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Cover: Students at a Math Circle class at Northeastern University study integer triangles. *See article on page 4.* *(Photograph by James Tanton.)*

FOCUS Deadlines

	August/September	November	December
Editorial Copy	July 15	September 16	October 16
Display Ads	June 25	September 24	October 29
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Joe Gallian Named CUR Fellow

The Council on Undergraduate Research recently announced that Joe Gallian, Distinguished Professor of Teaching and Professor of Mathematics at the University of Minnesota Duluth and Second Vice-President of the MAA, is one of the CUR Fellows for 2002. The award, to be presented at the CUR National Conference at Connecticut College on June 21, 2002, is awarded every two years to individuals who "exemplify the ideals of the Council on Undergraduate Research," whose goals are "to support and promote high-quality undergraduate student-faculty collaborative research and scholarship." Winners receive $1000 and are asked to give a special talk on their work with undergraduates.


Joe Gallian

Gallian was a pioneer in undergraduate research in mathematics. For many years he has run an REU program at the University of Minnesota Duluth. Forty-six of Gallian's REU students have earned PhDs, and more than ninety have published their results. He was involved in the creation of the Morgan Prize for undergraduate research and has helped organize the undergraduate poster sessions at national meetings. He is universally recognized as a leader in promoting real research by undergraduates in mathematics.

Gallian will share the CUR Fellow award with Thomas J. Wenzel, Charles A. Dana Professor of Chemistry at Bates College. CUR President Michael Nelson said, "Professors Wenzel and Gallian are role models for science faculty. They have achieved a professional nirvana by delicately balancing teaching, research, university citizenship, and personal life into a productive and rewarding career." ■

National Academies Consider AP and IB Courses

The National Academies released on February 14 a report on Advanced Placement and International Baccalaureate courses in mathematics and science. The report faults most such courses for attempting to cover too many topics too quickly instead of developing in-depth understanding of the subject. The report concludes that, while these courses have improved the quality of mathematics and science education in the United States, they have not yet realized their potential.

Noting that AP and IB courses have become standard for students seeking admission to highly selective colleges and universities, the report also calls for increased access to such courses, particularly for minority eand low-income students. To this end, the authors highlight what they believe are the most crucial factors: good teacher preparation and improvement in the quality of students' prior schooling.

The NAS report argues for several other changes to AP and IB courses, noting in particular that the goal should not be merely to reproduce what is done in colleges, but to do it better. A press release on the report can be found online at http://www4.nationalacademies.org/news.nsf/isbn/0309074401?OpenDocument. The full report will be published by the National Academy Press and can also be found online at http://www.nap.edu/catalog/10129.html. ■

László Lovász Will Lecture at Burlington MathFest

László Lovász will be the Hedrick Lecturer at MathFest 2002 in Burlington, VT. Lovász, who works mostly in combinatorics and theoretical computer science, is known both as a powerful mathematician and a great expositor of mathematics. He is famous, among other things, for the Lovász Local Lemma, an important tool in the probabilistic method in combinatorics. His work is important also in algorithmic number theory, particularly the LLL (Lenstra-Lenstra-Lovász) algorithm, which enables efficient searches for "small" vectors in given integer lattices. This algorithm was used to crack the knapsack public key cryptosystem, to disprove the Mertens conjecture in analytic number theory, and to give a fast polynomial factorization algorithm.

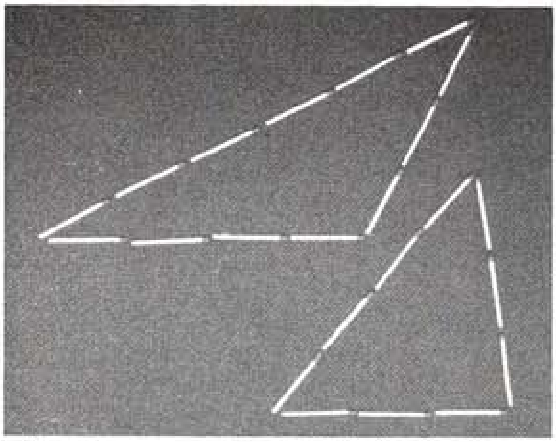
Lovász has won the Wolf Prize (for his mathematics) and the Polya Prize (for his expository work). His presence at the Burlington MathFest is certain to make the event all the more memorable. ■

Young Students Approach Integer Triangles

By James Tanton, with the help of David Batuner, Alexander Belyi, Owen Callen, John Coyne, Adam Donovan, Rostic Gorbatov, Avi Levitan, Sam Lichtenstein, Alan McAvinney, Benjamin Moody, Peter Sergey Panov, David Plotkin, Ben Plotkin-Swing, Yuri Podpaly, Noah Rosenblum, Teresa Shirkova, Sonya Shteingold, Matthew Tai.

How many different triangles of perimeter n can be made with a supply of n toothpicks? Let us assume all triangles created have an integral number of toothpicks per side and have positive area. We wish to count the number of incongruent triangles that can be so constructed. This is the problem that students aged 12 to 17 grappled with over ten one-hour sessions of *The Math Circle* in the fall of 2001.

Organized as a school for the enjoyment of mathematics, *The Math Circle* offers programs of courses for young students, aged 5 through 18, who enjoy math and want more than the typical school curriculum offers. We hold classes at Northeastern University, at Harvard University, and at Community Education centers. The school was founded by Robert Kaplan, Ellen Kaplan and Tomás Guillermo in 1994, and I have been fortunate to be involved with this program for the past two years. We typically begin a semester by posing a mathematical problem to each of our classes and allowing the small groups of students to explore the mystery for the ten weeks that follow. The role of an instructor at *The Math Circle* is not so much to instruct as to guide and offer occasional hand-holds (or sometimes to throw spanners into the works). We want our students to experience for themselves the creative aspects of mathematics, to make mistakes, to experience the frustrations of doing math, as well as the deep joy when inspiration finally arrives. In short, we want our students to own the mathematics they encounter.



With all boundaries removed, it is amazing just how far young students can, and do, go. This was shown by the accomplishments of my students in designing a novel solution to the toothpick triangle problem. It was a collaborative effort. The point of *The Math Circle* is not to foster competition but to allow students to take intellectual risks. The setting is collegial and relaxed. With free discussion of ideas and play of invention, innovation can blossom. The toothpick triangle problem, like all of our problems, has the added advantage of being immediately accessible and mathematically rich. Trial and error shows that a supply of 13 toothpicks can produce five incongruent triangles. We denote them as triples: (6, 6,1), (6, 5, 2), (6, 4, 3), (5, 5, 3) and (5, 4, 4). There is a surprise if you add one toothpick: the count decreases. Only *four* integer triangles can be made with 14 toothpicks. Let $T(n)$ denote the number of possible triangles for a given perimeter n (for n in **N**). Is there a general formula for it?

My students didn't know that this problem is well known and complete specification of the function $T(n)$ has already been established (see [1], [2, ch. 3], [3], [5] and [6, ch. 6]). The approaches taken in the literature make use of algebraic machinery that can only be described as hefty: generating functions, multiple-term partial fractions involving cubics, and the binomial theorem to extract coefficients (though see [3] for an alternative direct approach). I was astonished to see my students solve this problem completely using nothing more than formulas for quadratics. This paper describes the evolution of their approach. They began classically by first discovering a connection with partition functions (and they made some new observations along the way). Thereafter, their method is surprisingly simple, elegant, and new! A full-length version of this paper appears online at http://www.maa.org.

What makes a triangle? Physically manipulating toothpicks soon became tedious, so the students immediately looked to algebraic means to calculate values $T(n)$. They noted that three positive integers a, b and c, summing to n, form the sides of a triangle if, and only if, the three triangular inequalities hold: $a + b > c$, $b + c > a$, and $c + a > b$. Adding c, b and a respectively to each of these inequalities yields $n = a + b + c > 2a, 2b, 2c$. Thus a triple (a,b,c) forms a triangle of perimeter n if, and only if, each term in the triple is strictly less than $n/2$. We will assume for convenience that we always have $a \geq b \geq c$. It is now easy to compute values of $T(n)$: simply list the "3-partitions" of n (that is, list the ways n can be written as a sum of three positive integers) in a systematic way, and count all those 3-partitions that have terms all less than half n. For example, the 3-partitions of 12 are: (10,1,1), (9,2,1), (8,3,1), (8,2,2), (7,4,1), (7,3,2), (6,5,1), (6,4,2), (6,3,3), (5,5,2), (5,4,3) and (4,4,4), of which only the last three correspond to a triangle. Thus, $T(12)=3$. The students readily computed the first 15 values of $T(n)$:

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$T(n)$	0	0	1	0	1	1	2	1	3	2	4	3	5	4	7

The search for patterns. The desire to find patterns, it seems, is innate in the human psyche. Our pleasure at *The Math Circle* lies in nudging our younger students on to the next step—*why* are these patterns so? From inspection it seems that the value of $T(n)$ decreases at each even value of n larger than 6. The students offered the following observation by way of an explanation:

Lemma 1: *No integer triangle with even perimeter has a side of length 1.*

Proof: Suppose the triple $(a,b,1)$ represents a triangle of perimeter $2n$. Then $a < n$ and $b < n$. But this is impossible as $a+b+1=2n$.

"With the option of 'one' as a side-length removed," commented my 12- to 14-year-olds, "the number of possibilities for triangles is likely to decrease." They, and the class for juniors and seniors, later came up with the following proof based on the idea that any triangle of perimeter $2n$ can be transformed into a triangle of perimeter $2n - 1$ by removing a toothpick from a shortest side:

Lemma 2: $T(2n) < T(2n - 1)$ *for* $n > 3$.

Proof: Let (a,b,c) be the triple for a triangle of perimeter $2n$. Since $c \geq 2$, $(a,b,c - 1)$ is a triple representing a valid triangle of perimeter $2n - 1$. As no two triples of the first type map to the same triple of the second type we have $T(2n) \leq T(2n - 1)$. Moreover, any triangle of the form (a,b,b) of perimeter $2n - 1$ is not in the range of this mapping. It is easy to show that if $n > 3$ triangles of this form do exist and so $T(2n) > T(2n - 1)$.

The table suggests that $T(2n)$ is always equal to $T(2n - 1) - 1$, but this is not the case. $T(16)$, for example, equals five and is two less than $T(15)$. This provides a good argument for collecting a lot of data before formulating a theory. One of the most striking patterns the students noticed is the placement of pairs of values. For example, the value "2" appears twice in the table, separated three places: $T(7) = 2 = T(10)$. The values "3" and "4" also appear twice, again separated three places. The same is true for the two pairs of "1's" that occur. This led students to conjecture that $T(2n) = T(2n - 3)$.

Moreover, some students recognized the sequence of values appearing in the even (and odd) positions of the table. Let $C(n)$ be the number of 3-partitions of n. Recall that 3-partitions were used for counting triangles. Fortunately, a few students, naturally inclined to collecting data, had had the good sense to keep track of the number of these along the way too:

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$C(n)$	0	0	1	1	2	3	4	5	7	8	10	12	14	16	19

It seems that two copies of each $C(n)$ appear in Table 1 intertwined in its even and odd positions with one copy delayed three places behind the other.

Theorem 3: $T(2n - 3) = C(n) = T(2n)$

A specific example revealed the key to proving this. Consider the case $n = 8$, and list all the partitions being counted:

$T(13)$	$C(8)$	$T(16)$
6 6 1	6 1 1	7 7 2
6 5 2	5 2 1	7 6 3
6 4 3	4 3 1	7 5 4
5 5 3	4 2 2	6 6 4
5 4 4	3 3 2	6 5 5

Reverse the entries of the triples of the first column and sum them termwise to the entries of the middle column. This produces a constant sum of 7. Similarly, reversing the entries of the third column and summing them termwise to the middle column produces a constant sum of 8. This suggests correspondences of the form:

$$(n - 1 - c, n - 1 - b, n - 1 - a) \longleftrightarrow (a, b, c)$$
$$\longleftrightarrow (n - c, n - b, n - a)$$

Now it is just a matter of checking that each triple constructed this way is a valid triangle. Details of the students' proof of this can be found in the full-length version of this paper. Thus, to find a formula for $T(n)$ we should focus on the function $C(n)$.

Partition functions. Is there a general formula for $C(n)$? To examine this function the students decided to analyze the difference terms $\Delta(n) = C(n + 1) - C(n)$. "How else is there to analyze a sequence?" But they didn't find the outcome enlightening. "Do it again," someone suggested, noting that the double differences, $\Delta^2(n) = \Delta(n+1) - \Delta(n)$ lead to something striking:

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$C(n)$	0	0	1	1	2	3	4	5	7	8	10	12	14	16	19
$\Delta(n)$	0	1	0	1	1	1	1	2	1	2	2	2	2	3	2
$\Delta^2(n)$	1	-1	1	0	0	0	1	-1	1	0	0	0	1	-1	1

It seems the double difference values repeat in a cycle of length six, suggesting that there must be some relation between the terms $C(n)$ and $C(n+6)$ six places apart. Close examination of the table soon led to the conjecture that $C(n + 6) = C(n) + n + 3$. Attempts to prove this relation however proved fruitless until one student in the junior and senior class had the inspiration to represent partitions pictorially. Represent each term in a 3-partition of a number as a column of equally spaced dots. For example, figure 1 (see page 6) shows the partition 5+4+2 of 11.

Reading across the rows we obtain a multiple-term partition of the number 11 using only 1's, 2's and 3's: $11 = 1 + 2 + 2 + 3 + 3$. Every 3-partition of n yields a diagram with a row of three dots at the bottom (we insisted all terms be positive), and hence a multiple-term partition of n into 1's, 2's and 3's containing at least one 3, or, equivalently, a partition of $n-3$ into small numbers with no restrictions on the numbers of 3's present. Let $P_{123}(n)$ count the number of ways to write n as a sum of these small digits (order irrelevant). We have $C(n) = P_{123}(n-3)$, and the conjecture we're trying to prove translates to $P_{123}(n+6) = P_{123}(n) + n + 6$. Can this form of the relation be proved?

When the going gets tough it is often helpful to take a break, and perhaps take a step backwards. During this lull, some students asked "What's special about 3 here?" and wondered about other partition functions that might be easier to handle. Almost jokingly, one student defined $P_1(n)$ to be the number of ways to write n as a sum of ones, and noted that $P_1(n) = 1$ for all n. The function $P_{12}(n)$, the number of ways to write n as a sum of just 1's and 2's (order irrelevant), is more interesting, and can be handled easily. Since any representation of n of this type can involve at most $[n/2]$ twos (where brackets denote the integer part), we have $P_{12}(n) = [n/2] + 1$.

