

Contributed Paper Session

Saturday, November 17, 2007

Session I – Hemenway Hall 319

8:00 AM – 8:15 AM

Mathematical Problems from the Maine Farmer's Almanac

Bruce S. Burdick, Roger Williams University

The Maine Farmer's Almanac had an issue every year through most of the 19th century and well into the 20th. Nearly every year they featured mathematical problems, word puzzles, conundrums, and riddles, and gave answers to those from the previous issue. Readers had nearly a year to think about the problems and many wrote in with their solutions. We will survey some of the more interesting problems from the 19th century issues. The audience will be given a handout with the mathematical problems from issues that we have seen so far.

8:20 AM – 8:35 AM

Epidemiological Impact of ART in Burkina Faso, South Africa and Uganda

Emmanuel Drabo, Bates College

Since its appearance in the early 1980s, the number of infections and the death toll due to the human immuno-deficiency virus (HIV) has not ceased to rise. Sub-Saharan Africa remains particularly the worst affected region, with 63 percent of the world's HIV infection cases, and 72 percent of all AIDS death globally. However few epidemic declines were noticeable in Kenya, Zimbabwe and in urban areas of Burkina Faso, partly due to population growth and the life-prolonging effects of antiretroviral therapy (ART). Despite this recent progress, many countries still remain uncertain of how to efficiently allocate health budgets to combat the epidemic. This paper uses a mathematical model to predict the epidemiological impact of ART in urban areas of Burkina Faso, South Africa and Uganda, and estimates the cost of HIV/AIDS treatment over the next decades for these countries. We determine the basic reproduction number, R_0 , using a method developed by van den Driessche and Watmough.

8:40 AM – 8:55 AM

Arithmetical Rules for Rising the Chromatic and Diatonic Scales, the Musical Circle of the Fifths, and for Rotation in the Basic Chords

Krassimir Tarkalanov, The TJX Companies Inc.

We explain how simple arithmetical properties of the number 12 are reflected in the formation of the exactly 12 semitone intervals (why?) of the chromatic musical scale and then (inversely) of its already in one way determined part (why?) of the diatonic scale. $7x$ gives the circle of fifths F, C, G, D, A, E, B, F#, C#, G#, D#, A# from F#, G, G#, A, A#, B, C, C#, D, D#, E, F modulo 12 but $5x$ gives it (and therefore the 7 diatonic circle) in an inverse order, x gives the consecutive chromatic performance up of an octave but $11x$ gives the same down. That is a reflection of $7 \equiv -5 \pmod{12}$ and $11 \equiv -1 \pmod{12}$. The basic major and minor chords can be reordered by the sums 8-12, 14 of the halftones of their internal intervals. The rules for constructing their variations is a simple left-right rotation for sums 8-11 but other ones for 12 and 14. These rules reflect a philosophical universality of an intuitively built in the intellect ascendancy of some mathematical rules over the mental activities.

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Session II – Hemenway Hall 321

8:00 AM – 8:15 AM

Worksheet Activities in Calculus and Precalculus

Brian Kelly, Bryant University (presenter) and Annela Kelly, Roger Williams University

We will discuss the challenges and benefits of incorporating in-class worksheet assignments in these courses.

8:20 AM – 8:35 AM

Mathematics Exams in the CLEP Program: How to Make the Exams Relevant to the College Curriculum

Robin O'Callaghan, Senior Director, Mathematics Test Development, The College Board (presenter), and Marc Singer, Associate Director, CLEP, The College Board, New York

This paper will discuss the test development process for the four CLEP math exams (College Algebra, College Mathematics, Precalculus, and Calculus). The presenters will describe the curriculum surveys that are designed to keep the exams relevant to current classroom practices, the setting of test specifications and standards, and the work of faculty committees in guiding and reviewing the assembly of the exams. A brief discussion of the role of standardized testing in mathematics, the advantages and limitations of such assessments, will also be included.

Session III – Hemenway Hall 323

8:00 AM – 8:15 AM

An Assessment Procedure for a First Semester Calculus Course

Eric Johnson (presenter) and Ernest Manfred, United States Coast Guard Academy

Today, the number of students who take their first calculus course in high school is greater than the number who take calculus for the first time in college. The Mathematics Department at the U.S. Coast Guard Academy is interested in investigating the preparedness of our students in the Calculus I course. To this end, we give an exam the second class meeting. The test is a thirty-seven (37) question multiple-choice exam developed and published by Rensselaer Polytechnic Institute. The same exam is given on the last day of classes. After presenting brief descriptions of the Academy, our math placement program, and core mathematics program, scores on both exams plus correlations with high school experience and final course grades will be presented.

8:20 AM – 8:35 AM

A Potpourri of Iterated Function Systems

Len Brin, Southern Connecticut State University

Construction of fractal shapes from the classics like the Sierpinski Triangle, Hilbert's space-filling curve, and Julia Sets to not-so-well-known fractal shapes such as continuous nowhere differentiable functions and not-quite-Julia Sets has never been easier. The culmination of my Spring 2007 sabbatical project was the production

of a series of Java applets specifically designed for this purpose. Come see a live demo. These Java applets have been made freely available online, including source code and installable versions.