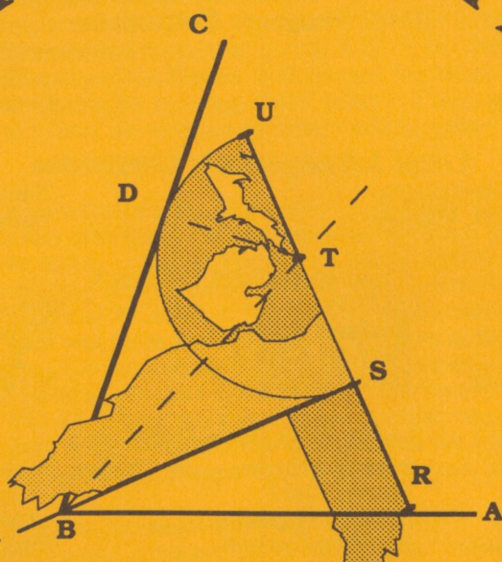
The Mathematical Association of America

Tri-Section Meeting • April 23-24, 1993 •



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About the logo on the cover: The Tri-Section Meeting of three sections of MAA calls to mind trisection of angles. While it is known that not all angles can be trisected using only a straight-edge and compasses, there are other tools which will do the job. One of these is known as the "tomahawk". The logo shows this trisection tool built out of maps of the three sections who will be meeting together.

Program Layout and Logo Design by John O. Kiltinen

GOLDEN ANNIVERSARY TRI-SECTION MEETING

In the spring of 1943, the MAA was in its twenty-eighth year, and it faced the prospect of promoting the interests of mathematics in America through an enduring period of world war. The activities of the sections were influenced by the crises, and that spring the Illinois, Indiana, and Michigan Sections met jointly, for the first time, to hear a program which pooled efforts of some of the most outstanding mathematicians from the three states and which included some topics relevant to the war effort. The meeting took place at the University of Notre Dame.

Information about the joint meeting of the three neighboring sections, archived for nearly fifty years in the Section Meeting Reports of the November 1943 *Monthly*, was discovered during research into the history of the Indiana Section. Since no such joint meetings had occurred since 1943, representatives of the three sections quickly agreed to combine their efforts during the spring of 1993; and they began planning for a second Joint Meeting of the Illinois, Indiana, and Michigan Sections, exactly fifty years after the first such meeting. Saint Mary's College of Notre Dame, Indiana, has agreed to host the meeting on Friday and Saturday, April 23 and 24, 1993.

The list of forty-six participants at the 1943 meetings includes names of many well-known mathematicians who had, or would subsequently have, great influence on mathematics and the MAA. **Lester R. Ford** of the Illinois Institute of Technology, who, at the time, was editor of the *Monthly*, presented a paper on Nomagraphy; Ford would serve as president of the MAA in 1947-48. A lecture entitled *On the Theory of Complex Functions* was presented by **Emil Artin**, then at Indiana University. Also attending the meeting was a young Ph.D. from the University of Chicago, **Ivan Niven**, who would go on to serve the MAA as First Vice-President in 1974-75 and as President in 1983-84. There are many other familiar names on the list of participants, including **R. M. Thrall**, of the University of Michigan, **W. L. Ayres** of Purdue University, and **P. M. Pepper** and **W. R. Utz,** both of Notre Dame.

As noted in this program, the anniversary meeting includes an array of invited speakers, contributed paper sessions, panel discussions, and student activities. Speakers will include **Marcia Sward**, Executive Director of the MAA, **Hugh Montgomery**, Professor at the University of Michigan, **Bruce Reznick**, Professor at the University of Illinois, and **Robin Wilson**, Professor at The Open University, England. A panel discussion on research in Mathematics Education will include **John Ewing**, Professor at Indiana University and Editor of the *Monthly*, along with editors **Frank Lester**, **Ed Dubinsky**, and **Brian Winkel**. **Jim Leitzel** will speak and help organize a special session on *Priming the Pump*, a look at NSF sponsored projects involving undergraduate mathematics.

As plans for the 1993 meeting developed, section representatives kept the 1943 program in mind, and they observed that the topics of interest then, as now, involve items such as pedagogical concerns in teaching calculus and in incorporating applications into the undergraduate curriculum. As a direct link to the 1943 meeting, the surviving participants of that meeting have been invited to attend the 1993 meeting, as special guests, and Professors **Thrall**, **Niven**, **Utz**, and **Pepper** have indicated that they plan to attend. They will be honored, along with recipients of the three sections' service and distinguished teaching awards, at a banquet dinner celebrating the golden anniversary.

The Schedule

Friday, April 23, 1993

8:00-5:00	**Registration** Coffee, Pastries & Exhibits (Open 9:00 - 5:00)	LeMans
9:00-9:15	**Opening Session** Presiding: Dan Maki, Chair, Indiana Secion Welcome: William Hickey, Pres., Saint Mary's College	O'Laughlin Aud. (Moreau Hall)
9:15-10:05	***The Indiana Needle Problem*** **Hugh Montgomery**, Univ. of Michigan—Ann Arbor	O'Laughlin Aud.
10:15-11:05	*Memoirs of a Victorian Mathematician* **Robin Wilson**, Open University, England Helen Gardner	O'Laughlin Aud.
11:05-11:50	**Break** *Refreshments & Exhibits* **Refreshments Compliments of Texas Instruments**	Lemans
11:50 -1:00	*Editors Panel: What is research in mathematics education and who should publish it?* **Ed Dubinsky** (*UME Trends*), **John Ewing** (*Monthly*) **Frank Lester** (*Research in Math. Ed.*), **Brian Winkel** (*PRIMUS*)	O'Laughlin Aud.
1:15-2:15	**Lunch**	Dining Hall
2:30-3:40	**Parallel Sessions 1**	Rooms in Madeleva Hall

Session A: On Industry/ Education Cooperation Madeleva - Carroll Aud.	Session B (General) Madeleva 247	Session C (General) Madeleva 233	Session D (Student Papers) Madeleva 224
2:30 - 2:55 *SIAM Great Lakes Section Initiatives in Industry/ Education Cooperation*, **Edward F. Moylan**, Ford Motor Co.	2:30 - 2:50 *Projects in Calculus*, **Steven Schlicker**, Grand Valley State University	2:30 - 2:50 *Fibonacci numbers and a chaotic piecewise linear function*, **J. S. Frame**, Michigan State Univ.	*Titles, names and times available at registration desk*
3:00 - 3:25 *Industrial consulting and its influence in the mathematics classroom*, **Michael S. LaChance**, University of Michigan–Dearborn	2:55 - 3:15 *Interaction and Insight: Studying Mathematics in Small Groups*, **Mary Treanor**, Valparaiso Univ.	2:55 - 3:15 *Simultaneous rational approximations and a related pair of diophantine equations*, **John H. Rickert**, Rose-Hulman Inst. of Tech.	
	3:20 - 3:40 *On the derivative of the inverse function*, **Yury Ionin**, Central Michigan Univ.	3:20 - 3:40 *Computability and complexity: What is this all about?*, **Bill Marion**, Valparaiso University	