Thinking along these lines, consider the number of threes that can be present in a representation of n as a sum of 1's, 2's and 3's. There are $P_{12}(n)$ such representations using no threes and $P_{12}(n-3)$ such representations using one three, $P_{12}(n-6)$ representations using two threes, and so on in a cascade down the number of threes used. This led students to a very complicated formula for $P_{123}(n)$. The students in the upper class were able to use this formula to prove that $P_{123}(n+6) = P_{123}(n) + n + 6$, but felt their approach was far from elegant. The students in the younger class, with a little nudging from me, had the insight to start with the term $n+6$ and stop the cascade after two steps: $P_{123}(n+6) = P_{12}(n+6) + P_{12}(n+3) + P_{123}(n)$.

The relation we want to prove now translates to $P_{12}(n+6) + P_{12}(n+3) = n + 6$, which the students were able to prove. So we have finally proved that $C(n+6) = C(n) + n + 3$. The moment of play paid off.

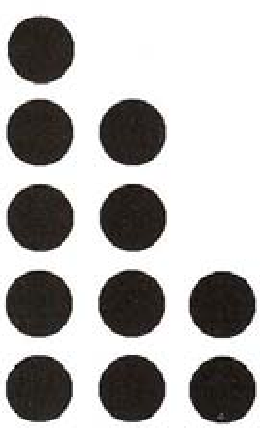


Figure 1: A 3-partition of 11 can be read as a partition of 11 as a sum of small numbers.

Solving for $C(n)$. Making the cycles of six explicit, this formula can be written

$$\begin{aligned} C(6n+a) &= C(6(n-1)+a) + 6(n-1) + a + 3 \\ &= C(6(n-1)+a) + 6n + a - 3 \end{aligned}$$

for a equal to 0, 1, 2, 3, 4, 5. This relation allows us to compute all values of the partition function recursively. By forming a telescoping sum, the students also obtained an explicit formula for $C(6n+a)$—after all, every term in a sequence is the sum of the differences. After some work, we get

$$C(6n+a) = 3n^2 + an + C(a).$$

We would like to express this general quadratic relation in terms of its argument $6n+a$. Writing the right hand side as a polynomial in $6n+a$ and equating coefficients gives

$$C(6n+a) = \frac{(6n+a)^2}{12} + C(a) - \frac{a^2}{12}$$

There are only six possible values for a, and so we can easily write all six equations out. When we did that, we noticed something neat. The fractions being added to or subtracted from the quadratic term are exactly what is needed to round it to an integer! We thus have the general formula $C(n) = \{n^2/12\}$, where the brackets indicate rounding to the nearest integer.

Solving for $T(n)$. Now it is just a matter of putting everything together. Using our formula we get that $T(n) = C(n/2) = \{n^2/48\}$ for n even, and $T(n) = T(n+3) = \{(n+3)^2/48\}$ for n odd.

These are the same formulae presented in [2] and [5], and not a generating function nor partial fraction in sight to get here. We found it amusing to note that with 1,000 toothpicks, one can produce precisely 20,833 different integer triangles. The mind snaps up what the eye and hand can't begin to take in.

To learn more about *The Math Circle*, see our website http://www.themathcircle.org. Also see [4]. ■

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The MathOnline System at the University of Colorado at Colorado Springs

By Gene Abrams

The MathOnline system is a learning delivery method currently in use at the University of Colorado at Colorado Springs that blends traditional mathematics instruction with distance learning. Courses taught using the MathOnline delivery system are standard university mathematics courses. This article briefly describes the program.

The MathOnline classroom environment is in most senses traditional. The only readily apparent difference is that the instructor, rather than writing directly on a chalkboard, writes on a graphics tablet that rests on a podium in the front of the classroom. The images are then projected on a screen. While the in-class students are experiencing a relatively traditional classroom presentation, much is going on behind the scenes. The images from the graphics tablet are simultaneously streamed via the Internet (using the LearnLinc software by Mentergy, Inc). By way of a wireless microphone, the instructor's voice is simultaneously streamed via the Internet. Both the tablet images and the audio are archived for future playback. We do not employ any sort of video broadcast of the instructor or the classroom, although a static picture of the instructor appears alongside the streamed board images. As a consequence, students may choose to physically attend the traditional class on a regular basis, to view the lectures via the Internet on a regular basis (either "live" or afterwards), or to blend these two approaches.

Students who attend the traditional classroom lectures (either regularly or occasionally) are extremely enthusiastic about the MathOnline delivery system. Survey results indicate that nearly 90% of such students, if given a choice, would in future semesters prefer to enroll in a MathOnline-supported section of a course rather than a section in which a traditional blackboard is used. There are three primary reasons for this preference: the archiving feature (and availability of class notes from the Internet); the ability of the instructor to incorporate Internet material and graphics in the classroom; and the ease with which the screen image can be seen from everywhere in the classroom.

The vast majority of our Internet-based distance students fall into one of three groups: advanced high school students who enroll in these courses as 11th or 12th graders, middle school and high school mathematics teachers (or potential teachers), and regularly-enrolled University of Colorado at Colorado Springs degree-seeking students who cannot attend the traditional class sessions for these courses. When asked to rate their overall experience with the course on a scale of 1 to 5 (5 being highest), the average response of Internet-based distance students from Fall 2000, Spring 2001, and Fall 2001 was 3.96.

Students at a distance are required to complete homework assignments on the same schedule as the in-class students. Such work can be submitted either by fax or as attachments to emails. On-site proctoring arrangements are made at the start of the semester in order that Internet-based students can complete exams at a distance. (For the high school students, a teacher or counselor in the school fills this role.)

An initial concern regarding the incorporation of the MathOnline system in our courses was that class attendance would fall as a result of the system's archiving capability. Although exact attendance figures are not kept, instructors have noticed no significant drop in attendance. Indeed, the responses to the following survey question of in-class students (combined Fall 2000, Spring 2001, and Fall 2001 semesters) are illuminating (perhaps surprising?) Suppose that you had easy, free access to all the hardware and software required to view and hear the lectures real time 'at a distance' via the Internet. Would you still choose to regularly attend the live lectures? Yes (306); No (41). When asked to give the single most important reason for this choice, the majority of 'Yes' respondents indicated either " teacher / student interaction," or a response represented appropriately by " ...education is still a largely social experience for me."

Our experience is that once the initial five or six lectures have been presented, a novice MathOnline instructor feels quite comfortable in the new environment. The MathOnline environment affords numerous pedagogical opportunities, including pre-producing lecture notes and graphics, utilizing Internet-based tools, and organizing student group work at a distance. Each of these tasks can consume an enormous amount of instructor time. However, the additional time and effort required (over and above the initial learning curve) to teach a standard course using the MathOnline delivery system versus a standard course with chalkboard delivery is relatively small. Thus, an advantage of the MathOnline blended learning system is that the development costs associated with bringing each new course online are negligible.

Sources of additional information:

The main web page for the University of Colorado at Colorado Springs Department of Mathematics MathOnline Program: http://mathweb.uccs.edu/mathonline/. To ask questions about the MathOnline delivery system, or to request a guest account to view the system, contact mathon@math.uccs.edu. Complete results of the aforementioned student surveys can be found at: http://mathweb.uccs.edu/mathonline/ArticlesandPowerpointPresentations/ListofArticlesandPresentations.htm.

(Portions of this article are excerpted from the article Abrams, G. and Haefner, J., "Blending Online and Traditional Instruction in the Mathematics Classroom: A Case Study", *The Technology Journal*, http://horizon.unc.edu, in press.). ■

Dr. Gene Abrams, Ph.D., is Professor of Mathematics at the University of Colorado at Colorado Springs. Along with his colleague Jeremy Haefner, Abrams co-developed the MathOnline program at UCCS in 1998. He can be reached at abrams@math.uccs.edu.

Internet Resources for Differential Equations

By Henry Ricardo

In recent years, as part of a wave of reform, instruction in ordinary differential equations has experienced a revolution in terms of both content and pedagogy. What once may have been regarded as a "collection of special 'methods,' 'devices,' 'tricks,' or 'recipes,' in descending order of kindness" [1] has gradually evolved to provide experiences that William Boyce has called *conceptualization, exploration,* and *higher-level problem solving* [2]. Technology is being used in an essential way to treat topics graphically, numerically, and analytically.

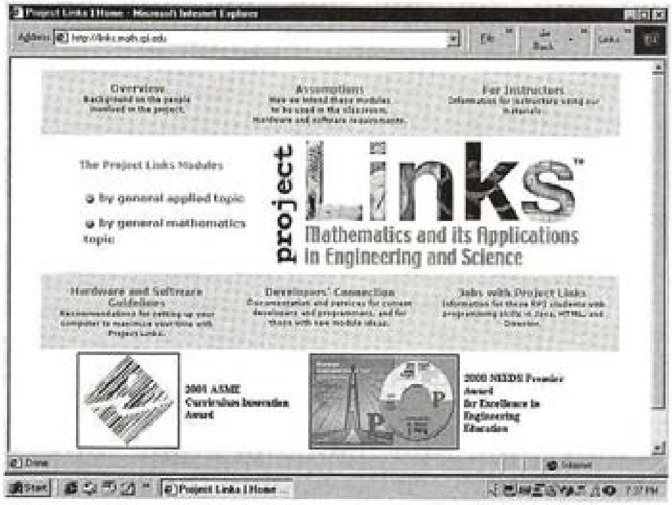


Figure 1: The Project Links home page. Copyright Rensselaer Polytechnic Institue. Used by permission.

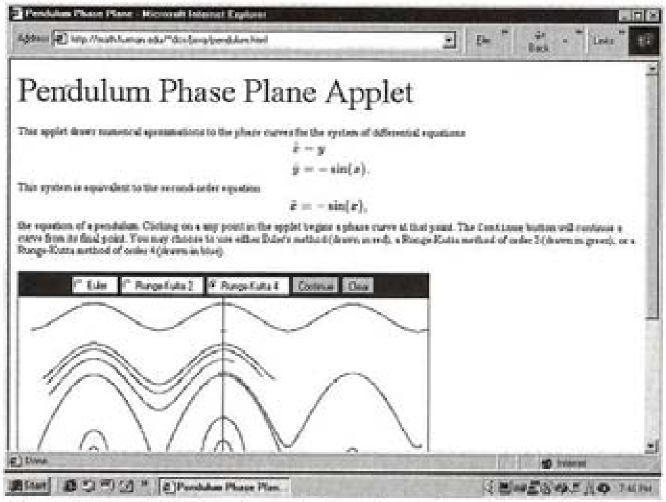


Figure 2: Dan Sloughter's pendulum phase plane applet. Image used by permission of DanSloughter and Furman University.

In particular, the resources of the Internet support this ODE revolution in three important ways: (1) by providing online tools such as Java applets to graph or do numerical approximations; (2) by supplying real-life data for modeling projects; and (3) by making accessible to a wide audience course materials developed by faculty for their own students or for general distribution. This article—which serves as both an updated version of my earlier resource list [3] and a supplement to the recent article [4] by Cooper and LoFaro—will highlight examples of web sites that fit into these three categories. It should be noted that most of the URLs given in sources [3] and [4] are no longer valid—a confirmation of the assertion made toward the end of [3]: "By the time this chapter is published, it will be out of date."

A good place to find lively interactive applications is the *IDEA (Internet Differential Equations Activities)* site at www.sci.wsu.edu/idea/welcome.html. Ranging from bungee jumping to mathematical models of neurons, most of the seventeen activities at this location come with Java applets or *DynaSys* input files. *DynaSys* is a Windows graphics package that can, for example, provide two- and three-dimensional phase portraits. From within some modules, the user can call up a helpful glossary of terms. However, several activities have bugs that will frustrate potential users.

A less ambitious, but perhaps technically more satisfying, set of modules is provided by *Project Links* (links.math.rpi.edu) (see Figure 1). A series of web-based modules designed to be used in both a math and a non-math course, the *Project Links* software is meant to be used with an instructor or teaching assistant in the room. Four modules are ready—Mass Transport, Vibrating Strings, Forced Spring Mass, and Spring Mass—with ten more in various stages of completion. Each complete module has a great deal of ancillary material available at just the click of a mouse.

A third source of plugins is *The New Mathwright Library and Café* (www.mathwright.com). This site is a bit busy; but if you are patient, you can download some nice ODE modules by Margie Hale. There's a simple program that plots solution curves and orthogonal trajectories for first-order ODEs at www.spectronixresearch.com/dosode.

Dan Sloughter at Furman University has developed a nice pendulum phase plane applet (see Figure 2) available at math.furman.edu/~dcs/java/pendulum.html. A rich collection of DOS-based downloadable programs is provided by Arizona Mathematical Software (www.math.arizona.edu/software/uasft.html). The selection includes includes "Are You Ready for Ordinary Differential Equations?", a diagnostic and review program etc.

For population models, a key resource might be a web site associated with the U.S. Census Bureau—for example, www.census.gov, www.census.gov/statab/www/, or factfinder.census.gov/servlet/BasicFactsServlet. A good source for medical information is *PubMed* (www4.ncbi.nlm.nih.gov/PubMed). There is a search engine and good links to related resources, including a free and unrestricted online archive of journal articles. The site www.ugrad.math.ubc.ca/coursedoc/math100/notes/mordifeqs/hiv.html develops a model of an AIDS epidemic in a section of Vancouver, using data gathered from newspaper articles. A Java applet implementing Euler's method is used to produce approximate graphs of solutions.

Then there is a growing treasure trove of materials developed by various instructors and made available through the Internet. An excellent source of ODE wisdom is the (*Consortium for ODE Experiments*) web site, www.math.hmc.edu/codee/main.html. Here you can find back copies of the organization's newsletter (unfortunately no longer published), reviews of popular DE solvers, and links to other ODE pages.

