometrician,
AART

Date: Thursday, October 6

Time: 2:30pm

Location: RNS 310

About the Talk:
As a student or professor at a university, you are constantly involved in testing and measurement. This talk will look into the obscure but stimulating field of psychometrics, which deals with psychological testing. Psychometricians use statistical models to help measure unobservable psychological traits, such as extroversion, depression, or statistics knowledge. What does a psychometrician do all day? What tools and abilities do psychometricians use? Why should I even care what a psychometrician is? This talk will answer all of these questions and more.

Problem's of the Week:

Two weeks ago we asked for the minimum value of

$$\cos x - 1 + \frac{2x}{\pi} \text{ for } x \text{ in } [0, \pi/2]$$

No local solutions arrived, but Reid Price, a 2007 alumnus, showed correctly (using the second derivative) that the minimum is zero.

Last Week's Problem of the Week
Last week we asked you to invert a 2-inch line segment in the plane by moving/sliding it around in a such a way that swept out the least amount of area. **Ross Neal**, **Reid Price** ('07 alum), and **Prof. Paul Zorn** all submitted *different* solutions that swept out less than 2 in² of area. All solutions seemed to involve hypocycloid curves in different ways; for example, one solution made use of the smallest possible "filled in" deltoid, while another solution involved dragging the segment along the edge of a sufficiently large deltoid.
It is clear that an area of $\pi/2$ in² can be achieved, but does a solution exist that sweeps out less area than this? Or is this the optimal answer? Email Prof. McDougall <mcdougal@stolaf.edu> if you think you have an idea.

This Week's Problem of the Week:
Imagine four runners on a racecourse. A demon, watching from on high, can "freeze" and 1 runner for any amount of time, and can shift attention from one runner to another instantaneously. The four runners takes times

$$0 < T_1 < T_2 < T_3 < T_4 < 1$$

to complete the course if undelayed by the demon. Under what conditions on T_1, T_2, T_3 can the demon cause all runners to finish together at time 1? (Note that the demon can't delay runner 4 at all.)

E-mail solutions to Paul Zorn (zorn@stolaf.edu) no later than Tuesday.

2012-13 Global Trip

Next year our very own Professor Julie Legler will be leading a global trip. There will be an information session October 11th, and she will be including a thread in the course for students in MSCS.

Topic: Health, Wealth, and Happiness; Measuring Quality of Life Crossculturally

Students develop several alternative measures while exploring the notion of what makes for good quality of life in your own life and the world over. What makes for a good quality of life? Is the definition of Quality of Life (QoL) country-specific? Is it even possible to construct a measure of QoL that can be compared cross culturally and why might that be important? Global policy-makers use measures of countries' QoL to allocate limited resources. Researchers use QoL measures to understand which characteristics of countries are associated with a better life. Often a country's QoL is distilled to its gross national product (GDP). Does this single measure of a country's economy aptly distinguish Beijing from Hong Kong or Egypt from India? More recently, the notion that a country's quality of life should be more broadly defined to include health, education and economic prosperity has taken hold. However, considerable debate surrounds how to measure these dimensions. The UN Human Development Index (HDI) is one attempt to incorporate health, education, and economic prosperity in measuring countries' QoL. Existing measures will be discussed, applied to countries we visit and contrasted with your travel experiences.

Student must have successfully completed a 200 level course in one of the following: statistics, political science, sociology, biology(with interest in health sciences), psychology, or economics.

WHAT IS OPERATIONS RESEARCH?

Operations Research (OR), also known as Management Science, is the mathematical discipline of identifying decisions that solve problems in an optimum way. St. Olaf is one of the few undergraduate liberal arts colleges to offer an undergraduate OR course (Math 266), our next offering being next spring.

A prototypical OR problem would be figuring out how to allocate airplanes and airplane flight crews to routes, a central problem to all airlines, large and small. Inefficient allocations can be extremely expensive, forcing an airline to lease more planes (at tens of thousands of dollars per day per plane) and hire more crew staff than is necessary. An even more complicated problem occurs regularly when bad weather or other unplanned disruptions leave an airline's fleet at unexpected locations at the end of a day, giving the airline's management the task of figuring out the best way to move around planes (and crews) in order to resume normal operations as quickly as possible. (St. Olaf grads have handled these problems for Northwest Airlines, now Delta, and Southwest Airlines.)

Beyond transportation, operations research finds application in just about any situation involving a quantifiable objective, a set of decisions, and one of more limited resources. Many examples involve the management of manufacturing or service operations, like a refinery deciding how to allocate its various grades of crude oil and distilling equipment to the production of various grades of gasoline, jet fuel and lubricating oils.

Operations research also has applications in areas outside the corporate environment. For example, political campaigns often use OR techniques to target campaign activities. Government agencies responsible for natural resources management use OR techniques to optimize the operation of state parks, national forests and wildlife refuges.

Our operations research course (Math 266) is a great experience for students interested in the application of mathematics to a wide range of optimization problems in the real world. The prerequisite is linear algebra (Math 220).

Have questions? Please contact Prof. Steve McKelvey (mckelvey@stolaf.edu) for more information.

Editor-in-Chief:	Josh Jacobson
Faculty Advisor:	Peter Blanchard
Mess Czar:	Donna Brakke

If you would like to submit an article or math event to be published in the Math Mess, e-mail jacobsoj@stolaf.edu.