Friday, April 23, 1993, continued

3:40 - 4:10 **Break** *Refreshments and Exhibits* Lemans

Refreshments Compliments of Harper Collins

4:10 - 5:05 **Parallel Sessions 2** Rooms in Madeleva Hall

Session A: On Industry/ Education Cooperation Madeleva - Carroll Aud.	Session B (General) Madeleva 247	Session C (General) Madeleva 233	Session D (Student Papers) Madeleva 224
4:10 - 4:35 *Conducting university mathematics classes within an industrial partnership,* Robert G. Kane, Univ. of Detroit Mercy	4:10 - 4:30 *The association of mathematical context with students' response to tasks involving infinity,* Jim Brackett, Northern Michigan University	4:10- 4:30 *The trisectors' guide to circling the square,* Steven C. Altheon and K. F. Schilling*, Univ. of Michigan—Flint	*Titles, names and times available at registration desk*
4:40 - 5:05 *An applied math degree program with a co-op. education component,* Thomas E. Elsner, GMI Eng. & Mgmt. Inst.	4:35 - 4:55 *Fostering an appreciation of mathematical induction,* Lynn Kiaer, Rose-Hulman Institute of Technology	4:35 - 4:55 *The three tangent theorem for conic sections,* Peter Andrews, Eastern Illinois Univ.	

5:10 - 5:45 **Business Meetings** Madeleva

Illinois Section Room 224

Indiana Section Room 247

Michigan Section Room 233

5:45, 6:00 **Buses leave from Madeleva for St. Adelberts**
6:15, 6:30

6:00 - 7:30 **Cocktail Party at St. Adelberts**

7:30 - 9:30 **Banquet at St. Adelberts**
Awards and Reminiscences
Ivan Niven, P.M. Pepper, R. M. Thrall, and W. R. Utz

The Cocktail Party will have free beer, wine, soft drinks and hors d'ouevres. There will also be a cash bar.

Buses will return following the program.

6:00 - 8:00 **Student Dinner and *Murder Mystery*** The Inn at Saint Mary's

This dinner will be free to students registered for the meeting. Come, enjoy dinner and put your deductive reasoning skills to the test to solve the murder mystery!

Saturday, April 24, 1993

7:30-8:30	**AWM Breakfast**	Rotary Room Dining Hall, Lower Level
8:00-10:00	**Registration** Coffee, Pastries & Exhibits (open 8:00 - 1:00)	LeMans
8:30 - 9:20	*Some identities of Hilbert and their implications* **Bruce Reznick**, University of Illinois	O'Laughlin Aud.
9:30 - 10:15	**Break** Refreshments and Exhibits	LeMans
10:15-1:10	**Parallel Sessions 3**	Madeleva

Session A: On Priming the Pump for Curricular Change, Carroll Aud.	Session B (General) Madeleva 247	Session C (Student Papers) Madeleva 233
10:15 - 10:55 *An overview of designated NSF program initiatives*, **James Leitzel**, Univ. of Nebraska, MAA Project Director	10:15 - 10:35 *The Impact of Functions and Technology on Introductory and Intermediate Algebra.*, **Phil DeMarois** et. al., William Rainey Harper Comm. College	10:15 - 10:25 *Efficient expression of permutations using 3-cycles, 4-cycles or k-cycles*, **B. Culver, N. Fende, M. Jain**, Northern Michigan Univ.
		10:30 - 10:40 *The original "proof" of the Four Color Conjecture*, **Robert Gemrich**, Alma Coll.
	10:40 - 11:00 *On the best uniform approximation of x^a on [0, 1]*, **Amos Carpenter**, Butler University	10:45 - 10-:55 *The norm of a Hadamard multiplier*, **Dana K. Jackman**, College of Wooster
11:00 - 11:40 *COMAP: Applications through the curriculum*, **R. M. Thrall**, Rice Univ.	11:05 - 11:25 *Rheological data reduction and analysis of non-Newtonian fluids*, **M. Butler** et. al., Central Michigan Univ.	11:00 - 11:10 *Beyond the third dimension*, **Damen Peterson**, Alma College
		11:15 - 11:25 *Analysis of natural convection in a rotating loop*, **Mark Stremler**, Rose-Hulman Inst.
11:45 - 12:10 *Computers in Calculus: The Dearborn Project*, **David James**, U. of Mich.–Dearborn	11:30 - 11:50 *Experimental data fit for polycarbon-ate melt with and without fillers*, **S. Chowdhury** et. al., Central Michigan Univ.	11:30 - 11:40 *A computer system conversion project*, **Mary Pat Sullivan**, Saint Mary's College
	11:55 - 12:15 *Open*	11:45 - 11:55 *Nuclear tank calibration*, **Joy Wysocki**, Saint Mary's College
12:15 - 12:40 *Resources in calculus*, **Mic Jackson**, Earlham College		**Session D (General) Madeleva 233**
	12:20 - 12:40 *Simulation model of starburst dendrimers*, **Junko Kosugi** et. al., Central Michigan Univ.	12:20 - 12:40 *Split four-dimensional real division algebras*, **L. D. Kugler** et. al., Univ. of Michigan—Flint
12:45 - 1:10 *Integrated first year curriculum in Science, Engineering, and Mathematics(IFYCSEM)*, **Brian Winkel**, Rose-Hulman Inst. of Technology	12:45 - 1:05 *Using conjugate gradients in an inverse problem*, **Roger Lautzenheiser**, Rose-Hulman Inst.	12:45 - 1:05 *Analytic singular value decompositions of a matrix function*, **Po-Fang Hsieh**, Western Michigan Univ.

11:45-12:30 1:00-3:15	**Brunch for Competition Participants** **Indiana College Math Competition**	Dining Hall Madeleva - Carroll Aud.
1:15-2:30	**Lunch** *Moving to the Meta-Level* **Marcia Sward**, Executive Director, MAA	Dining Hall

Abstracts of Talks

(in alphabetical order on speaker's last name)

Peter Andrews, Eastern Illinois University, Charleston, Illinois

The Three Tangent Theorem for Conic Sections Fri., 4:35, Madeleva 233

A comparison of undergraduate mathematics curricula in 1943 and today shows that things have changed quite a bit. We now require courses that were not even thought of 50 years ago. The flip side of this is that some material once considered part of every undergraduate mathematics major's experience is no longer studied at all.