Douglas Meade has developed a set of 35 *Maple* lessons (www.mapleapps.com/powertools/des/des.shtml), most of which have worksheets and/or code that can be downloaded; and his home page contains an eclectic collection of bookmarks (www.math.sc.edu/~meade/bookmarks.html), including ODE and research resources. Gavin LaRose's *DiffEq Resource Page* (www.math.lsa.umich.edu/~glarose/courseinfo/diffeq/), a revised version of a site he developed at Nebraska Wesleyan University, gives 14 *Mathematica* labs, a dozen projects, and some links to ODE resources. The site *Differential Equations: Explorations Through Technology* (www.ualr.edu/~DETECH/Detech.html), developed by Eric Roger Kaufmann and Russell Herman, contains labs using either *MathCad* 6.0 or *Maple V Release* 4. A good potential source of modules is the *Journal of Online Mathematics and its Applications* (*JOMA*, available through the MAA web site or at joma.org). For example, Volume 1, Issue 3 contains two modules—one on world population growth and one on the S-I-R model—both of which include worksheets in *Maple*, *Mathematica*, and *MATLAB*. As a supplement to his textbook, but available to non-adopters as well, Stephen Lynch provides *Maple* commands for each of his chapters at www.doc.mmu.ac.uk/STAFF/S.Lynch/cover1.html. For the most part, the home page of the *Boston University Ordinary Differential Equations Project* (math.bu.edu/odes/) leads to information about the group's textbook, but there are some nice animations and other ODE resources independent of the book. In general, it's likely that a current ODE textbook has a publisher's web site associated with it or a site developed by the author.

In addition to individuals' web sites, there are many general resource pages for differential equations. For example, The *Math Archives* site (archives.math.utk.edu/topics/ordinaryDiffEq.html) yields three pages of links to solvers, graphers, worksheets, projects, labs, animations, and so forth. The differential equations pages developed by *S.O.S. Mathematics* (www.sosmath.com/diffeq.html) provide an entire ODE course (including qualitative aspects) in a brief expository fashion. This site makes good use of color graphics, although there are no accompanying applets.

Finally, an instructor seeking information on a particular topic in differential equations or data for projects can always try a general search engine such as *Google* (www.google.com). For example, entering "Lotka-Volterra equations" or "predator-prey" will bring up a large number of sites arranged in descending order of likely usefulness. Among them is a site offering lecture notes on the original work of D'Ancona and Volterra on fishing in the Adriatic Sea from a Washington University modeling course (www.amath.washington.edu/courses/383-spring-2001/lecture_08.pdf). Similar browsing led me to a nice exposition of the van der Pol equation, presented as an undergraduate research problem (www.gvsu.edu/mathstat/reu/topics/reu_ode.html). With a little time and patience, you can find useful sites ranging from abstracts of doctoral dissertations and conference presentations to instructors' course notes, at both undergraduate and graduate levels. ■

Spring Section Meeting

Metro New York-May 5, 2002—Hostos Community College, Bronx, NY

Michigan-May 10-11, 2002—Lawrence Technological University, Southfield, MI

Northeastern-Joint Meeting with Seaway Section: June 21-22, 2002—Williams College, Williamstown, MA

Pacific Northwest-June 20-22, 2002—Portland State University, Portland, OR

Special Joint Meeting with Northeastern Section: June 21-22, 2002

Future National Meetings of the MAA

MathFest 2002:

August 1-3, 2002, Burlington, VT

Joint Mathematics Meetings 2003:

January 15-18, Baltimore, MD

MathFest 2003:

July 31-August 2, 2003, Boulder, CO

Joint Mathematics Meetings 2004:

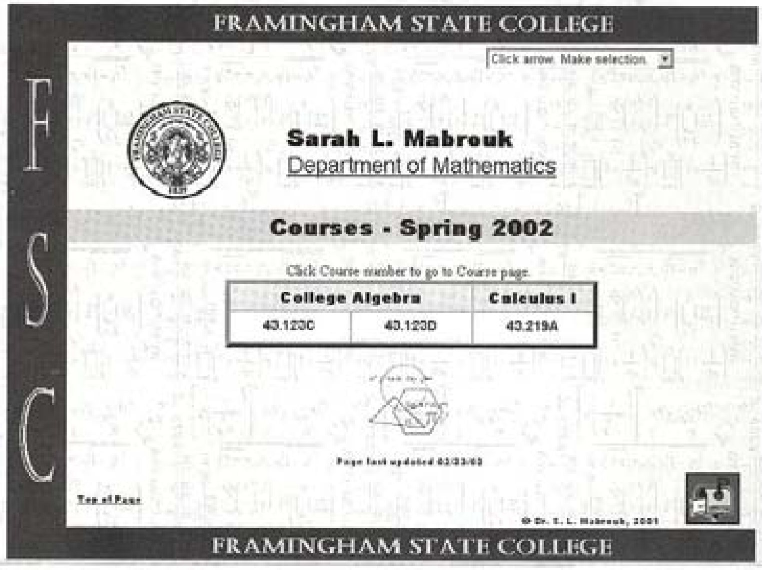
January 7-12, 2004, Phoenix, AZ

Lessons Learned from Having a Course Web Site

By Sarah Mabrouk

Prior to joining the Faculty at Framingham State College, I had never created a web site. After participating in the College's "Web Camp" and a variety of technology workshops, I felt prepared to give it a try. Although using BlackBoard.com might have been easier, I decided to create my web site from scratch: I wanted to choose my color scheme, to design the pages, to organize the information, and to "weave my web."

To get ideas for navigation tools, web site organization, fonts, colors, graphics, and backgrounds, I "surfed" the Web exploring college and university web sites and making note of features and designs that I liked and did not like. After careful consideration, I chose the resources to post on my site: contact, extra help, and course information, my semester schedule, course syllabi, homework, course handouts, solutions for handouts, quizzes, and exams, an assortment of hyperlinks to external and College web sites, and some general information about myself and my professional activities. While there will always be additions and updates to make, I believe that getting students to use the resources on the site is more important than making the web site flashy or involved.



After developing my site for a year, it was time to investigate my students' use of it. I surveyed my students during 2001: Spring, two sections of General Mathematics, one section of Calculus II, and one section of Precalculus; Summer Session, one section of College Mathematics I; and Fall, two sections of General Mathematics and one section of Calculus III. I asked my students about their use of the WWW, general and academic, their use of and attitudes toward my web site, and what they thought a course web site should include.

Student use of the WWW and computers: A couple of my students could best be described as technophobes and several students had limited access to the WWW. Others had never used the WWW for coursework. Some students had used computers only for playing games and writing papers. Several commented that they had used the internet for email, "to check horoscope", for shopping, or for general "surfing". Comments about academic uses of the WWW included obtaining general course information, accessing course syllabi, homework assignments, accessing essay questions and exam questions, searching for sources for research papers, and doing research for assignments, projects, or papers.

Use of my web site: The majority of students used my web site, more in the Calculus sections than in the General Mathematics sections. Those who used the site commented that it was helpful throughout the course. Some General Mathematics students who admitted to not having used the course web site commented that they had heard from others that the web site was helpful and that they wished that they had taken the time to use the web site as well. A few General Mathematics students made comments such as "I don't like web sites or online. I don't like computers," or "I don't know computers well. They scare me. I tend to freeze computers if I go near one." These comments lead me to give my Spring 2002 students a gentle introduction to using the web.

Responses to the question regarding the extent to which the students used the course web site included "I did not [use the course web site] because my computer was not hooked up," and "None! I never really thought about it! I knew it existed, but I completely forgot!" This despite the availability of computer labs and my constant reminders. Since the survey was not anonymous, comparison of course grades and web site usage comments confirmed that the better students used the available materials and resources.

I was pleased that students felt that the materials that I had posted on the web site were helpful. They liked having instant access to my contact information, phone, fax, email, office hours, and semester schedule especially when they misplaced or lost the paper copies that I had given them. They liked having online access to the course syllabus, homework assignments, graded homework assignments, handouts, and solutions. Some even commented that my "General Information" page made me seem more "real" since it provided a "glimpse" of what I do when I am not teaching.

Use of hyperlinks to external web sites: Students had visited some of the web sites to which I provided hyperlinks on the "Other Links" page of my web site. They commented that visiting Tom Banchoff's Artwork Home Page, http://

www.math.brown.edu/~banchoff/art/, and his virtual art exhibit, http://www.math.brown.edu/~banchoff/art/PAC-9603/tour/floor-plan.html, helped them to view mathematics in a new way. Visiting the web sites for mathematics associations (MAA, AMS, AWM, SIAM, and NCTM) was interesting; students were surprised that there are professional organizations for mathematicians. They also found it interesting to visit web sites for mathematics meetings, both local and national.

Students commented that interactive sites such as the Vector Cross Product JAVA Interactive Tutorial, http://www.phy.syr.edu/courses/java-suite/crosspro.html, Taylor Polynomials, http://www2.norwich.edu/frey/TaylorPolynomials/, Quadratic Functions, http://www2.norwich.edu/frey/Math107/parabola/index.html, and Grapher, http://www.ugrad.cs.jhu.edu/~russell/classes/grapher2/, were helpful and useful for concept exploration. They also liked tutorial web sites such as the Armstrong Atlantic State University Mathematics Department's College Algebra tutorial, http://www.math.armstrong.edu/MathTutorial/.

Some students were astonished that there are web sites devoted to the history of mathematics such as the MacTutor History of Mathematics Archive, http://www-history.mcs.st-and.ac.uk/~history/, and the History of Mathematics page in the Math Archives, http://archives.math.utk.edu/topics/history.html. They also enjoyed fun math web sites like Mudd Math Fun Facts, http://www.math.hmc.edu/funfacts/, Ask Dr. Math at The Math Forum at Drexel, http://www.mathforum.com/dr.math/, and CoolMath.com, http://www.coolmath.com/home.htm.

What students asked me to add: Some students suggested that I post my "helpful hints" and my comments about real life applications. Others mentioned that they would like to have fully worked solutions for handouts. Although I am considering this suggestion, I learned from years of putting full solutions on reserve in the College library that only a few students actually use these solutions to check their work. The majority read the solutions right before an exam without ever working the problems on their own. I am likely to decide to post detailed solutions for more challenging problems, especially for upper level courses; currently, my posted solutions are limited to the "final answer" for problems.

There were a couple of requests for a "list of steps for problems" or a set of rules to follow for any situation in a mathematics class. (Is there such a thing?) The request for "suggested uses of the site" is one that I still do not understand. I thought that the purpose and use of the posted materials was straightforward, and that I had included sufficient commentary on how to succeed in the course and how to study mathematics in the course syllabus.

Since many students still do not read their course textbook or their own class notes, I was astonished by suggestions that I post class notes, "lessons," and a summary of class material on my web site. My "favorite" request was that I put the exam problems or a list of irrelevant material on the course web site before the exam so that students will know exactly what to study and "not waste time studying anything that is not important"!

Requests that I post "the answers to the evens in the text" were surprising since I make the instructor's solutions manual available to students. Requests that I post exam and quiz grades as well as student phone numbers cause me concern due to privacy issues.

A student suggestion that I am considering is online quizzes and some sort of online extra credit, maybe a problem-of-the-day, to increase student use of the web site. Online quizzes and a problem-of-the-day might get students in courses like General Mathematics and College Algebra to spend more time in what my colleague Ken Preskenis calls the "math state of mind"; the more frequently and the longer their "visits" to this "math state of mind", the more mathematics they will learn. Anything that gets my students to spend more time working on their mathematics is worth my time and effort. I plan to check out a variety of textbook web sites, since many publisher web sites include online quizzes.

Online office hours and discussion boards: Online office hours appealed more to my students taking courses below the Calculus level than to those taking Calculus II or III. Although I am not sure how I would conduct online office hours, I like the thought of having extra contact hours with my students. Students commented that they liked my efforts to accommodate their various schedules as I do by making appointments. Some commented that the online office hours would not be the same since "the professor would not be right there writing upside down" as we worked the problems together, that they liked "working together in person", and, surprisingly, that "the prof. would get less time off". Some concerns about using a course discussion board included difficulty in judging the reliability of the information, a preference for face to face contact, and not feeling comfortable "talking to fellow students about my weaknesses in math".

So, what lessons have I learned from my web site? First, creating and maintaining a web site takes a lot of time. I have made many format, color, background, and organizational changes since I posted my site on the WWW in September 2000. Second, although a web site can be a valuable resource for students, the web site has to be a labor of love and a project that you do for fun. My web site is an outlet for my artistic side and provides great opportunities for gaining new computer skills and for learning new software. Third, the web site will never be finished. It has taken on "a life of its own." The next phase of my web site "project" is creating interactive modules. Perhaps the greatest ongoing lesson is that students know when you care and they appreciate your interest in their learning, your efforts to help them, and your delight in their improvement and their success. So, enjoy your students and invest your time and your efforts in them—remember that others invested time and effort in you. ■

Sarah L. Mabrouk is an Assistant Professor at Framingham State College in Framingham, Massachusetts. She welcomes your comments and your suggestion for additions and improvements to her web site, http://www.frc.mass.edu/smabrouk.

An Urgent Call to Improve Traditional College Algebra Programs

By Don Small

Traditional College Algebra is not working. That was the strong consensus of the participants in a recent Conference to Improve College Algebra, held at the U. S. Military Academy, February 7-10, 2002. The Conference, supported by the HBCU Consortium for College Algebra Reform, was organized by the MAA's Task Force on the First College-Level Mathematics Course. The forty-five educators from twenty-seven states represented diverse educational experiences and positions. Seven invited speakers provided the background and challenges for breakout groups to define major issues, create visions, and develop recommendations to enhance college algebra programs. Scott Snook (U.S. Military Academy and Harvard Business School) opened the Conference by discussing why organizational change often fails. The keynote speaker, Arnold Packer (Senior Fellow and Chair of the SCANS 2000 Center at Johns Hopkins University's Institute for Policy Studies) presented a view of how revamped college algebra programs could address the quantitative needs of citizens, consumers, and producers. Mercedes McGowen (William Rainey Harper College) and Steve Dunbar (University of Nebraska) drew upon the 2000 CBMS survey and long-term studies at their individual institutions to examine demographic profiles of students in college algebra and precalculus. John Dossey (Illinois State University) traced the historical development of College Algebra and then discussed the Pacesetter math program. "Quantitative Literacy and College Algebra" was addressed by Bernie Madison (University of Arkansas and MAA) and Dennis Davenport (NSF) spoke on "Managing Change and Financial Support Opportunities."

