

CONTRIBUTED PAPER SESSIONS
Saturday, November 23, 2002

Session I – Hemenway Hall 115

4:30 – 4:45 p.m. **Attitudes Toward Statistics and Course Achievement Among Japanese and American College Students**
Philip P. Amato and Eiki Satake, Emerson College

This study investigated the relationship between attitudes toward statistics (ATS) and course achievement (CA) among Japanese and American college students majoring in communications studies. Seventy-two students participated in the study. The Japanese sample consisted of 20 male and 20 female students from a small liberal college in Tokyo. The American sample included 9 males and 23 females from a small, Northeastern college specializing in communication arts and sciences.

Statistics attitudes was measured using Wise's (1985), Attitudes Toward Statistics (ATS), consisting of twenty-nine, 5-point, Likert-type scales (strongly agree to strongly disagree); a Japanese version was developed by the authors. The instrument was administered at the outset and at the conclusion of the course. The final course grade of the participants, using a 9-point scale (A = 9, A- = 8, B+ = 7, F = 0) served as the measure of achievement. Data analyses include factor analysis and reliability estimates for the ATS and independent t tests and correlation analyses of pre-posttest measures.

4:50 – 5:05 p.m. **Introducing Statistical Concepts Using Interactive Excel Worksheets**
Laura McSweeney , Fairfield University

In statistics education, the trend has moved to using technology to help students develop a deeper conceptual understanding of statistics. In this presentation I share how Microsoft Excel can be used as more than a computational tool by creating interactive statistical worksheets that students can use for exploratory learning. Students can also use these dynamic worksheets to make and test conjectures, which again brings learning to a higher level. Examples of interactive Excel worksheets and sample lessons will be presented. The topics include:

- Comparing descriptive statistics and seeing the affects of outliers and skewness on the measure of central tendency
- Exploring the binomial, normal and t-distributions
- Exploring linear regression and the affects of outliers.

5:10 – 5:25 p.m. **Interactive Course Syllabi**
Ronald W. DeGray, Saint Joseph College

Course syllabi became popular during the 1970s. From the beginning, their usefulness has been rather limited and often have had unfulfilled objectives. Because of technology and the Internet we can now evolve course syllabi to higher practical levels. I will demonstrate an interactive working syllabus for courses in probability and statistics. For an example interactive syllabus, refer to <http://www.sjc.edu/rdegray/Math251F02/WkSylindex.html>

Session II – Hemenway Hall 101B

4:30 – 4:45 p.m.

Learning Disabled Students and Math Word Problems

Janet M. Pfeiffer of Upper Arlington High School (Ohio), and
Kenneth J. Preskenis of Framingham State College

This presentation describes the use of elementary math word problems with high school special education students. Each Friday is designated “Word Problem Day”, and (just as last year) during this second year, the participants readily exclaim to their peers that it is not just Friday, but it is “Fun Friday”. The unexpected success of this program not only confirms the charm of word problems for many people, but also conjures up a new look at the richness contained in word problems and makes one wonder how this richness can be dispersed. The talk will explain how students become labeled as “learning disabled” and will suggest reasons why such students find solving word problems an enjoyable and pleasantly challenging experience.

4:50 – 5:05 p.m.

The Long Exact $(\bar{\pi}, Ext_{\Lambda})$ -Sequence in the Second Variable and the Long Exact $(\bar{\pi}, Ext_{\Lambda})$ -Sequence of a Triple

C. Joanna Su, Providence College

In this talk, we will address the work that has been done either by Professor Peter Hilton or by myself, in the homotopy theory of modules, and what might be pursued in the future.

5:10 – 5:25 p.m.

The Helmholtz Classification of Vector Fields and the Maxwell Equations

Domina Eberle Spencer, University of Connecticut, and
Uma Shama, Bridgewater State College

Helmholtz has shown that vector fields can be fitted into four classes depending on whether or not the divergence and the curl of the vector field vanishes. The thermal field, the gravitational field, the electric field, the magnetic field and the hydrodynamic field all fit nicely into this classification scheme. However, the electromagnetic field does not fit into this scheme. Instead, it is characterized by the four Maxwell equations. It will be pointed out that two of the Maxwell equations are vector identities. It will be shown that the electromagnetic field can alternatively be characterized by a single force field which fits into the Helmholtz classification scheme quite perfectly.

Session III – Hemenway Hall 101A

4:30 – 4:45 p.m.

“Mathematics and War”: a First Year Seminar

Bonnie Shulman, Bates College

I will give a brief overview of a course I designed for first year students that is writing-intensive, satisfies the quantitative requirement, and integrates STS (science, technology and society) issues. Here is the course description from the catalog: "From Archimedes, who designed ingenious devices to help defend Syracuse against a siege by the Romans in the 3rd century B.C.E., to John von

Neumann and many others who worked on the Manhattan Project in World War II, mathematicians have played an important role in supporting their country's war effort. In this course we explore what happens when we apply mathematical thinking to situations of conflict. Can mathematical understanding help us to fight wars more effectively? Could mathematical models help us prevent wars? We investigate and critically assess the power and the limitations of applying mathematical techniques to study war and peace." The mathematical content includes Game Theory and Finite Difference Equations. I am happy to share materials (syllabus, reading list, assignments) with anyone who is interested.

4:50 – 5:05 p.m.

Are we far enough offshore to pass this headland safely?