Another obvious change is the availability and use of computers both for symbolic computations and for graphic displays of curves and surfaces. Somewhat ironically, a great deal of computer graphics relies on old and beautiful ideas from analytic geometry that we no longer routinely teach.

We briefly look at algorithms for drawing conics dating back to Newton and culminating with those used in computer aided geometric design. The de Casteljau algorithm for generating Bézier curves is inspired by the Three Tangent Theorem for parabolas—a result that appears as an obscure exercise in many 19th century analytic geometry texts.

The cyclic ratio, is defined by T.N.T. Goodman to be

$$(A_1, \dots, A_n; B_1, \dots, B_n) = \prod_{i=1}^{n} \frac{A_i B_i}{B_i A_{i+1}}$$

Using this we get a Three Tangent Theorem for all conic sections:

THEOREM Let P_0, P_1 and P_2 be points on a conic with P_1 between P_0 and P_2. Let p_i be the tangent line to the conic at P_i and Q_{ij} denote the intersection of p_i and p_j. Then if P_0 and P_2 are fixed and P_1 allowed to vary on the conic between them, there is a constant K such that

$$\frac{P_0 Q_{01}}{Q_{01} Q_{02}} = K \frac{Q_{02} Q_{12}}{Q_{12} P_2}$$

and

$$(Q_{01}, Q_{12}, Q_{02}; P_1, P_2, P_0) = 1.$$

Moreover, the value of K determines whether the conic is an ellipse, a parabola or a hyperbola.

As in the parabolic case, this theorem suggests an algorithm for generating the rational Bézier form of a conic section, giving a parametrization that is slightly different from the weighing system conventionally used for such curves. Either version can be conveniently used in computer aided geometric design schemes.

##########

J. Angelos, M. Butler*, S. Hirschi and L. Rakesh, Central Michigan University, Mount Pleasant, Michigan

Rheological Data Reduction and Analysis of Non-Newtonian Fluids Sat., 11:05, Madeleva 247

Often, while attempting to evaluate the rheological properties of non-Newtonian fluids, the problem of distortion on the time-history trace makes comparison of the experimental results with theoretical models virtually impossible, or at best unreliable. In this paper we will discuss techniques of data reduction which will effectively remove or reduce periodic and quasi-periodic wave forms and other transients from the trace. We will then analyze actual experimental results, which contain decaying sinusoidal, quasi-periodic, or complex noise components superimposed in their output traces. Finally, we will make an attempt to explain how this technique improves the performance of master curve fitting algorithms.

##########

Jim Brackett, Northern Michigan University, Marquette, Michigan

The Association of Mathematical Context with students' Response to Tasks Involving Infinity Fri., 4:10, Madeleva 247

The purpose of this study was to characterize students' knowledge of infinity by investigating the following questions:

(1) Do students' responses to infinity tasks vary according to the numerical/geometric context of the task situation?

(2) Do students' responses to infinity tasks vary according to the aggregate/serial context of the task situation?

(3) Do students' responses to infinity tasks vary according to the convergent/divergent context of the task situation.

A test of infinity conceptualizations, whose items assessed understanding of infinity in numerical and geometric situations, was administered to 31 sixth grade students, a group representing three distinct (mathematics) ability tracks. Responses to items were rated as finitist, transitional, or infinitist.

Students' responses to geometric tasks were rated finitist more often than students' responses to numerical tasks; students' responses to aggregate tasks were rated finitist as often as students' responses to serial tasks; and students' responses to convergent tasks were rated finitist much more often than students' responses to divergent tasks. No student gave infinitist responses to all tasks; several students gave finitist responses to all tasks. Students tracked into high-ability mathematics classes gave more infinitist responses than students tracked into low-ability mathematics classes. Many 6th grade students create viable concept images of infinity without the benefit of instruction. It is argued that the range of mathematics experienced by students in the higher track accounts for the viability of concept images of infinity found in this group.

Suggestions for improving mathematics instruction will be presented. By providing experiences of infinity to all students, teachers would help students to construct viable concept images of infinity. Limitations of students' representational systems contribute to students' difficulties in constructing concept images of the geometric context of infinity; therefore, teachers should present students with multiple representations of the geometric context of infinity.

##########

S. Chowdhury*, J. Angelos, G. Grossman, S. Hirschi, L. Rakesh, Central Michigan University, Mount Pleasant, Michigan and **K. Nichols**, Dow Chemical Co., Midland, Michigan

Experimental Data Fit for Polycarbonate Melt with and without Fillers Sat., 11:30, Madeleva 247

The processing of high performance polycarbonate via their processable filler modification is of great importance to automotive, aerospace and many daily life applications. A controlled stress-rheometer is used to investigate the rheological behavior of polycarbonate melt with and without fillers. Particle size, shape, distribution and viscosity are the main experimental variables in this work. Various data are analyzed with respect to shear rate, shear stress, and viscosity. Experimental data fit for polycarbonate melt with and without fillers will be discussed.

##########

Batina Culver, Nicole Fende and Mahesh Jain (Students), Northern Michigan University, Marquette, Michigan

Efficient expression of permutations using 3-cycles, 4-cycles or k-cycles Sat., 10:15, Madeleva 233

It is well known that in the group S_n of all permutations on the set {1, 2, ... n}, the transpositions (or 2-cycles) generate all of S_n and the 3-cycles generate A_n, the alternating group consisting of the even permutations. This raises the question of what subgroup of S_n is generated by the 4-cycles, by the 5-cycles, etc. It is easy to prove that one alternately gets S_n and A_n, the former if the generators are k-cycles of even length k and that latter if they are of odd length.

It also can be shown that the standard way of representing permutations using transpositions is the most efficient. (See J. Kiltinen, "How many transpositions suffice? You already know!", *Math. Mag.*, to appear.) This raises the question of how to efficiently represent permutations using 3-cycles (even ones only) or 4-cycles, or for that matter, k-cycles.

It turns out that the matter is not as simple as the 2-cycle case, but it is possible to get analogous results. For example, one can most efficiently express a cycle of length 3m-1 or 3m+1 using m 4-cycles, but for a cycle of length 3m, one needs m+1 4-cycles. We will present the results of our study of this question.

Phil Demarois and **Mercedes McGowen**, William Rainey Harper Community College and **Darlene Whitkanack**, Northern Illinois University

The Impact of Functions and Technology on Introductory and Intermediate Algebra. Sat., 10:15, Madeleva 247

This session will discuss a restructured curriculum based upon research and recommendations for change by the MAA and NCTM. In Introductory Algebra the structure of number and algebraic systems drives the development of function and variable. The focus on the function concept continues in Intermediate Algebra using data analysis as the theme.