College Algebra, according to the 2000 CBMS survey, currently has the largest enrollment —approximately 400,000 students (Fall, 2000)—of any credit bearing mathematics course, the total number being approximately equal to the combined enrollments in all calculus courses. In 1980 College Algebra enrollment was only 73% of the combined calculus enrollments. Although the enrollment in College Algebra is large and continues to grow, the role of College Algebra in the mathematics curriculum is very unclear. A traditional understanding of the role of College Algebra (along with Precalculus) is that it will launch students into calculus; but less than 10% of College Algebra students enter Calculus I. Furthermore, the combined enrollments in College Algebra and Precalculus have grown approximately 32% since 1980 while the Calculus I enrollments have remained relatively constant.

The pragmatic reason most students take College Algebra is to fulfill a college or state requirement. As a result, the course is the terminal mathematics course for many students. What then should the content be? Participants in the Conference rejected the traditional content—factoring linear and quadratic polynomials, radicals, absolute value, determinants, Cramer's rule, etc.—with its emphasis on algebraic manipulations. Such a list does not seem suitable for a last mathematics course. One participant commented, "Interpreting data has become more important than manipulation of algebraic skills that can be computerized." Another, who is a Dean of Science and Mathematics, said, "Traditional College Algebra is a boring, archaic, torturous course that does not help students solve problems or become better citizens. It turns off students and discourages them from seeking more mathematics learning."

The high FDW rate—percentage of students receiving grades of F or D or withdrawing—is a major reason for the claim that traditional College Algebra is not working. Several studies have reported FDW rates in the 40% to 60% range. Although no national studies have been conducted, these FDW rates are generally accepted as being typical. Thus, College Algebra blocks academic opportunities and plans for approximately 200,000 students per semester. Participants agreed that we should not accept this constraint of human potential or ambition.

Many factors contribute to the FDW rate —high school preparation, placement, content, attitude, pace, pedagogy, etc. Noteworthy, however, is the fact that several improved College Algebra programs have succeeded in lowering FDW rates by 15 to 25 percentage points while reversing the negative attitudes of students towards mathematics. Students in these programs were drawn from the same pool and were subject to the same placement as students in the traditional sections. The difference was the content and the pedagogical focus.

The vision espoused at the Conference is to create programs that empower all students to become confident problem solvers. These programs, motivated by real-world problems, address the quantitative needs of other disciplines as well as those for citizenship and the workplace. They incorporate strong communication components and employ technology to enhance conceptual understanding and computing. These programs should also prepare and encourage students to take additional quantitative courses.

The Conference participants recommend the following as major characteristics of a College Algebra program:

A base of real-world problems: a topic is introduced through a real-world problem and then the mathematics necessary to solve the problem is developed. Example problem: Schedule a multi-faceted process.

Modeling (transforming a real-world problem into mathematics):—using power and exponential functions, systems of equations, graphing, and difference equations—primary emphasis is placed on creation of a model and interpretation of the results. Example: Model the stopping time versus speed data presented in a driver's manual by plotting the data and fitting a curve to the plot. Interpret how well the resulting stopping time function models reality at small speeds. Revise the model, if necessary, to account for zero stopping time at zero speed. Use the (revised) function to predict stopping times for speeds not given by the data. Revise the model to account for different road surfaces.

Emphasize communication skills as needed in society as well as in academia — reading, writing, presenting, and listening. Example: Students learn how to read, understand, and critique news articles that include quantitative information and to make informed decisions based on the articles.

Small group projects involving inquiry and inference. Example: Analyze the soda preference of students by conducting a survey and comparing the results with data from the school's dining hall or a local fast food restaurant.

Appropriate use of technology to enhance conceptual understanding, visualization, inquiry, as well as for computation. Example: "What-if" a model for paying off a credit card debt by changing the monthly payment, interest rate, size of debt, etc. Plot the results to visually compare the different scenarios.

Student centered rather than instructor centered pedagogy: hands-on activities rather than all lecture.

Collaboration with faculty in other disciplines and with representatives from the workplace is important to the improvement of College Algebra and in on-going assessments of the program. This collaboration helps ensure that content will align better with student interests and needs — something that is often lacking in the traditional College Algebra program. This collaboration also establishes bridges to other disciplines that enhance embedding qualitative literacy throughout the academic program.

In the final analysis, curricula and syllabi are local in nature, as is the means for implementing change. Thus, the task of everyone involved with College Algebra is to engage colleagues, administrators, and local business people to improve the role of College Algebra in our educational system and in the effectiveness of the present programs. ■

Don Small teaches at the U. S. Military Academy at West Point.

NSF Beat

By Sharon Cutler Ross

New Program

Efforts to increase the number of undergraduate majors in mathematics and science-based fields range from those of individual professors and departments to national projects. The National Science Foundation (NSF) has recently announced a new program initiative in this area. The Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP) aims to increase the number of US citizens and permanent residents receiving associate or bachelors degrees in mathematics, engineering, or other science. As is common with new programs, the funding available for the first year, approximately $5 million, will restrict this year's grants to planning and pilot efforts.

Full proposals are due by 3 June 2002; FastLane submission is required. Projects may involve a single institution of higher education, a consortium of institutions, or collaboration of an institution with business partners. In the case of associate-degree granting schools where degrees are not granted in all science, engineering or mathematics (STEM) fields, the school must demonstrate a record of articulation with STEM baccalaureate programs. Collaborative efforts are encouraged.

A proposal may focus on a subset of STEM fields, but must not gain enrollment in these fields at the expense of other STEM majors. Appropriate proposals might include one or more of the following aspects:

* ways to increase the number of students from underrepresented groups in STEM majors;
* bridge activities for students not fully prepared to succeed in STEM majors;
* improvements in the quality of student learning through innovative teaching methods and through the thoughtful use of technology;
* co-operative programs with industry or government that provide internships or part-time employment;
* interdisciplinary approaches to STEM undergraduate education; or
* other innovative ways of achieving STEP goals.

The NSF anticipates making 10-15 awards for 2-3 year projects in this first round of STEP awards. Cost sharing will not be required. The maximum award level is related to current institution enrollments and duration of the project. In addition to the customary review criteria for NSF Division of Undergraduate Education proposals, STEP proposals will be evaluated for overall vision of the institution to achieve a substantial increase in STEM enrollments, justification of the likelihood of proposal success, reasonable benchmarks for progress, and probability of across-the-board increase in STEM students. For further details, consult http://www.nsf.gov/pubs/2002.

CCLI

The Course, Curriculum, and Laboratory Improvement (CCLI) program now comes in three flavors: Educational Materials Development (CCLI-EMD), National Dissemination (CCLI-ND), and Adaptation and Implementation (CCLI-A&I). Program solicitations for EMD and ND proposals are currently available with a submission deadline of 30 June 2002. The solicitation for A&I proposals is being developed with an anticipated submission deadline of December 2002. All three tracks encourage collaborative efforts of two- and four-year institutions.

EMD projects may either demonstrate the feasibility of an idea or prototype or develop fully a product or practice. Materials developed are expected to be disseminated nationally. ND projects should focus on professional development opportunities on a national scale. These opportunities should help faculty incorporate new content into courses and explore effective teaching practices. A&I proposals should be designed to improve STEM education through the adaptation and implementation of exemplary materials or practices developed and tested at other institutions. More information may be found at the NSF website http://www.nsf.gov. ■

This is the first of a series of columns on funding opportunities.

Two-Year College Mathematics Programs At the Millennium

By Stephen B. Rodi

Once every five years since 1965, two-year colleges have participated in a survey of collegiate mathematics programs in the U.S. sponsored by the Conference Board of the Mathematical Sciences (CBMS) with support from the National Science Foundation (NSF). This article highlights some interesting facts about mathematics programs in two-year colleges taken from the CBMS2000 survey, conducted in fall 2000. The entire survey is available in print from the American Mathematical Society or online at http://www.cbmsweb.org.

For fall 2000, the survey was managed by professional statisticians in the survey unit at The University of North Carolina (Chapel Hill) who determined a stratified sample of 300 two-year colleges to receive the survey instrument from a nationwide universe of 1053 two-year colleges. Of the 300, 179 (60%) returned the survey, from which national figures were projected. The CBMS Survey Committee used these projections in its regular five-year report/analysis.

For more information about the survey and its findings as they pertain to two-year colleges, contact Stephen Rodi, Associate Survey Director for Two-Year Colleges, at srodi@austin.cc.tx.us.

The Faculty

In fall 2000 there were 7000 full-time permanent faculty members in mathematics programs in two-year colleges in the U.S. This was an 8% drop from fall 1995. Another 960 individuals taught as temporary full-time faculty, an almost 600% increase (yes, six-fold) from 1995.

Of the full-time permanent faculty members in mathematics, 49% were women. This was the first time in 35 years of surveying that the proportions of men and women among the full-time permanent faculty were essentially equal.

Of the full-time permanent faculty members, 13% were ethnic minorities. Ethnic minorities made up a higher proportion (20%) of the full-time permanent faculty under age 40 than they did of the full-time permanent faculty as a whole.

The median age of the full-time permanent faculty in two-year college mathematics programs was 48. The average age rose slightly since 1995, from 47.2 to 47.6. The proportion of the full-time permanent faculty over age 54 rose to 27%, up from 18% in 1995.

The number of part-time faculty (over 15,500 when including about 750 part-time faculty who teach dual-credit courses and are actually paid by outside sources like school districts) was more than double the figure for full-time faculty and made up 69% of all mathematics faculty in two-year college programs. The proportional size of the part-time faculty, which had remained steady at 65% in 1990 and 1995, rose by 4 percentage points in fall 2000.

Of all course sections in mathematics programs, 46% were taught by part-time faculty members. In addition, 52% of full-time permanent two-year college mathematics faculty members taught extra hours for extra pay at their own college, class sections which otherwise would have required additional part-time faculty teaching.

The part-time faculty teaching percentage varied by type of course, with part-time faculty members teaching 58% of remedial courses and 15% of mainstream calculus courses. The first number rose by 11 percentage points between 1995 and 2000, and the second dropped by 2 percentage points.

Selection patterns for the 572 new full-time permanent faculty hired academic year 2000-2001 showed unexpected characteristics. Only 13% of new hires had a doctorate as compared to 19% in 1995-1996. Only 8% were hired directly from graduate school compared to 30% in 1995. The percentage of new hires chosen from current part-time or temporary faculty nearly doubled to 34%. The percentage of new hires whose terminal degree was a bachelors jumped dramatically from 1% for academic year 1995-1996 to 19% for academic year 2000-2001.

Enrollment

Enrollment in mathematics and statistics courses taught *within* mathematics programs at two-year colleges *dropped* from 1995 to 2000 by 7.5%, even though over-all enrollment in two-year colleges had risen 2% from 1994 to 1998, according to the most recent confirmed over-all enrollment data available from the Department of Education.

(Remediation programs managed *separately* from the mathematics program — for example, in a developmental studies division—are not included in this figure either for CBMS1995 or for CBMS2000. In fall 2000 there were 1,347,000 enrollments in two-year college mathematics program with another 118,000 enrollments in mathematics courses not part of the mathematics program. These latter were mostly enrollments in remedial mathematics courses in separate developmental studies departments.)

Two-year and four-year schools each ended the decade with mathematics enrollments at 1990 levels. But they followed very different paths to this result. Four-year enrollments fell from 1990 to 1995 and rebounded in 2000 to their earlier levels. Two-year mathematics enrollments rose sharply from 1990 to 1995 but by 2000 had fallen back to 1990 levels.

Enrollment in mathematics courses outside of the mathematics program (e.g., in a developmental studies department) continued to decline and at a rate faster than overall mathematics program enrollment (23% versus 7.5%).

Enrollment in remedial classes accounted for over half (55%) of mathematics program enrollment in two-year colleges. (This figure includes only remedial courses supervised by a mathematics program, not remedial enrollment in separate developmental studies programs.)

Remedial level courses, which lost 37,000 enrollments, accounted for the largest segment of the mathematics program enrollment decline. This was an almost 5% remedial mathematics enrollment drop within mathematics programs from 1995 to 2000.

A new course to which some *college algebra* enrollment likely migrated since 1995 is Introductory Mathematical Modeling. It was offered in fall 2000 at 12% of two-year colleges.

The calculus segment, which includes both mainstream and non-mainstream calculus, had the largest *percentage* enrollment decrease (18%) from 1995 to 2000. This decline was 23,000 students. Non-mainstream calculus was particularly hard hit with a 38% drop in enrollment in the first term course. ("Mainstream" refers to the calculus courses which lead on to more advanced mathematics courses such as Differential Equations, and are taken by, among others, engineering, physics, and science majors.)

Mathematics courses showing enrollment percentage increases from 1995 to 2000 were Elementary Statistics (3%), Mathematics for Liberal Arts (13%) and Mathematics for Elementary School Teachers (12.5%). These were the only courses to show increases.

Only 14% of two-year college mathematics programs offered a high-school-level geometry course in fall 2000, a 3 percentage point drop since 1995. This reflects a steady decline in geometry enrollment at two-year colleges. In 1970 high school level geometry was offered by 24% of two-year colleges and in 1980 enrollment reached a peak of 12,000 students.

Placement, Pedagogy and Curriculum

Virtually all two-year colleges with mathematics programs offered diagnostic or placement testing. About 98% had a mathematics lab or tutorial center. Locally written placement test materials were used in 99% of colleges while commercial tests came from American College Testing (ACT), the Educational Testing Service (ETS) and a variety of other test providers. The first two commercial sources were used, respectively, by 30% and 34% of two-year colleges.

On a comparative level, in fall 2000 two-year colleges were much more likely than four-year colleges or universities to require placement testing of their entering or first-time students (98% versus 49%) or to enforce mandatory course placement based on the test (67% to 47%). The gap also is large with regard to a required visit with an advisor before enrolling in a mathematics course, 79% at two-year colleges and 60% at four-year colleges.

In fall 2000, the average section size in two-year college mathematics courses continued the downward trend begun ten years earlier, ending the decade with an average section size of 24 students. The average section size in 1995 was 26 and in 1990 was 28 students.

The predominant instructional modality continued to be the standard lecture method. However, the graphing calculator was widely used in all courses beginning with College Algebra. For College Algebra, the percent of course sections using graphing calculators nearly doubled to 74% in the period from 1995 to 2000.

The percentage of sections in all three levels of mainstream calculus using group projects and writing components increased, although the rate of increase was not as great as was seen between 1990 and 1995 earlier in the reform movement. In these three courses, the use of graphing calculators rose from 1995 levels by 13 percentage points, 11 percentage points, and 6 percentage points, respectively.