A mathematician's look at a 'quick and dirty' navigational trick.
Joel S Silverberg, Roger Williams University

In a brief article prepared for boaters by BoatUS, Don Casey describes how to use a hand-bearing compass to determine how far offshore you are.[How-To Tip #911027, BoatUS. Also online at <http://www.boatus.com/boattech/casey/27.htm>]

Take the time (in minutes) that it takes a compass bearing on a shoreline feature to change by the same number of degrees as your boat speed is in knots (nautical miles per hour). This time (in minutes) is the same as the distance to the offshore feature (in nautical miles).

Say what? Angles in degrees, not radians, giving me information about distances? Speed in miles per HOUR and time in MINUTES, giving me distance in MILES? What a bizarre collection of units! Can this method possibly work at all?

The mariner asks, "Can I use this method safely?" The mathematician answers, "It depends." A mathematical analysis of the geometry of the situation and the algorithm described reveals that the method can not possibly be correct under all conditions. In fact it is not precisely correct under any conditions, but it can provide a useful approximation under certain conditions. Since the safety of a vessel and the people onboard depends upon an accurate estimate of the distance offshore, the mariner should be very interested in knowing under what conditions and to what extent he or she can rely on the method described.

5:10 – 5:25 p.m.

Pattern Recognition and Sequences of Natural Numbers

Christopher Aubuchon, Johnson State College

Quite often in the teaching of abstract mathematics (particularly number theory) we instruct our students to: (1) List empirical evidence, (2) identify a pattern and generate a hypothesis, and (3) prove this hypothesis true in the general case. While recently teaching an undergraduate course in number theory, I discovered that the above outline under-emphasizes the importance of not only identifying the pattern, but being able to communicate it in mathematical terms. This talk will highlight two examples (stemming from sequences of natural numbers) that challenge the student to produce a careful mathematical formulation of patterns that seem obvious to the naked eye, and yet elude immediate precise description.

Session IV – Hemenway Hall 307

4:30 – 4:45 p.m. **Notes on the Structure of $P\Sigma_n$ - Part I**
Vince Ferlini, Keene State College

The pure symmetric automorphism group $P\Sigma_n$ consists of those automorphisms of the free group on n generators that map each standard generator to a conjugate of itself. We can interpret $P\Sigma_n$ as a group of motions of n unknotted unlinked circles in \mathbb{R}^3 . This talk will provide the background information about group presentations, free groups, and automorphisms to understand $P\Sigma_n$.

4:50 – 5:05 p.m. **Notes on the Structure of $P\Sigma_n$ - Part 2**
Erin Corman, Keene State College

This talk is based on a research project done by KSC student Erin Corman as part of an REU experience at James Madison University during the summer of 2002.

This project involved the derivation of presentations for kernels of homomorphisms $\theta : P\Sigma_n \rightarrow \langle t \rangle$ (where $\langle t \rangle$ is the infinite cyclic group) in which each generator is mapped into the identity or t . These kernels necessarily contain the commutator subgroup of $P\Sigma_n$. When the kernel is finitely generated, a generating set is derived. These ideas are then studied in the context of the graph of groups associated with $P\Sigma_n$.

5:10 – 5:25 p.m. **Generalized Metric Spaces via Neighborhoods**
Mike Cullinane, Keene State College

Neighborhood assignments and weak neighborhood assignments will be employed to characterize certain topological spaces that can be generated by distance functions that do not necessarily satisfy the triangle inequality.

Session V – Hemenway Hall 305

4:30 – 4:45 p.m. **A Revision to Michael Prasse and Peter Rittgen's "Interactive Protocol"**
Jonathan Brinker, Framingham State College

Interactive Automata can already be proven to be more powerful than the Turing machine in a sense of computability. According to Peter Wegner, the Interactive Model can be expressed by a set of infinite number of processes. On the other hand Turing machines can only be describe by sets of finite size thus limiting its power of computation. There is however a way to allow a system of two Turing machines to behave in an interactive sense. Michael Prasse and Peter Rittgen have introduced an "Interactive Protocol" which describes a system of two Interactive Turing machines that can be modeled exactly the same as Interactive Automata. However valid their protocol may seem, a better model can be conceived by replacing the two Interactive Turing machines within the protocol with basic Turing machines. By doing this, a more efficient, simpler, and

comprehensible model can be realized to help show that a system of Turing Machines have equal power of computation to Interactive Automata.

4:50 – 5:05 p.m.

Minimization of Interactive Transition Systems

David Keil, Framingham State College and University of Connecticut, and
Dina Q Goldin of University of Connecticut

This work introduces notions of minimality for the models of sequential interactive computing known as interactive transition systems (ITSs) and persistent Turing machines (PTMs). We extend the Myhill-Nerode Theorem to deterministic versions of these models. In doing so, we show that equivalence and minimality hierarchies of interactive machines collapse, to different degrees, under conditions of determinism, nonredundancy, and amnesia. Furthermore, we produce some computability results for the minimality functions described.

5:10 – 5:25 p.m.

Monte Carlo Queuing Simulation Implementation as Turing Machines and Finite State Automata

William F Heess Jr., Marlborough MA

The "Standard Model" for Monte Carlo simulations of queuing systems requires placing arrivals on a queue. Since the number of arrivals to the system is, in general, unknown, the number of items in the queue is, in theory, unbounded. This requires unbounded storage for the queue. Since the First In First Out nature of the queue precludes use of a Push Down Automaton, the equivalent of a Turing Machine is needed.

This paper presents a scheme to perform Monte Carlo simulations, and obtain time data without using a queue, which permits it to be implemented as a finite state machine. It discusses limitations introduced by this scheme, which include the loss of queue length information and an alternative scheme that obtains queue lengths, at the price of losing timing data. Finally I address the question of whether running these two schemes with identical pseudo-random number sequences, obtains identical or different sequences of events.