The use of graphing calculators and Derive in these courses has been a catalyst for change in teaching style from lecturing to cooperative groups. It has resulted in greater motivation, better attitudes and higher performance with better attendance and lower attrition rates.

Thomas E. Elsner, GMI Engineering and Management Institute, Flint, Michigan

The creation and maintenance of an applied mathematics degree program with a cooperative education component Fri., 4:40, Carroll Aud.

In 1991, GMI admitted its first freshman class to a B.S. in Applied Mathematics program with the same requirements for a cooperative education component that exists for programs in engineering and management. This presentation reviews the process of developing the program, the GMI structure for cooperative education, student employment experience, the founding of an advisory board, etc.

##########

J.S. Frame, Michigan State University, East Lansing, Michigan

Fibonacci Numbers and a Chaotic Piecewise Linear Function Fri., 2:30, Madeleva 233

Graphs of the iterates $g^n(x)$ of the piecewise linear function g(x) defined on U:[0,1], which is x+1/2 on H:[0,1/2] and 2(1-x) on I:[1/2, 1], consist of F_{n+2} linear segments of which F_n are maps onto I and F_{n+1} onto U — where the integers F_n are Fibonacci Numbers. The Lucas number $L_n = F_{n-1} + F_{n+1}$ counts the number of points x for which $g^n(x) = x$ — points whose periods divide n — found in F_{n-1} subintervals of the graph g^n that map onto I and in all F_{n+1} that map onto U. Each rational fraction x = a/b in U, b odd, is periodic under g^n for some n which can be determined as shown by examples.

##########

Robert Gemrich (student), Alma College, Alma, Michigan

The Original "Proof" of the Four Color Conjecture Sat., 10:30, Madeleva 233

In 1879, Alfred Kempe presented the mathematics community with a "proof" of the Four Color Conjecture, closing the lid - so he thought - on the problem. However, a decade later, John Heawood reopened the problem by exposing a subtle flaw in Kempe's argument. We will discuss Kempe's proof and reveal the subtle error.

##########

Po-Fang Hsieh, Western Michigan University, Kalamazoo, Michigan

Analytic Singular Value Decompositions of a Matrix Function Sat., 12:45, Madeleva 233

For an m by n matrix M(t) analytic on [a, b], $(-\infty \leq a < b \leq \infty)$ we introduce two kinds of *singular values*, one is *analytic* and the other *nonnegative*, which is shown to be continuous and piecewise analytic. Based on these, two kinds of singular value decompositions are developed. If M(t), in addition to being analytic in $(-\infty, \infty)$, itself and all of its singular values are periodic with the same period, then, both kinds of decompositions are also proved to be periodic with the same period. The corresponding decompositions of the pseudoinverse $M(t)^+$ are also obtained. Two examples are given.

##########

Yury Ionin, Central Michigan University, Mount Pleasant, Michigan

On the Derivative of the Inverse Function Fri., 3:20, Madeleva 247

As distinct from other elementary theorems of differential calculus, the theorem on the derivative of the inverse function seems to have unnecessary restrictions. We will give a counterexample showing that some restrictions are necessary (we could not find such an example in calculus or analysis texts), discuss the nature of these restrictions and their impact on the understanding of connections between fundamental properties of functions such as continuity, differentiability, and geometric properties of their graphs.

##########

Dana K. Jackman (student), The College of Wooster, Wooster, Ohio

The Norm of a Hadamard Multiplier Sat., 10:45, Madeleva 233

If A and B are n x n matrices, the Hadamard product of A and B is the n x n matrix $C = A \circ B$ whose entries are given by $c_{ij} = a_{ij} b_{ij}$. The Hadamard product is sometimes called the Schur product or the entrywise product. We consider the operator on the space of n x n matrices, $X \longrightarrow B \circ X$ of Hadamard multiplications by a fixed matrix B. The norm of this operator is given from the Euclidean norm on C^n. We denote the norm of this linear operator by K_B and examine $\{X\colon\ K_B\|X\| = \|B \circ X\|\}$, the maximizers of B. Discussion of the norm of this operator involves a discussion of norms and of singular values.

##########

David A. James, University of Michigan–Dearborn, Dearborn, Michigan

Computers in Calculus: The Dearborn Project Sat., 11:45, Carroll Aud.

Over the past five years, faculty members at the University of Michigan–Dearborn have developed computer labs for calculus. These labs have become very user-friendly as a result of incorporating suggestions over a period of time from teachers and students. Two years ago we received an NSF grant which included as one component a training program to help faculty through their initial semester when using a computer to teach calculus. This training program involved written computer laboratory materials, 5-minute classroom demonstration ideas, and help in the lab by the project directors. Twenty faculty members, at a rate of five per semester, have now passed through this training program. Components leading to the success of this program will be discussed. The laboratory materials and list of classroom demonstrations (for IBM and Macintosh) will be available free of charge.

Robert G. Kane, University of Detroit Mercy, Detroit, Michigan

Conducting university mathematics classes within an industrial partnership Fri., 4:10, Carroll Aud.

The University of Detroit Mercy has close relationships with both General Motors and Ford Motor Co., teaching classes on-site leading to degrees in Business or Mechanical Engineering. Teaching mathematics classes in these environments requires adjusting the course content to meet the needs of the unique student body while still maintaining mathematical rigor.

##########

Lynn Kiaer, Rose-Hulman Institute of Technology, Terre Haute, Indiana

Fostering an Appreciation of Mathematical Induction Fri., 4:35, Madeleva 247

Mathematical induction is an important proof technique in many areas of application, but the teaching of mathematical induction is often hampered by an approach that teaches the 'easy' summation examples first. This talk describes an introductory lecture that is designed to foster the students' appreciation of the topic. The suggested plan of attack includes an appeal to the student's intuition and a carefully grounded development of how an induction proof is constructed, as well as a number of examples of induction proofs, many drawn from graph theory.

##########

S.C. Althoen, K.D. Hansen and L.D. Kugler*, University of Michigan—Flint, Flint, Michigan

Split Four-Dimensional Real Division Algebras Sat., 12:20, Madeleva 233

Dickson's construction obtains the quaternions as pairs of complex numbers with a specific multiplication. We generalize his construction to obtain four-dimensional real division algebras from pairs of two-dimensional real division algebras.

##########

Michael S. LaChance, University of Michigan—Dearborn, Dearborn, Michigan

Industrial consulting and its influence in the mathematics classroom Fri., 3:00, Carroll Aud.

The "culture" of a workplace where mathematics is used is quite distinctive from one in which mathematics is taught. Operating in both environments can lead to profound differences in the ways a teacher relates to mathematics and to students. Problems will be described in computer aided geometric modeling and geometric data exchange which frequently have solutions drawn from the calculus, linear algebra, and numerical analysis.