Fewer than 1% of mathematics class sections were offered via television in 1995 and only 2.5% in 2000 were described as using distance learning. Among high enrollment courses, College Algebra had 6.7% of sections offered via distance learning and Elementary Statistics had 5.8%.

During the two-academic-year periods of 1999-2000 and 2000-2001, 65% of all two-year colleges offered a pre-calculus/elementary functions course, a nearly twenty percentage point increase compared to 1994-1995 and 1995-1996. The percentage of two-year colleges offering a combined college algebra/trigonometry course during that same two-year period almost doubled to 32%.

Half of two-year colleges offered a special mathematics course for pre-service K-8 teachers in either academic year 1999-2000 or 2000-2001. Fewer than a quarter assigned a faculty member to coordinate pre-service K-8 teacher education.

In comparison to 1995, in fall 2000 an increasing percentage of two-year colleges, but still less than 50%, offered specialized courses such as Linear Algebra, Mathematics for Liberal Arts, and Mathematics for Elementary School Teachers.

Other Issues

In fall 2000, *dual enrollment* courses—courses often taught on a high school campus by a high school teacher and for which a student received both high-school and college credit —made up 14% (1726 of 11,995) of all college algebra, precalculus, and calculus course sections at two-year colleges. About 61% of two-year college mathematics programs reported full control over the selection of instructors for dual enrollment courses.

The number of institutions and mathematics programs requiring some form of continuing education or professional development for full-time permanent faculty almost doubled from 20% in 1995 to 38% in 2000.

In fall 2000, a traditional mathematics or mathematics/computer science department structure was found in fewer than half (43%) of the two-year colleges with mathematics programs, and 10% of these were multi-campus departmental arrangements. More common was a division structure, where mathematics program administration was combined with science or other disciplines.

In 29% of two-year colleges, remedial/developmental mathematics courses were administered separately from the mathematics program. This was almost exactly the same percentage as in 1995.

	Fall 2000	Multiplier	Academic 2000-2001 Estimated
4-Year Math Dept	1,785,000	1.84	3,284,000 (including stat)
4-Year Stat Dept	74,000	2.18	161,320
2-Year Math Program Plus Outside Program	1,465,000	2.01	2,944,650
Grand Total Academic Year			6,389,970
Ratio of Two-Year College to Total			46%

For the first time, in fall 2000 essentially all full-time permanent faculty had a computer or terminal in their office, up to 99% from 76% in 1995. On the other hand, there was an 8 percentage point increase, up to 51%, in the number of part-time faculty who needed to share a desk with two *other* people (that is, three or more faculty using the same desk on a rotating schedule).

More mathematics program heads (62%) classified too much need for remediation as the most important problem faced by their mathematics program. Low student motivation and the need to use too many part-time faculty were second and third.

Academic Year Total Mathematics Enrollment in Two-Year Colleges

The CBMS2000 report contains a section on the ratio of academic year enrollment to fall enrollment for various kinds of schools. In 1995 and earlier, this was taken to be "2." Double the fall to get academic year. There seems to have been a significant change in that regard, especially for four year schools, in fall 2000, as a result of almost all schools moving to a semester (rather than quarter) system between 1995 and 2000. The multiplier respectively for academic 1999/2001 as reported in CBMS2000 are:

Four Year School Math Departments:	1.84
Four Year School Stat Departments:	2.18
Two Year School Math Programs:	2.01

The following calculates a mathematics and statistics (but not computer science) total academic year enrollment based on the fall 2000 data, using the multiplier above. It includes mathematics and statistics taught in math departments, statistics taught in statistics departments, and (for two-year colleges) mathematics courses (mostly remedial) taught outside of math programs (e.g., in developmental studies departments). Fall enrollment numbers can be found in the printed CBMS2000 report in Table SE.1, except for the "outside program" enrollment number for two-year colleges which is in Table TYR.15.

CBMS and the Survey Committee especially thanks the two principal collegiate undergraduate mathematics professional organizations for their help in gathering survey data, namely, The American Mathematical Association of Two-Year Colleges (AMATYC) and the Mathematical Association of America (MAA).■

Stephen B. Rodi teaches at Austin Community College. He is the CBMS Associate Survey Director for Two-Year Colleges.

New MAA Section Governors for 2002

Allegheny Mountain	Thomas Keagy
Indiana	Roger B. Nelson
Kentucky	Rodger Hammons
Metro. NY	Raymond N. Greenwell
Nebraska-SE S.Dakota	John Fuelberth
Northern California	Leonard F. Klosinski
Oklahoma-Arkansas	Lisa Mantini
Rocky MOuntain	Hortensia Soto-Johnson
Wisconsin	Richard L. Poss

A Correction

The notice on the Annual Conference on Research in Undergraduate Mathematics Education (page 13 in our April issue) included an incorrect URL. The correct reference is http://www.math.ilstu.edu/~jfcottr/rume2002.html.

Short Takes

Demos with Positive Impact

Demos with Positive Impact is an NSF-sponsored project to connect undergraduate mathematics instructors with effective instructional demonstrations. Every experienced mathematics instructor has a tool kit of classroom demos that they have found help their students. The web site at http://www2.gasou.edu/facstaff/lroberts/demos has a collection of such demos that use a variety of technologies and platforms and that can be used for a variety of courses and levels. The collection was put together by David R. Hill of Temple University and Lila F. Roberts of Georgia Southern University. They invite you to use the collection, provide feedback on the site's contents, suggest topics you would like to include in the collection, and submit your favorite demos to share with the mathematical community.

Harvard Math Club Celebrates Pi Day

At 3:14 PM on March 14, the Harvard University Math Club held its second annual Pi Day celebration. The main event was a pie-eating contest in which Harvard faculty and students competed. The winner, Phil Matchett, ate exactly two pounds of pie in 3 minutes and 14 seconds. Sarah Moss, co-president of the Harvard Math Club, hopes to inspire similar events at other universities. For more photos of the event, visit http://modular.fas.harvard.edu/pics/ascent9/03-14-02-PIE_DAY/.

Pie Day at the Harvard Math Club.

Slates, Slide Rules, and Software: A Correction

The notice on the new Smithsonian exhibit on mathematics teaching devices (page 7 in our March issue) included an incorrect URL. The correct reference is http://americanhistory.si.edu/teachingmath/index.htm. The exhibit will be on view at least until mid-August.

Heinz-Otto Kreiss wins NAS Award

The National Academy of Science Award in Applied Mathematics and Numerical Analysis was awarded to Heinz-Otto Kreiss of UCLA. The citation says that Kreiss received the award "for his seminal contribution to the understanding of differential and difference equations and for his many outstanding contributions to numerical analysis, fluid dynamics, and meteorology." The award, which is awarded approximately every three years, was established by IBM and has been presented since 1972.

Proof Movie on the Way

Reports from Hollywood say that Miramax will be making David Auburn's Pulitzer prize-winning play, *Proof*, into a movie. Initial information was that the director had decided not to use any of the members of the Broadway cast in the movie version, which caused some controversy. Given the success of *A Beautiful Mind*, expectations are high that another movie about mathematics and mental health will mean another hit.

Concerns About Teacher Preparation Continue

Issues of teacher preparation, including both professional development and the education of pre-service teachers, continue to have a high profile in the news. According to the Pittsburgh Post-Gazette, about 43% of teachers failed the "content knowledge" portion of Pennsylvania's math test, and about a third failed the math portion of the "pre-professional skills" test. Due to the shortage of mathematics teachers, this may lead to a decision to make the tests easier. Similar stories are heard throughout the country. The New York Post reports that New York City is thinking of spending $9 million over three years on professional development for mathematics teachers, in part because too many of the city's current teachers had no mathematics training in college.

Bridges: Mathematical Connections in Art, Music, and Science

The fifth annual international conference on Mathematical Connections in Art, Music, and Science will be held at Towson University in Maryland from July 27 to 29. The conference will focus on a wide range of topics connected to mathematical visualization, mathematics and art, and aesthetic connections between mathematics and the humanities. The conference will include an art exhibit, a poster session, and other special events. More information about the conference can be found at http://www.sckans.edu/~bridges/. Proceedings of past Bridges conferences are available through the online store http://mathartfun.com.

Conference on Research in Mathematics Education

The SIGMAA on RUME will be holding its sixth conference in Burlington, VT on July 30 and 31, the two days preceding MathFest2002. By scheduling its annual conference next to MathFest, the organizers hope to allow more people to attend both conferences. The conference is a forum for researchers in collegiate mathematics education and includes a wide range of themes. The program will include plenary addresses and a panel discussion, general paper sessions, contributed paper sessions, and poster sessions. For more information, visit the conference web page at http://www.math.ilstu.edu/~jfcottr/rume2002.html.

Returning Home

By Randall J. Swift

Sights, sounds, and scents are among the most powerful ways to invoke memories. The science building at California State Polytechnic University, Pomona has not changed since I was an undergraduate. The familiar is very comforting, and the fact that the building has remained the same since at least the mid-80s is very reassuring.

Randall J. Swift in his office at Cal Poly.

As an undergraduate, I set my career goal to become a mathematics professor. The faculty in the mathematics department at Cal Poly were my role models. Not only were they excellent lecturers who taught exciting courses, but they also gave me advice and guidance. Many students, including myself, spent hours in faculty offices, doing mathematics or just discussing life. Their open door policy and warm friendliness added richness to my undergraduate experience. My goal was to become a mathematics professor who would be to students like the Cal Poly faculty was to me.

While in graduate school in the late 80s, there were numerous indications that academic employment was going to be easy to obtain. I clearly remember reading articles discussing the forthcoming retirements of science and mathematics faculty hired during the space race of the 1960s. Spurred on by Sputnik, these faculty members were part of the country's push to catch up in the space race.

We could not foresee the changes that were soon to take place. The collapse of the Soviet Union, changing national and academic priorities, and the difficult economic conditions of the early 1990s changed academic employment prospects. Some faculty were opting not to retire. Colleges and universities were freezing positions and not hiring, or were hiring temporary faculty. The California state system of universities had a general hiring freeze.

The optimism that I and other graduate students felt at the time was soon replaced by a sense of desperation and despair. After spending years studying and preparing for careers in mathematics, we were not able to find positions. It didn't seem fair.

The poor hiring conditions lasted from 1990 to about 1996 or so, but the effects of this hiring crisis can still be felt today. There is a generation of misplaced mathematicians, as many of us found ourselves in positions we had not considered.

I finished my PhD in 1992, and the job market was tough—not as difficult as some of the years to follow, but still a rather tight market. I was very fortunate. I was offered a tenure-track position at Western Kentucky University, which is a large regional state university in south central Kentucky. Although I would have preferred to stay in California, I had to pursue my best opportunity.

Having grown up in southern California, my adjustment to southern Kentucky was not trivial, to say the least. However, the faculty in the mathematics department were friendly and the department head was very supportive. I was encouraged to pursue my mathematical interests and teaching ideas. I soon found my stride there and began to make a career.

Times change, as do university administrations. During my eighth year, well after promotion and earning tenure, I began to wonder if the current direction of my career was where I wanted it to go. As fate would have it, Cal Poly was hiring.

A position at Cal Poly would be a huge change for me professionally and personally. While it would increase my opportunities in the profession, it would also uproot my family. I had to weigh the decision carefully. After many long discussions with my wife and very careful consideration, I decided to apply. I had to take the chance at the opportunity.

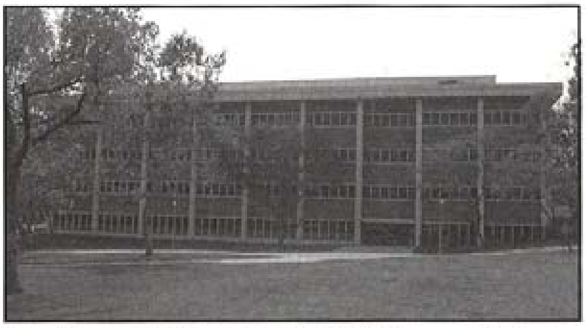
I was delighted and scared when the call came for an interview. Having served on hiring committees and being in the profession for many years, it was difficult to imagine being on the other side again —having to compete for a position. The difficulty was compounded by the fact that these were my former professors. What if I did a poor job at the interview? What would they think of me? How would I handle them rejecting me?

It turned out better than I had anticipated. Not only was I offered a position, but also one with rank and tenure. This wonderful situation could not have come about without the opportunities that Western Kentucky University gave me. It was through my hard work and Western Kentucky's support that Cal Poly viewed me in such a positive manner.

As my first year on the faculty at Cal Poly has progressed, things have been interesting, joyful, and at times difficult. The move from Kentucky to California was a trial, to say the least. It goes without saying just how tough the housing situation is in Southern California.

Time has also brought change to the faculty in the department at Cal Poly; many of the faculty I knew have retired or passed away. However, many are indeed still there. It has been fun and interesting to see them as colleagues and to share time with them in departmental meetings. Some of my student perceptions of them are right on when it comes to their behaviors, while at other times I have been completely surprised.

The faculty have accepted me as a colleague. I was concerned that I would be viewed as "the former student." But, time and my experiences have added richness and depth to the relationships. I have thoroughly enjoyed their company.



The Science Building at the Cal Poly Campus. Photo by Randall J. Swift.

The return to California has also brought a nice boost to my research program. Not only do I have colleagues in the department who have similar mathematical interests, but also my PhD advisor, M. M. Rao is 30 miles away at the University of California, Riverside. Several unexpected opportunities have also arisen, including interesting collaboration with mathematics education faculty.

Teaching has been a real joy. The department has a wide range of offerings and a strong Masters program. Generally, the students are strong mathematically and are interested in mathematics. I also have the distinct advantage of having taken most of the courses in the department. I thus have the perspective of both the students and the faculty.

As the students have come to know me, I have found them in my office more frequently. Often, I will have four or five of them there, working on mathematics, asking advice, or just hanging out discussing life.