Junko Kosugi*, Leela Rakesh, Central Michigan University, Mount Pleasant, Michigan and **Marc L. Mansfield**, Michigan Molecular Institute, Midland, Michigan

Simulation Model of Starburst Dendrimers Sat., 12:20, Madeleva 247

A Monte Carlo model of starburst dendrimers is presented. The model is composed of equilateral triangles connected at their vertices, each pair being free to rotate about their common axis, and with no two triangles permitted to intersect. The model is expected to be an adequate representation of the dendritic aromatic polyethers being developed by J.M.J. Frechet and coworkers at Cornell. Preliminary studies using the Programmer's Toolkit from Mathematica are presented.

Roger Lautzenheiser, Rose-Hulman Institute of Technology, Terre Haute, Indiana

Using Conjugate Gradients in an Inverse Problem Sat., 12:45, Madeleva 247

While on sabbatical leave with Sabbagh's Associates, Inc, in Bloomington, IN, I worked on a non-destructive evaluation inverse problem. The setup of the problem involves changing the integral equations resulting from Maxwell equations to a system of algebraic equations and the solution process involves iterative methods for solving linear and bilinear systems of equations. This presentation will concentrate on using conjugate gradient algorithms for solving this type of problem.

##########

Bill Marion, Valparaiso University, Valparaiso, Indiana

Computability and Complexity: What Is This All About? Fri., 3:20, Madeleva 233

As mathematicians rely more and more on the use of computer hardware and software as an aid in the doing of mathematics as well as the teaching of mathematics, it becomes important to understand the nature and limitations of computation. Much work has been done in the past 60 to 70 years to address these issues. Computer scientists who do research in the field of Theoretical Computer Science have appropriated this area for their life's work. In this paper the author will provide an overview of two of the main ideas in the theory of computation: computability and computational complexity. Questions, such as what can be computed? and what can be computed in a reasonable amount of time?, will be addressed. References for those who are interested in further reading will be given.

##########

Edward F. Moylan, Technical Affairs Staff, Ford Motor Company

SIAM Great Lakes Section Initiatives in Industry/Education Cooperation Fri., 2:30, Carroll Aud.

In 1992, the Section researched examples of successful industry/education cooperation throughout the U.S. in order to understand the factors that made them work. Proposals then were developed for initiatives within the Section to support cooperation at the high school and undergraduate mathematics levels. Status and plans for selected initiatives will be presented.

Damen Peterson (student), Alma College, Alma, Michigan

Beyond the Third Dimension Sat. 11:00, Madeleva 233

Educators often use graphs and other visual models to display graphs of two- or three-variable equations. Beyond three variables, however, such a model may not be obvious. In this presentation, we discuss two possible methods for displaying four- (or more) dimensional equations on a two-dimensional surface. Advantages and disadvantages of these methods will also be considered.

##########

Bruce Reznick, University of Illinois, Champaign, Illinois

Some identities of Hilbert and their implications Sat., 8:30, O'Laughlin Aud.

We will present some identities of Hilbert, and explore their implications for number theory, algebra, geometry, numerical analysis and combinatorics.

John H. Rickert, The Rose-Hulman Institute of Technology, Terre Haute, Indiana

Simultaneous rational approximations and a related pair of diophantine equations Fri., 2:55, Madeleva 233

Certain contour integrals produce good simultaneous approximations to special sets of algebraic numbers near 1. By looking at approximations to the numbers $\sqrt{1 - 1/n}$ and $\sqrt{1 + 1/n}$ it is possible to show that the solutions to the pair of diophantine equations $x^2 - 2z^2 = 1$, $y^2 - 3z^2 = 1$ are the obvious ones.

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Steven C. Altheon and K. E. Schilling*, The University of Michigan—Flint, Flint, Michigan

The Trisectors' Guide to Circling the Square Fri., 4:10, Madeleva 233

Promising immortality, a mysterious stranger hands you a pair of scissors and a paper square. "Too square," you think, so you make marks to trisect each edge, connect adjacent marks and cut off the corners. You stop to note, "too octagonal," and so you again make marks to trisect each edge, connect adjacent marks and cut off the corners. You've now unleashed the stranger's curse (a sort of hex-la-dismal) that forces you to cut corners by repeating the trisection process forever. What can be said about the roundish convex figure that appears at the end of the universe? What is its area? Is its boundary smooth? If so, how smooth? Suppose that, instead of trisecting at each stage, we divide the edges in the ratio $r : 1 - 2r : r$. How does the value of r affect the answers to our questions?

Our solutions use infinite series, exponential generating functions, and Farey fractions. And none of the answers is 42.

Steven Schlicker, Grand Valley State University, Allendale, Michigan

Projects in Calculus Fri., 2:30, Madeleva 247

We will present a number of projects that are used in the calculus sequence at Grand Valley State University. The projects vary from short, in-class projects to one to two week projects. Most of the projects involve some technology, but many require only a graphing calculator. The goals of the projects are varied. Many of the projects allow students to investigate mathematical concepts on their own, using technology as a tool for gathering information. Other projects allow students to explore applications of mathematics. The projects are all designed for small group work.

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Mark A. Stremler (student), Rose-Hulman Institute of Tech., Terre Haute, Indiana

Analysis of Natural Convection in a Rotating Loop Sat. 11:15, Madeleva 233

This work deals with a one-dimensional analysis of a rotating open loop subjected to a uniform heat flux per unit length. Fluid is driven by buoyancy as well as by a pressure gradient. The criterion for onset of motion is first determined. Steady state motion is then analyzed and is found to exhibit both a positive and a negative branch. Linear stability analysis is performed to determine regions in parameter space over which the flow is unstable. Parameters varied for this analysis are those corresponding to rotational velocity, heat flux, and a modified pressure difference across the loop. One or both velocities may be stable. It is also possible to have an oscillatory state coexist with a time-independent solution. A perturbation method is used to evaluate the effect of gravity on flow characteristics. [This is joint work done with Prof. Mihir Sen and David Sawyers (graduate student), Department of Aerospace and Mechanical Engineering, University of Notre Dame].

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Mary Pat Sullivan (student), Saint Mary's College, Notre Dame, Indiana.

A Student Summer Internship Experience: A Computer System Conversion Project Sat., 11:30, Madeleva 233

In my summer internship at Arthur Andersen and Co. I was responsible for converting a system from a PC onto the current network. I had to learn Focus and then analyze the current database before adding this system. Finally, I had to modify the programs to account for the differences between the PC and the network environments.

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R. M. Thrall, Rice University, Houston, Texas

COMAP: Applications Through the Curriculum Sat., 11:00 , Carroll Aud.

An overview of the COMAP program and some personal ideas and experiences.