Each day, as I enter the science building, I get a sense of déjà vu. The sights, sounds, and scents take me back to the mid-80s. I see my colleagues and students, and my senses are flooded with the familiar. I have the feeling that I have come full circle and am now home. ■

Randall Swift's research interests include nonstationary stochastic processes, probability theory and mathematical modeling. He is a co-author of the MAA text A Course in Mathematical Modeling. *His non-mathematical interests are mainly focused on his wife and three young daughters, but, when he has the time, he enjoys collecting odd bits of plastic (primarily R&L cereal premiums), history, listening to public radio, the Blues, cooking and baseball.*

Mathematics Books on MAA Online and MathDL

By Fernando Q. Gouvêa

Some people say that the advent of the World Wide Web will mean the end of books. I hope they're wrong. I like to be able to carry my books around, write in the margins, feel the paper on my fingers. I love looking at my shelves and seeing the colorful mix of volumes sitting there. And I appreciate the fact that we know that books can last hundreds of years.

That love for books is, I think, widely shared in the mathematical community. That is one reason why both MAA Online and MathDL, while including lots of material designed for the internet (from *JOMA* to *Cut the Knot*), also pay a lot of attention to books. On MAA Online, this is most visible in the *Read This!* column, which runs reviews of recent books. On MathDL, it shows up in the *Catalog of Commercial Materials*, whose goal is to catalogue a wide range of products of interest to mathematicians, including books (and textbooks in particular).

Read This! tries to cover recent books that we think would interest many members of the MAA. We cover books aimed at the general public, expository and historical books, books on teaching mathematics, and other books that we think deserve some attention. We don't usually review textbooks, except when they are so innovative or different or exceptionally good that we can't hold ourselves back. (Often such reviews come from reviewers who have fallen in love with a book.) Since we receive recent books from many different publishers, we are somewhat selective. On the other hand, since we are online, we can publish more reviews and do it more promptly than most print publications.

Recent reviews on *Read This!* include a book on the statistical study of baseball, a collection of problems in analysis, a philosophical introduction to probability and statistics, a collection of articles on combinatorics, a historical book on mathematics funding in the 20th century, the story of a brilliant young woman mathematician, and an expository book about highlights of the last two millennia of mathematics. You can find Read This! at http://www.maa.org/reviews/reviews.html.

The MathDL *Catalog of Commercial Materials* is still in development. When complete, it will cover textbooks, software, and even graduate programs. As I write, it already contains an extensive list of textbooks, with lots of information on each: the table of contents and preface, reviews of the book, links to the publisher's site, and often other things too. When you set out to choose a textbook for a course, this site is a useful tool. (As it becomes more complete, it'll be an essential tool.) You can find the *Catalog of Commercial Materials* at http://www.mathdl.org/lcp/.

Both MAA Online and MathDL will continue to pay attention to books. Come visit and tell us what you think. ■

The Curriculum Foundations Workshop in Computer Science

By Allen Tucker

Curriculum development has been an obsession for the computer science education community during the last four decades, due to the enormous and rapid rate of evolution that has occurred in the discipline itself. During this period, the Association for Computing Machinery (ACM) has developed various curriculum standards for undergraduate programs, first in 1968, and then again in 1978 and 1991. A new standard was published in December 2001 (see http://www.acm.org/sigcse/cc2001/ for more information).

Central to each of these curriculum efforts is the important discussion of the role and flavor of mathematics within the computer science curriculum. Recently, the undergraduate mathematics curriculum committees (CUPM and CRAFTY) reached out to computer science educators and raised the central question, "what mathematics is needed for an undergraduate major in computer science, and how should it be taught?"

In response to this question, an eight-member panel of computer science educators gathered for the first of a series of *Curriculum Foundations Workshops*, which took place at Bowdoin College on October 28-31, 1999. The group included Owen Astrachan (Duke University), Doug Baldwin (SUNY Geneseo), Kim Bruce (Williams College), Peter Henderson (Butler University), Charles F. Kelemen (Swarthmore College), Dale Skrien (Colby College), Allen Tucker (Bowdoin College), and Charles Van Loan (Cornell University).

After a vigorous discussion, the panel developed a report that it believes reflects current thinking about the role of mathematics in the computer science curriculum. To provide a sense of the panel's findings, we summarize in this article the essential ideas in that report. The full report can be obtained at http://academic.bowdoin.edu/faculty/B/barker/dissemination/Curriculum_Foundations/.

In the first two years of a computer science major, students should be comfortable with abstract thinking and with mathematical notation and its meaning. They should be able to both generalize from examples and create examples from generalizations. To estimate the complexity of algorithms, they should understand functions that represent different rates of growth (e.g., logarithmic, polynomial, exponential). To reason effectively about the complexity and correctness of programs, they should gain facility with formal proofs, especially induction proofs. The same kind of clear and careful thinking and expression needed for a coherent mathematical argument is needed for the effective design of a computer program.

For mathematical problem solving skills, students should be able to represent "real-world" problem situations using discrete structures such as arrays, linked lists, trees, finite graphs, other multi-linked structures, and matrices. They should be able to develop and analyze algorithms that operate on these structures. They should understand what a mathematical model is and be able to relate mathematical models to real problem domains. General problem solving strategies such as divide-and-conquer and backtracking strategies are also essential.

For specific topics, students should master the following in their first two years: logical reasoning (propositions, DeMorgan's laws, including negation with quantifiers), functions, relations (equivalence relations and partitions), sets, notation for functions and for set operations, mathematical induction (structural, strong, weak), combinatorics, finite probability, asymptotic notation (e.g., $O(n^2)$ and $O(2^n)$), recurrence/difference equations, graphs, trees, and number systems.

Later in their undergraduate careers, students should gain experience in the following topics in order to master additional intermediate and advanced computer science coursework:

* differential and integral calculus, multidimensional calculus, and linear algebra, for scientific and numerical computing courses.
* linear algebra (matrix algebra, change of coordinates), 3-dimensional calculus, and topics from geometry, for computer graphics courses.
* induction and diagonalization proofs, the use of counterexamples and proof by contradiction, for algorithms and theory of computation courses.

speech understanding and synthesis algorithms use transforms.
compression algorithms use wavelets
encryption algorithms use group and ring theory

The panel's general conclusion is that undergraduate computer science majors need to acquire mathematical maturity and skills, especially in discrete mathematics, early in their college education. The following topics are likely to be used in the first three courses of a computer science major: logical reasoning, functions, relations, sets, mathematical induction, combinatorics, finite probability, asymptotic notation, recurrence/difference equations, graphs, trees, and number systems. Ultimately, calculus, linear algebra, and statistics topics are also used, but none of these is needed earlier than discrete mathematics. Thus, a discrete mathematics course should ideally be offered in the first semester of college, and its prerequisites and conceptual level should be the same as the Calculus I course. ■

Allen Tucker is Bass Professor of Natural Science at Bowdoin College. He was the local organizer for the Curriculum Foundations Workshop in Computer Science, held at Bowdoin College in October 1999.

This is one of a series of articles on Curriculum Foundations, a project of CRAFTY, the MAA Committee on Calculus Reform and the First Two Years. Earlier articles have described the project as a whole (November 2000) and the workshop on the mathematics courses needed by physics students (March 2001). Future articles will focus on other client disciplines. CRAFTY is a subcommittee of CUPM, the Committee on the Undergraduate Program in Mathematics, which is undertaking a review of the whole undergraduate curriculum.

Responses to *Contact Us* at MAA Online

Our January issue included an article by Annie Selden on the many and varied queries that she has received from people using the "contact us" button on MAA Online. Annie received many responses to her FOCUS article. Here are some of them.

Japanese Method

Your article in the January 2002 issue of FOCUS includes an inquiry from a professor of English who wanted to know about a Japanese method of instruction. I suspect that your correspondent was thinking of the Kumon method. The Web site is http://www.kumon.com/home/.

Leon Tabak Cornell College

Use Google!

I suppose your FOCUS article will generate a lot of this, but I just had to push your button. My suggestion in most cases is to refer your correspondents to google (http://www.google.com) rather than some specific site. I quickly discovered that Kumon is the Japanese teaching method (I entered "japan math newsweek", without the quotes of course), pico- is the one trillionth prefix (trillionth meter), Calc II online is available a number of places including Oregon State. I struck out on lightning calculators, and of course you can't ask Google about math problems per se, but still it is an incredible resource.

Donald Girod
girod@canisius.edu

Audio Tapes versus Braille

I can't help you with braille versions, but there is a source for audio tapes of textbooks on a wide range of subjects, mathematical and otherwise. Recording for the Blind and Dyslexic is an organization which records books onto tape in every conceivable field. At their website http://www.rfbd.org, a search yielded no fewer than six books on partial differential equations. There is a nominal fee for borrowing the tapes (they're in the process of moving to digital technology) but it's free for those who can't afford it.

Rick Farber
rfarber@alum.mit.edu

More Online Calculus Programs

The MathOnline program at the University of Colorado at Colorado Springs has offered online calculus courses during each of the past seven semesters... For more information about this program, visit http://mathweb.uccs.edu/mathonline.

Dr. Gene Abrams, Coordinator
MathOnline Program, University of Colorado

(see the article on page 7)

Just Thanks

Just a note to tell you how very much I enjoyed your piece in the January issue of FOCUS. I could become addicted to reading such a piece in every Focus issue! Also, this is the first time I have accessed MAA online so am doubly glad I read your piece. I am now retired - but it is never too late. Best wishes and thanks.

Marion Walter Math.Dept. U. of Oregon

MAA Headquarters Gets New Software System

The first phase of the MAA's conversion to a new software system is complete, and we are happy to report that it works well. The conversion process involved the transfer to a powerful relational database system of a large number of data files of MAA members, book customers, donors, and other parties who work with the MAA. We thank the many MAA members who advised us on the conversion. The result is a new system that will help better serve and be more responsive to the MAA membership. If you have experienced any difficulties, please contact us by telephone at 800.331.1622 or e-mail at maahq@maa.org.

E-commerce is the next phase of the system that will soon be installed. It will make it possible for you to renew your membership, place book orders, and check your MAA account— all online! We're excited about the benefits that e-commerce will bring to members. ■

Have You Moved?

The MAA makes it easy to change your address. Please inform the MAA Service Center about your change of address by using the electronic combined membership list at MAA Online (www.maa.org) or call (800) 331-1622, fax (301) 206-9789, email: maaservice@maa.org, or mail to MAA, PO Box 90973, Washington, DC 20090.

Partial Credit: A Debate

In our December issue, we ran a letter from Jay Beder asking for guidance on giving partial credit when a student has misread a problem and thereby rendered it simpler. In our February issue, Rick Norwood replied arguing that no partial credit be given at all. That generated a great many responses. We reproduce a selection of them here.

In the February Focus Rick Norwood responds to a letter I had written in December concerning the awarding of partial credit to a student who makes an error that converts a problem to an easier one. I thought I should take the opportunity to report on the replies I received personally by email.

The eight respondents had similar responses. The essential burden of proof is against the student. Partial credit in such a case should be awarded sparingly, the amount depending on how close the altered problem is to the original. Closeness depends on several factors: To what extent are the skills being tested the same as those that are tested by the altered problem? To what extent has the student avoided some difficulty that was present in the original problem?

The reason for my original query is that a student who makes an honest error of this type and does legitimate work might deserve to see some fruit born of his or her labor. There may be no completely just way to deal with this, fair to all students, and perhaps, to paraphrase one writer, "that's life."

A number of letters had specific suggestions. One writer noted that students have been known to alter a problem intentionally — meaning that one should be even more circumspect in awarding partial credit in such cases. Rather than summarize the letters, I have put them on a web page (http://www.uwm.edu/~beder/grading.html). I think the replies were thoughtful and very helpful.

Based on his own experience, Dr. Norwood argues against any form of partial credit for any problem under any circumstance. That certainly settles the issue, although none of the writers suggested that, and in any case it raises a separate issue.

Jay Beder
University of Wisconsin-Milwaukee
beder@uwm.edu

In the February 2002 Focus, Rick Norwood wrote against giving partial credit. I think his reasoning presented not so much an indictment against partial credit but an indictment against over generous partial credit. My thinking on this topic was shaped in part by Gus Garver, now retired, from the University of Missouri-Rolla. In an orientation session for new graduate assistants, Professor Garver said something like "A student who only misses a sign deserves more credit than a student who leaves the problem blank."

I believe that Professor Garver was right. I am very careful when giving partial credit. I try to only reward good work. I work hard to determine how much partial credit to award. I tell students that if they disagree, that is their right, but I will not tolerate debate on the issue unless they want to go to no partial credit. That saves a lot of time that I used to spend defending my decisions.

I have had instructors who were so free with partial credit that it was possible to make a B while getting nothing completely correct. The way I give partial credit, that is virtually impossible.

I don't know that this short note will change Dr. Norwood's mind (or anyone else's for that matter), but I still think Professor Garver was right.

Fred Worth
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worthf@hsu.edu

The response in the February FOCUS, that no partial credit is the way to go, just perpetuates several myths: 1) to be good in math you must be perfect 2) mathematics is all about precision and computation, and 3) mathematicians know no compassion.

I do not believe that partial credit rewards carelessness, but rather bases credit received on the skills/concepts tested. (Would Rick Norwood give no partial credit for a completely correct solution which in the last step had a copy error? Carelessness is difficult to judge!)

If the concern is dealing with student inquiries about partial credit, there are diplomatic ways to handle this: a) have a detailed rubric showing how the partial credit is established (which also takes care of his third concern—wasted time); b) allow review of partial credit only in conjunction with a review of the student's entire exam (if too many points were taken off in one instance, perhaps too few were taken off in another instance); c) assure the students that you have given partial credit systematically - all have been treated fairly and a review of one student's work would not be fair to the rest of the class.

For me the time issue is a non-concern, perhaps since I believe strongly in constructive feedback on learning. To me this means identifying just what the student knows and where any misconceptions lie. My test problems usually address several concepts within the framework of a single problem. Hence, I believe that providing partial credit for illustrating some particular stage of understanding is indeed warranted and productive feedback.

Sherrie Serros
Western Kentucky University
sherrie.serros@wku.edu

In the February FOCUS, Rick Norwood writes that the giving of partial credit on tests is a practice which he has discontinued, because he feels that (1) it rewards carelessness, (2) it focused the attention of the student on how much partial credit the student could talk him into and (2) it wasted a good deal of his own time.

My own feeling is that, while there is some truth to all three of his concerns, the matter is not quite so simple. Here are some of my thoughts: Giving partial credit need not "reward carelessness" because, for one thing, students in general are so nervous that they try their very best not to make mistakes, even if they've been told that they'll get partial credit. (How much partial credit, and what kind, are unknowns to them.) And while it could happen that students will try to talk the teacher into giving more partial credit, and sometimes succeed, this need not get out of hand, or even get started in the first place. Knowledge of the material is very important in knowing what and how much partial credit to give, students usually don't posses this knowledge to the extent that the teacher does, and a teacher often has to be very assertive about this. Independent of this, it has been my own experience that students are usually grateful for receiving partial credit, and don't "bother" the teacher for more. (There are of course exceptions.) Third, while I can certainly understand that the giving of partial credit makes test-grading much more time-consuming, to me it seems only fair to do so. At the very least being off by a factor of 2 (or 2 to some power...) should not cost a student the entire credit for the problem. Of course, what the course is would be a factor in all of this, and there is partial credit and there is partial credit. . . Giving partial credit (and test grading in general) can be an art and, while I also would not want to spend too high a percentage of my working hours on it, there are efficient ways to give partial credit.

Rick Norwood ends with "Students who know they are not going to get partial credit do not get lower grades, they just learn to be more careful" - and more nervous, I would add. I would bet, and admit, that I would fail many of my own tests, if being off by a factor of 2 (or even making a more "creative" error) meant losing all the points.

Marion Cohen
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A true story may explain why I avoid partial credit. I told a class "You don't get partial credit in the real world. Employers expect right answers." "That's just not true," a student responded. "My boss is very forgiving when we make mistakes. He just says not to worry about it, that everyone makes mistakes." I asked, "Where do you work?" The answer: "In a medical testing lab."

There are times when partial credit may be called for. But I think the base line should be no partial credit, because students come to think of partial credit as an entitlement, and to think parentheses and minus signs are trivial and not worth paying much attention to. It is the complacency so many students show toward careless errors that I am trying to correct.

I got quite a few e-mails after my letter was published from people who would like to stop giving so much partial credit, but did not dare, for fear it would hurt their Student Assessments of Instruction, on which promotion and tenure often depend. I find this very disturbing, whether there is any basis for the fear or not.

If my students were all failing because of my policy of no partial credit, of course I would stop. But they do not fail. Rather, they become more careful. Which shows greater "compassion", giving the students the partial credit they crave, or teaching them to be careful in their work?

Rick Norwood
East Tennessee State University
norwoodr@access.etsu.edu

Employment Opportunities

RHODE ISLAND

NAVAL ACADEMY PREPARATORY SCHOOL,
Newport, RI
Mathematics Positions
MATHEMATICS INSTRUCTORS, three full time permanent positions, $56,738-$73,757 per calendar year. Primary duty is teaching at the introductory college level. MATHEMATICS SUPPLEMENTAL INSTRUCTOR, one ten months, full-time, permanent position, $39,126-$50,860 per calendar year. Primary duty is supplemental instruction at the introductory college level. EEO. Must apply on internet. See www.naps.edu

TENNESSEE

TENNESSEE STATE UNIVERSITY
The Department of Physics and Mathematics invites applications for a nine-month tenure-track position in mathematics at the assistant professor level beginning in the fall semester 2002. Requirements include a doctorate in mathematics and a strong commitment both to teaching and to continued scholarly activity. All areas of mathematics will be considered, but preference will be given to applicants with a strong background in mathematical statistics. Salary range $38,000-$45,000 depending on experience. Application deadline: May 15, 2002 or until filled. AA/EEO Employer. Applicants should send a letter of application, vita to Human Resources, 3500 John A. Merritt Blvd. An EO/AA/M/F Employer.

MAA Contributed Papers Sessions Baltimore Joint Mathematics Meeting, January 15-18, 2003

PRELIMINARY ANNOUNCEMENT

The organizers listed below solicit contributed papers pertinent to their sessions. Sessions generally limit presentations to ten minutes, but selected participants may extend their contributions up to twenty minutes. Each session room contains an overhead projector and screen; black boards will not be available. Persons needing additional equipment should contact, as soon as possible, but prior to September 10, 2002: the session organizer whose name is followed by an asterisk (*). Please note that the dates and times scheduled for these sessions remain tentative.

MAA CP A1 Innovative Uses of the World Wide Web in Teaching Mathematics

Wednesday morning and Thursday afternoon

Brian E. Smith*
Faculty of Management, McGill University
1001 Sherbrooke St. W., Montreal, QC H3A 1G5, Canada;
(514)398-4038; fax: (514)398-3876
smithb@management.mcgill.ca
Marcelle Bessman, Jacksonville University
Marcia Birken, Rochester Institute of Technology
Tom Leathrum , Jacksonville State University
David Strong, Pepperdine University
Joe Yanik, Emporia State University

This session seeks to highlight innovative teaching strategies in mathematics that emphasize the use of the World Wide Web as a learning tool. These strategies could include the construction of teaching materials or creative use of existing or standardly available materials. This session will include Java Applets, and other Mathlets used in teaching mathematics.

MAA CP B1 Classroom Demonstrations and Course Projects that Make a Difference

Wednesday Morning and Thursday afternoon

David R. Hill*
Mathematics Department, Temple University
Philadelphia, PA 19122
(215) 204-1654; fax: (215) 204-6433 hill@math.temple.edu
Sarah Mabrouk, Framingham State College
Lila F. Roberts , Georgia Southern University

The use of course projects and classroom demonstrations enables instructors to show students that mathematics is meaningful and applicable in a variety of real-life situations. Demos, important tools for instruction in any class format, enable instructors to engage the students on a level beyond that created by lectures. Projects are useful in helping students to apply the course material and to make connections between mathematics and the real world. This session invites papers about favorite instructional demos and course projects appropriate for any level in the undergraduate curriculum designed to engage students and to enable them to gain insight into mathematics. Presenters of demos are encouraged to give the demonstration, if time and equipment allow, and to discuss how to use it in a classroom setting. Presenters of projects are encouraged to discuss the specifics of how the project was conducted and how it was evaluated. Proposals should describe how the demo/project fits into a course, the use of technology or technology requirements, if any, and the effect of the demo/project on student attitudes toward mathematics.

MAA CP C1 The History of Mathematics in the Americas

Wednesday afternoon

Amy E. Shell*
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United States Military Academy
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(845) 938-2413 aa7423@usma.edu
Daniel E. Otero, Xavier University

This session invites papers on the history of mathematics, mathematicians, or ethno-mathematics of both North and South America. Special consideration will be given to mathematics in countries other than the United States.

MAA CP D1 Getting Students To Discuss And To Write About Mathematics

Wednesday afternoon

Sarah L. Mabrouk*
Mathematics Department, Framingham State College
100 State Street, PO Box 9101
Framingham, MA 01701-9101
(508)626-4785; fax:(508)626-4003 smabrouk@frc.mass.edu

Many students, especially in lower levelcourses, tend to view Mathematics as incomprehensible equations and calculations rather than as meaningful and applicable in a variety of disciplines. This view of mathematics as meaningless affects the student's ability to verbally communicate mathematics just as it affects the students understanding of and ability to apply mathematics. When students are required to use the language of mathematics and to explain the meaning of the mathematics that they are applying or analyzing, they learn to understand and to communicate mathematics. This session invites papers about assignments and projects that require students to communicate mathematics through in-class oral presentations that they make or in-class discussions that they must lead and motivate and through written assignments and papers. These assignments can include analysis and applications of mathematics, presentations of and analysis of proofs, presentations about famous mathematicians and the mathematics that they studied, and assignments/projects that utilize creative writing. Each presenter is encouraged to discuss how the use of the assignment/project helped students to improve their understanding of mathematics and their ability to communicate mathematics. Of particular interest is the effect of such projects/assignments/presentations throughout the course on the students' understanding of mathematics, their communication of mathematics, and their attitude toward mathematics.

MAA CP E1 Quantitative Literacy in Practice: What is it and what works?

Wednesday afternoon

Rick Gillman*
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Valparaiso University, Valparaiso IN, 46383
(219) 464-5067; fax: (219) 464-5065 rick.gillman@valpo.edu

Quantitative Literacy can be defined as the ability to use elementary mathematics in authentic contexts from an individual's personal, economic and social life. Colleges and universities across the country are reasonably expected to deepen and expand the quantitative literacy of all of the students that arrive on their campuses. This session seeks papers that will illustrate how the presenters and their institutions have operationalized the definition given above. These papers may include discussions of requirements in particular courses or at a general curriculum level, lists of student learning competencies established by the institution, and assessment methods and results at both the student and institutional levels. Of particular interest are discussions of the placement process, articulation agreements with other institutions, and credit transfer issues.

MAA CP F1 Environmental Mathematics in the Classroom

Wednesday afternoon

Karen D. Bolinger*
Department of Mathematics, Clarion University
Clarion PA 16214
(814) 393-2360; fax (814) 393-2735 kbolinge@clarion.edu
Ben Fusaro, Florida State University

We invite papers that deal with all aspects of applying mathematics to solve problems of the environment and that are suitable for classroom use at grade levels 12-15. Also invited are papers that address the issue of infusing environmental awareness into the teaching community. Papers dealing with exposition, pedagogy or modeling are as welcome as those about successful experiences with getting this intrinsically interdisciplinary subject into the curriculum. This session is sponsored by the MAA Committee for Mathematics and the Environment.

MAA CP G1 Incorporating History of Mathematics in the Mathematics Classroom

Thursday morning

Victor J. Katz*
Mathematics Department
University of the District of Columbia
4200 Connecticut Ave. N.W., Washington, DC 20008
(202) 274-5374; fax: (301) 592-0061 vkatz@udc.edu
Edith Prentice Mendez , Sonoma State University
Eisso J. Atzema, University of Maine

One of the purposes of the History of Mathematics Special Interest Group of the MAA (HOM SIGMAA) is to support the use of the history of mathematics in the teaching of mathematics. Therefore, we are soliciting contributed papers on innovative ways to incorporate the history of secondary and undergraduate mathematics into the mathematics classroom. Presentations describing student projects or classroom activities are especially encouraged, as are those dealing with curriculum development which promotes the use of history by prospective secondary teachers.

MAA CP H1 Helping Students Give Effective Mathematics Presentations

Thursday morning

Suzanne Dorée*
Augsburg College
Campus Box 61, 2211 Riverside Avenue
Minneapolis, MN 55454
(612) 330-1059; fax: (612) 330-1649 doree@augsburg.edu
Thomas Linton, Central College

Do you have courses that include student speaking assignments? Is your undergraduate research student presenting a paper at an upcoming conference? Are your future K-12 teachers giving practice teaching demonstrations? Is your advisee preparing for a job interview? Whatever the reason, many of us are faced with the challenge of helping our students be prepared to speak about mathematics. Proposals are sought that describe characteristics of high-quality student presentations, processes used to help students prepare to speak, methods of evaluating student presentations, or innovative uses of student presentations in mathematics programs.

MAA CP I1 Mathematics Experiences in Business, Industry and Government

Thursday morning

Phil Gustafson*
Department of Computer Science
Mathematics and Statistics, Mesa State College
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(970) 248-1176; fax: (970) 248-1324 pgustafs@mesastate.edu

This contributed paper session will provide a forum for mathematicians with experience in Business, Industry and Government (BIG) to present papers or discuss projects involving the application of mathematics to BIG problems. BIG mathematicians as well as faculty and students in academia who are interested in learning more about BIG practitioners, projects, and issues, will find this session of interest. This session is sponsored by the MAA Business, Industry and Government Special Interest Group (BIG SIGMAA).

MAA CP J1 Applications of Abstract Algebra
Thursday morning
Robert Lewand *
Department of Mathematics and Computer Science
Goucher College
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(410) 337-6239; fax: (410) 337-6408 rlewand@goucher.edu
George Mackiw, Loyola College, Maryland

The methods and tools of abstract algebra have been used successfully in many areas of endeavor and study. Cryptography, coding theory, and digital signal processing are examples of areas where algebraic methods are currently prominent. Abstract algebra has also interacted fruitfully with geometry, combinatorics, number theory, logic and other fields of study. Applications can certainly enhance and enliven presentations of the subject, since they provide motivation and can stimulate student interest. This session seeks contributions that present applications of the theory of groups, rings, and fields that would be suitable for use in an undergraduate course. Of particular interest are topics that might not ordinarily be encountered in the standard curriculum and ones that are not readily available in popular texts.

MAA CP K1 The Special Interest Group of the MAA on Research in Undergraduate Mathematics Education
Friday and Saturday mornings
Jim Cottrill*
Illinois State University
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Anne Brown , Indiana University South Bend

The Special Interest Group of the MAA on Research in Undergraduate Mathematics Education (SIGMAA on RUME) aims to foster a professional atmosphere for quality research in the teaching and learning of undergraduate mathematics through contributed paper sessions for mathematics educators and mathematicians interested in research on undergraduate mathematics education. Research papers that address issues concerning the teaching and learning of undergraduate mathematics are invited. Theoretical and empirical investigations using qualitative and quantitative methodologies are appropriate. These should be set within established theoretical frameworks and should further existing work. Reports on completed studies are especially welcome.

MAA CP L1 Best Statistics Projects/Activities
Friday and Saturday mornings
Carolyn K. Cuff*
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New Wilmington, PA 16172-0001
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Mary M. Sullivan, Rhode Island College

Successful statistical education requires that the student not only be exposed to real data but also actively participate in the analysis of the data and effectively communicate the results. Faculty who teach statistics and include activities and projects in their courses are invited to contribute papers that describe creative projects or activities that they have used in their classes. Activities will be demonstrated during the session. These projects and activities can be from introductory to advanced courses in statistics or from courses that are only partially devoted to statistics.

MAA CP M1 Rethinking the Courses Below Calculus
Friday and Saturday mornings
Mary Robinson*
University of New Mexico , Valencia Campus
280 La Entrada, Los Lunas, NM 87031
(505) 925-8622; fax: (505) 925-8697 maryrobn@unm.edu
Sheldon P. Gordon; , SUNY at Farmingdale
Florence S. Gordon, New York Institute of Technology
Arlene H. Kleinstein; SUNY at Farmingdale

The MAA and several groups of mathematicians have recently launched a number of related major curriculum initiatives all of which are addressing the changing needs of the students who take courses below calculus. These initiatives include efforts to rethink college algebra and precalculus courses, to increase quantitative reasoning among all students, and to provide better mathematical support to the partner disciplines. Enrollment in these courses is on the order of about 2,000,000 students a year and represents about 2/3 of all mathematics enrollments. Yet, the available evidence indicates that the traditional courses at this level do not work, in terms of preparing students for subsequent math courses, of preparing them for quantitative courses in the other disciplines, or of motivating them to continue on in mathematics. In this session, we specifically seek to address all of the courses below calculus outside of QL programs, with particular emphasis on offerings in College Algebra and Precalculus. In particular, we seek presentations that: present new visions for such courses, describe implementations of such courses, discuss the results of analysis of data on student performance and student tracking information coming out of these courses, discuss the issues involved in smoothing the transitions between mathematics in high school and in college and between different collegiate institutions, discuss the needs of other disciplines from courses at this level. This session is cosponsored by the MAA Task Force on the First College Level Mathematics Course, the Committee on Curriculum Renewal Across the First Two Years (CRAFTY), the Committee on Two Year Colleges, and the Committee on Articulation and Placement.