Mary T. Treanor, Valparaiso University, Valparaiso, Indiana

Interaction and Insight: Studying Mathematics in Small Groups Fri., 2:55, Madeleva 247

This presentation will discuss initiating and structuring small group activities by students in our undergraduate mathematics classes. The focus will be on worksheets or short projects in which the work is either done in class or completed outside and reported back to the class or at least to the instructor. Though not specifically addressing concerns that arise in structuring sessions or assignments that use the computer as a tool, many of the comments made will apply to that situation as well.

I will suggest times in a course and situations in which work in small groups may be especially appropriate and fruitful. I will address reasons why work in groups is helpful to students and to the teacher, show how the small group setting facilitates learning, list some advantages for individual students and for the class as a whole, and suggest some outcomes that are fostered by work in small groups.

I have used small groups in a variety of settings from precalculus service courses to the abstract algebra course for majors. I will share my reflections on these experiences and supplement these with feedback from my students and colleagues. I can suggest some pitfalls to avoid, some alternatives among which to choose, some topics for which the small group setting seems especially well suited, and some ideas about crafting worksheets and project directions so that they help the process rather than impede it.

Small groups provide a setting in which instructors and students can ask questions, explore situations, become more proficient in problem-solving and more flexible in their thinking, and learn to articulate their questions and their insights in a way that fosters growth in their ability to do mathematics. Work in small groups complements that done individually or by the class as a whole.

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Joy Wysocki (student), Saint Mary's College, Notre Dame, Indiana.

A Student Summer Internship Experience: Nuclear Tank Calibration Sat. 11:45, Madeleva 233

In nuclear tank calibration, many methods have been used, but the project I worked on last summer at Battelle Pacific Northwest Laboratories was to explore spline fitting methods as an alternative. According to my advisor, Al Liebetrau, the advantages of such a technique are that it is more easily automated than other methods, it accounts for point-to-point correlation, and can control the degree of smoothness in the fit. Taking a specific set of calibration data which used linear regression, I showed that a spline fit to that same data more accurately portrayed where the material was located in the tank.

Parking Information

Parking will be available in the two lots north of Douglas Road on the Saint Mary's campus. Overflow parking will be in the lot behind Angela Athletic Facility. These lots are marked with the large letters "P" on the campus map on the inside back cover.

Meals

Lunch on both Friday and Saturday and the early brunch on Saturday will be served through the college's cafeteria line. At a cost of $5 per meal, there will be a choice of several main dishes, a deli and a salad bar. The cocktail party and dinner will be held at St. Adelbert's Church in South Bend. The cost will be $11 per person. A **Polish Wedding Dinner** in the best South Bend tradition will be served. It consists of chicken, sausage, noodles, mashed potatoes, beans, sauerkraut, bread, pie, coffee and milk. It is served family style, and no one has ever walked away hungry!

Reservations for meals must be made through the pre-registration process by April 2, 1993. Meal tickets will be provided upon arrival at the meeting.

Exhibits

An exhibit by vendors of textbooks and computer and calculator equipment will be held in the Stapleton Lounge of LeMans Hall near the registration area. There will be ample time within the meeting schedule to visit the exhibits. Coffee break refreshments will be set up near the exhibit area.

MAA Book Sale

An MAA book sale will also be held in Stapleton Lounge. Meeting participants should plan to purchase MAA books and videos (and other special titles) at the meeting in order to receive an additional 20% discount on the usual MAA member prices. Purchases made at this meeting will directly benefit the Sections in the form of a 10% commission on sales.

Hospitality

A number of textbook and software vendors have provided support for refreshments during the meeting. There will be complimentary coffee and rolls each morning prior to the start of the sessions, and coffee breaks during the morning and afternoon. In addition, several vendors are underwriting the cost of the cocktail hour prior to the Friday evening banquet.

WAM-AWM-Women's Study Breakfast

There will be a breakfast on Saturday morning,, April 24, for all meeting participants interested in women's issues in mathematics. It will be held between 7:30 and 8:30 A.M. in the Rotary Room in the lower level of the Dining Hall. Reservations are needed, and can be made using the registration form. The session is being organized by Toni Carroll of Siena Heights College, Adrian, Michigan and Bette Warren of Eastern Michigan University, Ypsilanti. Included in the program will be a report on the research Bette Warren is doing on the climate for women in Michigan colleges and universities, and an activity involving micro-inequities offered by the MAA Committee on the Participation of Women.

Student Housing and Meals

Limited funds are available to support student housing needs. Contact Rick Gillman, Mathematics Department, Valparaiso University [Tel.: (219) 464-5067, E-mail: rgillman@exodus.valp.edu] by **March 15.**

There will be a separate dinner on Friday evening at the Inn at Saint Mary's for the students attending the meeting. **It will be provided at no extra cost.** There will be a murder mystery game held along with the dinner. For the students who will be participating in the competition on Saturday afternoon, there will be an early lunch provided.

Additional Student Papers

Times have been built into the schedule for additional student papers. Titles and abstracts should be submitted **by March 15** to Donald Miller, Department of Mathematics, Saint Mary's College, Notre Dame, IN 46556-5001. A supplemental schedule will be available at the registration desk.

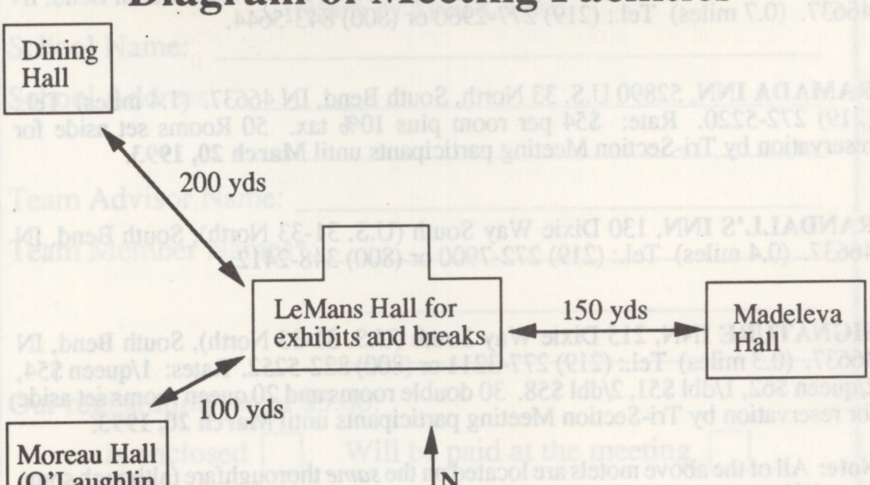
Year 'round Standard Time

Saint Mary's College is located in the part of Indiana which remains on Eastern Standard Time all year. Since the surrounding states will be on Daylight Savings Time, the local time will be the same as for Illinois, and one hour behind Michigan.

Illinois Section Agenda Item

Members of the Illinois Section are informed that it is the intention of their Section to amend its bylaws at its business meeting.

Diagram of Meeting Facilities



Motels

Meeting participants must make their own reservations. Several area motels are holding rooms for Tri-Section Meeting participants until March 20th, as indicated below. *Please mention that you are attending the MAA Tri-Section Mathematics Meeting when making your reservation.*

EARLY RESERVATIONS ARE STRONGLY RECOMMENDED AS THE SPRING NOTRE DAME "BLUE-GOLD" FOOTBALL GAME IS SCHEDULED FOR THE SAME WEEKEND.

DAYS INN, 52757 U. S. 31 North, South Bend 46637. (1.8 miles) Tel.: (219) 277-0510. Rate: $40 per room. 100 double rooms set aside for reservation by Tri-Section Meeting participants until **March 20, 1993.**

HOLIDAY INN, 515 Dixie Way North (U.S. 31-33 North), South Bend, IN 46637. (1.1 miles) Tel.: (219) 272-6600

HOWARD JOHNSON, 52939 U. S. 31, South Bend, IN 46637. (1.7 miles) Tel.: (219) 272-1500.

THE INN AT SAINT MARY'S, 53993 U. S. 31-33 North, South Bend, IN 46637. (on campus) Tel.: (219) 232-4000. Rate: $65 per room. 50 Rooms set aside for reservation by Tri-Section Meeting participants until **March 20, 1993.**

KNIGHTS INN, 236 Dixie Highway North (U.S. 31-33 North), South Bend, IN 46637. (0.7 miles) Tel.: (219) 277-2960 or (800) 843-5644.

RAMADA INN, 52890 U.S. 33 North, South Bend, IN 46637. (1.4 miles) Tel.: (219) 272-5220. Rate: $54 per room plus 10% tax. 50 Rooms set aside for reservation by Tri-Section Meeting participants until **March 20, 1993.**

RANDALL'S INN, 130 Dixie Way South (U.S. 31-33 North), South Bend, IN 46637. (0.4 miles) Tel.: (219) 272-7900 or (800) 348-2412.

SIGNATURE INN, 215 Dixie Way South (U.S. 31-33 North), South Bend, IN 46637. (0.3 miles) Tel.: (219) 277-3211 or (800) 822-5252. Rates: 1/queen $54, 2/queen $62, 1/dbl $51, 2/dbl $58. 30 double rooms and 20 queen rooms set aside for reservation by Tri-Section Meeting participants until **March 20, 1993.**

Note: All of the above motels are located on the *same* thoroughfare (although some have different street names; the addresses provided are for mailing purposes only). They are all within two miles of the Saint Mary's campus.

The 1993 Indiana College Mathematics Competition

The 28th Annual Indiana College Mathematics Competition will take place from 1:00 p.m. to 3:15 p.m. on Saturday, April 24, 1993, at Saint Mary's College, Notre Dame, Indiana, in conjunction with the Tri-Section Meeting of the Illinois, Indiana, and Michigan Sections of the MAA. The Indiana Section cordially invites colleges and universities from all three states to enter teams of three undergraduate students in this year's competition. Announcement of awards will be made within one month of the examination.

Background and rules: The ICMC test questions are similar to, but usually not as difficult as, those which appear on the MAA's Putnam Competition tests. A college or university may enter as many teams of three undergraduate students as desired, and each team should identify a faculty sponsor from their school. Each team will work on the test questions as a team, turning in a single team solution for each problem attempted. Solutions turned in will be identified for grading purposes only by team numbers, not by school or contestant names. No books, calculators, computers, slide rules, rulers, or other such aids will be allowed in the testing rooms. The contest questions are designed in such a way that a calculator provides no significant advantage to any team.

How to register teams: A school wishing to enter teams in the Competition should contact Steve Carlson, Secretary-Treasurer of the Indiana Section, before April 2, 1993. A required entry fee of $5.00 per team may be paid in advance or at the Tri-Section Meeting registration desk. Contact Carlson at: Department of Mathematics, Rose-Hulman Institute of Technology, Terre Haute IN 47803. Phone: (812) 877-8458, or E-mail: carlson@nextwork.rose-hulman.edu. Use the form below to register a team, or send the requested information by electronic mail. A history of the competition (including problems from past exams) will be mailed to each school entering teams (limit of one history per school).

Competition Registration

(return by April 2, 1993)

School Name: ______________________________

School Address: ______________________________

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Team Advisor Name: ______________________________

Team Member Names*: ______________________________

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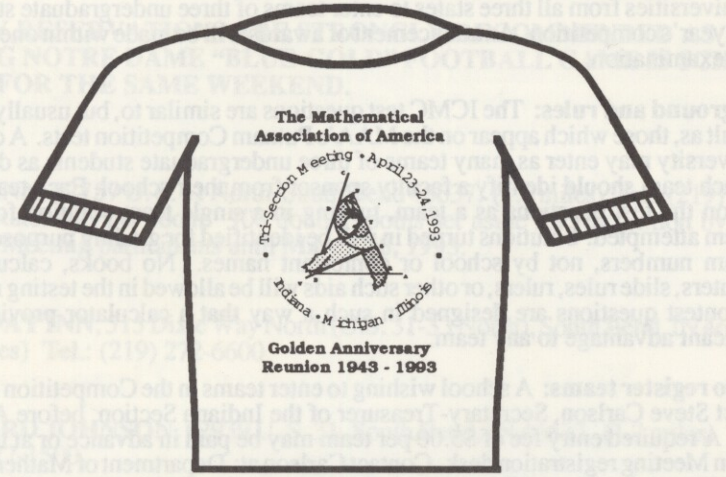
Our registration fee of $5.00:

Is enclosed ☐ Will be paid at the meeting ☐

* Team members must be registered for the meeting also.

ONCE IN FIFTY YEARS!