MAA CP N1 Assessment of Student Learning: Models and Methodology
Friday and Saturday mornings
Jay A Malmstrom*
Oklahoma City Community College
7777 S May Ave, Oklahoma City, OK 73159
(405) 682-1611 x7365; fax: (405) 682-7805 malmstrm@qns.com
Linda Martin, Albuquerque-TVI
Mercedes McGowen , William Rainey Harper College

Accrediting agencies, boards of regents, and government agencies are placing an increased emphasis on the assessment of student outcomes. As a result of this, Mathematics departments need to look at their offerings from a variety of viewpoints in order to assess the effectiveness of their courses. These include (but are not limited to): Student readiness for college level work, student readiness for upper division work, student readiness for work in their major, and quantitative literacy. Papers in this session will emphasize: methodology used in the evaluation, lessons learned from the evaluation (which tools worked and which did not), and impact of the evaluation on the department (how did the department change as a result of the evaluation.)

MAA CP P1 Encouraging Underrepresented Groups of Students in Math Contests

Friday morning

Harold Reiter*
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Charlotte, NC 28223
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Ruth G. Favro, Lawrence Technological University
David M. Wells, Pennsylvania State University
Susan Schwartz Wildstrom, Walt Whitman High School
Jeff Dodd, Jacksonville State University

Mathematics competitions at the high school and university levels in the United States have traditionally been dominated by white and Asian males. Females compete successfully in contests for younger students, but do not do very well in middle school years and later. Black and Hispanic Americans also do less well than others, in general, in local, regional, and national math contests. Recruiting these underrepresented groups to math competitions is a vexing problem whose solutions we would like to explore in the session. The Committee on Local and Regional Competitions (CLARC) solicits papers discussing how some have tackled this representation problem. Some possibilities to consider may include: coaching students for competitions, preparing teachers to be coaches for competitions, writing problems for competitions, encouraging participation in competitions, communicating effectively with coaches and participants, competition formats and styles, and social aspects, follow-up of participants or mentoring, interesting uses of technology in conducting competitions (for example, conducting competitions on the web).

MAA CP Q1 Strategies for Increasing the Diversity of Students in Mathematics

Friday morning

Marjorie (Marj) Enneking*
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(503)725-3643; fax: (503)725-3661 marj@mth.pdx.edu
Wade Ellis, West Valley College
William Hawkins, SUMMA
Robert Megginson, University of Michigan
Kenneth Millett, University of California, Santa Barbara
William Velez, University of Arizona

This session will present strategies for recruiting students from diverse backgrounds into mathematics; programs to support high success rates and level of achievement by these students; and faculty development initiatives which help faculty and departments initiate such programs. Presenters will present methods for evaluating such programs and evidence of the success of their program.

MAA CP R1 Mathematical Modeling In and Out of the Classroom

Friday afternoon

Brian Winkel*
United States Military Academy, West Point NY 10996
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Tanya L. Leise , Rose-Hulman Institute of Technology
Amy Radunskaya, Pomona College

Modeling is still a buzzword in mathematics education circles. For some it is just that, a buzzword, without comprehension, certainly without concrete examples. We propose a contributed paper session that will help attendees' understand the process of mathematical modeling as well as the process of teaching mathematical modeling. Specifically, we ask each presenter to offer the attendees (1) details of a modeling activity (or several) - how, why, what, where, and when, with attention to both mathematics and content area of application and (2) a discussion on how to implement the activity. We require from each presenter something specific that can be done in a mathematical modeling course or a general course, be it high school mathematics, or graduate level course work. Additionally, we shall ask the presenters to prepare an annotated bibliography on five modeling sources/activities materials they have used or found appropriate. This set of annotated bibliographies will be combined into an electronic file for web access as well as a hard copy for meeting distribution to session attendees. Certainly activities including data collection, modeling lessons/classes, modeling studios/activities, and class consulting are but a few of the appropriate areas discussed.

MAA CP S1 Philosophy of Mathematics

Friday afternoon

Bonnie Gold*
Mathematics Department, Monmouth University
400 Cedar Avenue, West Long Branch, NJ 07764-1898
(732) 571-4451; fax: (732) 263-5378 bgold@monmouth.edu

This session invites papers on any topic in the philosophy of mathematics except logic and set theory. Possible topics include the nature of mathematics, the nature of mathematical objects, the nature of mathematical knowledge, the relation between mathematics and the physical world, the role of esthetics in the development of mathematics; philosophical implications of logic and set theory are also acceptable. Talks should be addressed to a mathematical audience, not an audience of philosophers (in terms of background), but should attempt to meet the same level of precision you are used to using in your mathematical presentations.

MAA CP T1 Integrating Undergraduate Research with the Mathematics Curriculum

Friday afternoon

David Brown*
Ithaca College
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1212 Williams Hall, Ithaca NY 14850-7284
(607) 274-7375; fax: (607)274-1588 dabrown@ithaca.edu
Osman Yurekli, Ithaca College

In this session, we focus on efforts to incorporate the mathematics research experience within the curriculum. We encourage the submission of papers that demonstrate creative ways of involving undergraduates in mathematical exploration. Ideas ranging from projects within established courses to courses specifically designed to conduct research are welcomed. We also look for discussion of how the models used for sustaining undergraduate research has affected the rest of the curriculum and how valuable such experiences have been. Some questions that we would like to see addressed include: In what way have departments been able to incorporate undergraduate research projects within the curriculum? Have these efforts been successful? What types of research have students completed? What students have had these opportunities? (ie, is the experience only for the most talented?) Has there been any follow-up for students? What has been the reaction of colleagues? Have such experiences affected the department's curriculum? How have these research experiences been assessed?

MAA CP U1 Courses and Projects Addressing the Shortage of K-12 Teachers

Saturday afternoon

Harel Barzilai*
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Maria Fung, Western Oregon University
Jay M. Jahangiri, Kent State University

As highlighted by the Glenn Commission report, "Before It's Too Late," the shortage of well-prepared K-12 mathematics teachers is a serious and growing national concern. Resources such as the NCTM Principles and Standards for School Mathematics and the CBMS Report on the Mathematical Education of Teachers provide valuable insights on where we want to be in teacher education. Nevertheless, creatively implementing change which helps us "get there" is a formidable challenge, and will remain so for the foreseeable future. Contributed presentations are invited which address this national shortage of qualified mathematics school teachers through innovative courses, programs, or projects effecting better recruitment, preparation, retention, and professional development for mathematics teachers. Of particular interest are creative efforts which help strengthen the mathematical preparation of preservice and inservice middle school teachers, those teaching on a temporary certification or out of their certification, teachers teaching out of field, and teachers who otherwise lack sufficient background. Additional important elements can include: community outreach; professional networking, mentoring, and development of and by teachers; strengthening diversity; collaborations among faculty in mathematics and education departments, and between faculty and school system personnel; efforts to help teachers meet the increasing demands of assessment standards from multiple sources; and innovative ways of institutionalizing support systems for teachers and for professional standards in mathematics teaching.

MAA CP V1 Creative Visualization Labs

Saturday afternoon

Sarah J. Greenwald*
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Boone, NC 28608
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Catherine A. Gorini, Maharishi University of Management
Mary L. Platt, Salem State College

Effective projects that help students develop visualization skills are important for success in many courses. There are many resources for incorporating such activities into the K-12 geometry classroom, but few are aimed at college level courses. This session invites papers describing a complete lab or series of labs using computers, technology, dynamic software and/or manipulatives aimed at increasing visualization skills. Activities designed for use in college level geometry, topology, or visualization courses are especially encouraged. Presentations detailing student reactions, educational benefits and difficulties encountered, and the effect of the lab on teaching and learning are desired. The organizers are developing a website of college labs and contributions to this session will be considered for inclusion.

MAA CP W1 Linking Mathematics with other Disciplines

Saturday afternoon

Stephanie Fitchett*
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5353 Parkside Drive, Jupiter, FL 33458
(561) 799-8613; fax: (561) 799-8602 sfitchet@fau.edu
Blake Mellor, Honors College, Florida Atlantic University
Gavin LaRose, University of Michigan

This session will explore the linking and integration of mathematics with other disciplines by inviting contributions, from both mathematicians and instructors in other disciplines, on the following themes: strategies or environments that encourage instructors, as well as students, to take an integrated and interdisciplinary approach to teaching and learning mathematics; the incorporation of realistic applications in mathematics courses in a way that enhances mathematical understanding; examples of how mathematics is used or taught in courses offered by other disciplines (natural science, social science, humanities, business, etc.); and exemplary courses, projects or collections of activities.

MAA CP X1 Mathematical Connections in Art, Music, and Science

Saturday afternoon

John M. Sullivan *

UIUC Math Dept, 1409 W Green St. , Urbana IL 61801
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Doug Norton, Villanova University
Reza Sarhangi, Towson University

Mathematics can be defined as the study of patterns. Patterns have always been used in artistic creation: in music, the visual arts, and architecture. This was particularly evident, for example, in antiquity, during the flourishing of Islamic art, and in the Renaissance in Europe. Patterns lending themselves to mathematical interpretation arise across the disciplinary spectrum: in the chain of evolution, in the histories of cultures and civilizations, in the extreme complexities encountered in high-speed computations. These patterns are the topics of ever deepening mathematics created to help understand them. Numerous mathematicians are developing curricular materials linking mathematics to the arts and other cultural branches of our civilization. By using attractive and accessible examples to show the presence of and benefit from mathematics in art, music, humanities, and sciences, these materials can help reduce the aversion to mathematics too often found in the general public, fostering new linkages and new appreciation of things mathematical. Objectives of the session include: present new findings relating mathematics to its artistic and aesthetic presentations; demonstrate the use of new technology to illustrate connections between mathematics and the arts; and introduce innovative techniques promoting interdisciplinary work in the fields of mathematics, science, art, and music.

MAA CP Y1 Computation Mathematics in Linear Algebra and Differential Equations

Saturday afternoon

Rich Marchand*
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Elias Deeba, University of Houston-Downtown
Tim McDevitt, Millersville University

Computer algebra systems, spreadsheets and graphing calculators have become popular tools for facilitating numerical investigations of many meaningful problems in Linear Algebra and Differential Equations. Such investigations lead to better students' understanding of mathematical concepts while empowering them with the capabilities to analyze more realistic problems. This session invites papers describing novel projects from these disciplines in which technology is required. Outstanding papers may be considered for publication as part of an MAA collection.

MAA CP Z1 General Contributed Paper Session

Wednesday, Thursday, Friday, and Saturday mornings

Michael Jones
Montclair State University
1 Normal Avenue, Upper Montclair, NJ 07043
(973) 655-5448; fax (973) 655-7686;
jonesma@pegasus.montclair.edu
Jill Dietz, St. Olaf College
Steve Hetzler, Salisbury University
Shawnee McMurran, California State University at San Bernardino

This session is designed for papers that do not fit into one of the other sessions. Papers may be presented on any mathematical topic. Papers that fit into one of the other sessions should be sent to that organizer, not to this session. Papers should not be sent to more than one organizer. E-mail submissions are preferred.

Submission Procedures for MAA Contributed Papers

Submit your abstract directly to the AMS. Concurrently, send a more detailed one-page summary of your paper directly to the organizer - indicated with an (*). In order to enable the organizer(s) to evaluate the appropriateness of your paper, include as much detailed information as possible within the one-page limitation. The summary need not duplicate the information in the abstract. Your abstract and summary must reach the AMS and the organizer by Tuesday, September 10, 2002.

The AMS will publish abstracts for the talks in the MAA sessions. Abstracts must be submitted on the appropriate AMS form. Electronic submission is available via the Internet or email. No knowledge of LaTeX is necessary, however, LaTeX and AMSLaTeX can be accommodated. These are the only typesetting systems that can be used if mathematics is included. To see descriptions and to view the electronic templates available, visit the abstracts submission page on the Internet at http://www.ams.org/abstracts/instructions.html, or send e-mail to abs-submit@ams.org, typing HELP as the subject line.

Completed email templates must be sent to abs-submit@ams.org with SUBMISSION as the subject line. Abstracts submitted electronically are quickly either acknowledged, with a unique abstract number assigned to the presentation, or rejected, with a short message on what information is missing or inappropriate. All questions concerning the submission of abstracts should be addressed to abs-coord@ams.org.

Here are the codes you will need: MEETING NUMBER: 983

The EVENT CODE is the seven characters appearing before the title of the sessions shown below, e.g., MAA CP A1

The SUBJECT CODE is the last two-character letter/number combination from the event code list, i.e., A1, B1.

MAA Data on Gender Year 2001

Below is the information collected for the year 2001. This information will also be published on MAA Online.

Board of Governors	Total Board Members 50 Female Board Members 13 Male Board Members 37 Percentage of female participation: 26%
Nominees to the Board of Governors[1]	Total nominees 14 Female nominees 6 Male nominees 8
Committee Chairs[2]	Total chairs 137 Female chairs 44 Male chairs 93 Percentage of female participation: 32%
Invited Speakers at MAA National Meetings in 2001 * one was joint with AWM ** two were joint with AMS, one with NAM, one with PME	Total invited speakers 21 Female invited speakers* 7 Male invited speakers** 14 Percentage of female invited speakers: 33 1/3%
Contributed Paper Sessions	Male Organizers 28 Female Organizers 27 Percentage of female organizers 48.2% Male Speakers 202 Female Speakers 120 Percentage of Female Speakers 37.3%
MAA Awards	Total Awards 14 Female Awardees 3 Male Awardees 11 Percentage of female participation: 21%

Notes

1.This includes nominees for section governors elected in 2001 as well as nominees for other governor slots included in Board agendas

2. The list includes chairs of committees, including joint committees, representatives and editors.