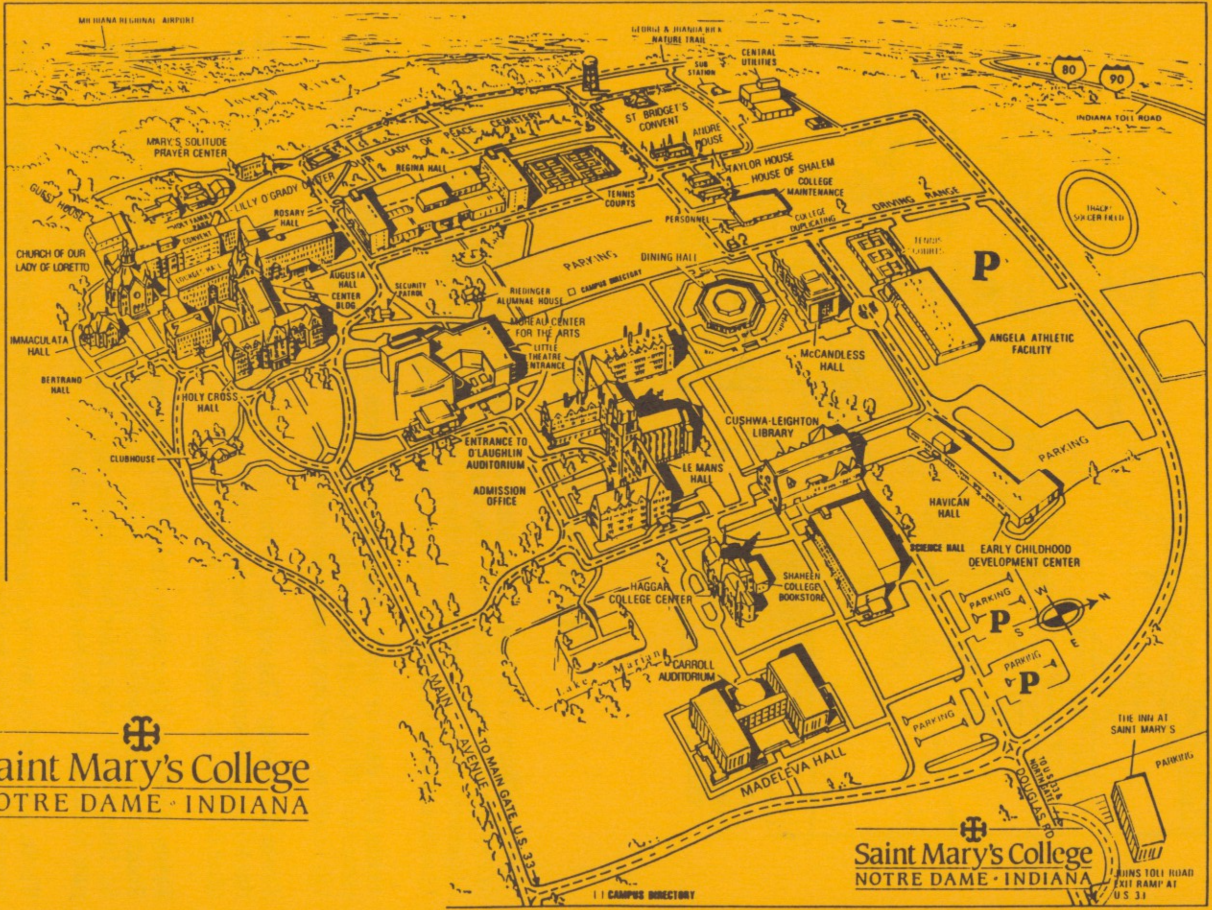
THAT CALLS FOR A T-SHIRT!



Celebrate the fifty-year reunion meeting of the Indiana, Michigan and Illinois Sections of the MAA. To remember the historic occasion, get the limited edition Tri-Section Meeting Souvenir T-Shirt.

- Quality Fruit of The Loom Best 50-50 cotton-polyester.
- Two-color imprint (jeweltone gold and white) on jade.
- Order on the registration form for pick-up upon arrival.
- Priced at $8.75 for advance orders, $9.50 at the meeting.
- All sizes available in advance; L, XL, XXL only at meeting.
- Very limited quantities available at meeting, so order in advance to be sure you get yours.
- Why not take care of the "What did you bring me?" gifts for the kids even before leaving home?

* *Design shown above and colors are tentative and subject to modification.*



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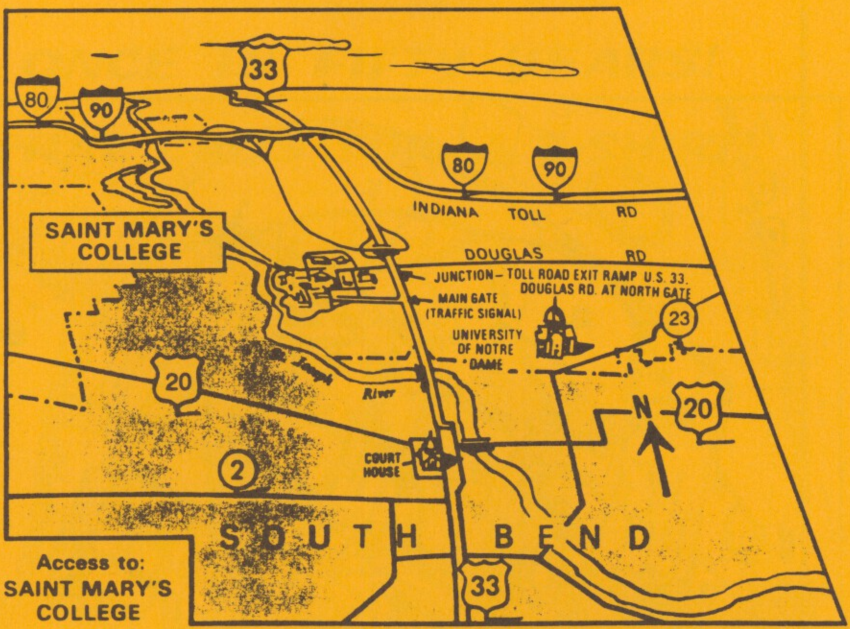

Travel Directions

To Saint Mary's College: Saint Mary's College is located at mile 77 of Interstate 80/90 (The Indiana Toll Road). The north entrance to the college is at the bottom of the exit ramp. The Inn at Saint Mary's is located at the north entrance. The main (south) entrance is marked by a stone entrance way.

From the east or west: Head toward South Bend on the Indiana Toll Road (Interstate 80/90). Get off at mile 77 at the U.S. 33 exit. Turn right into the campus via Douglas Road just beyond the exit ramp.

From the north: The college is located on U.S. Highway 33 four miles south of the Michigan boundary. Watch for the Douglas Road entrance to the campus just after crossing the Indiana Toll Road.

From the south: It is easiest to take U.S. Highway 31 and continue straight through South Bend (not turning on the bypass). This becomes U.S. 33. After crossing the St. Joseph River, watch for Notre Dame and Saint Mary's signs. Take the second turn to the left into the Saint Mary's campus on Douglas Road.

To St. Adelbert's Church (Banquet Site): Buses will leave from the parking lot nearest Madeleva Hall, but for those who wish to drive themselves: From the Saint Mary's campus, take U. S. 33 south two miles into the city of South Bend. It becomes one way, and traffic diverts to Main Street. Continue on Main to Western Avenue. Turn right on Western and continue to Olive Street (1.5 miles). Turn left on Olive: St. Adelbert's is about three blocks south on the right.