EDITOR'S NOTES

It is summer time, and in the military that means it is time to farewell people. MAJ **Garry Lambert**, managing editor of *Mathematica Militaris*, is leaving West Point to attend the Naval Command and Staff College. **Dr. Judy Holdener** (USAFA Associate Editor) also leaves this summer. She is moving on to a new job at Kenyon College in June. She will be replaced by **Dr. Bradford Kline** (Brad). Both Garry and Judy have worked hard to make *Mathematica Militaris* so successful, and we will miss their creativity and energy.

This issue focuses on the use of multimedia for mathematics education, especially multimedia which is delivered over the Internet. Several excellent articles offer interesting perspectives on this timely issue.

I enjoyed attending the 7th Service Academy Student Mathematics Conference, hosted by the Air Force Academy in April. (See our article in this issue). I was struck again by the diversity and the quality of the work of our students. The excellence of their research efforts reflects well on each of our departments. If you have an opportunity to attend one of the SASMCs, I strongly recommend that you do so. Each of our departments admits about the same student population, and adds value according to our own unique processes. Attending this conference is a good way to get a perspective, albeit limited, on how our different approaches compare.

I also found that the interaction between faculty members was very stimulating: a second reason to attend!

West Point is meeting in June to consider proposing an expansion of the SASMC to disciplines outside of Mathematics, and renaming the conference "The Service Academy Student **Research** Conference". This is in reaction to two other departments at USMA, who have admired our model and who would like to extend it to their seniors. If you have comments on this idea, please contact me directly. If the idea is approved by our Dean, he will contact the other Academies directly with a proposal. Since West Point is hosting the SASMC in 1998, we would first host any expanded conference in 1998 as well.

We are always on the lookout for good issue themes. If you have a theme to propose, pass it to your associate editor, to our (soon to be named) new managing editor, or to me directly.

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SUBSCRIPTIONS TO *MATHEMATICA MILITARIS*:

If you would like to be on our mailing list, please send your name, address, and affiliation to:

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Overview

We lead off this issue with Commander **George Rezendes**' discussion of several multimedia tools in use at the Coast Guard Academy in their Probability & Statistics course. Commander Rezendes outlines the successful implementation of such multimedia tools as: Data Desk, a graphical exploratory data analysis program; the Chance Database web site, a database of statistical information; and a CD ROM titled ActivStats which incorporates video, text and audio presentations for a broad range of statistical concepts. He reports that the "successes we have had ... have convinced us that technology, including multimedia tools and the world wide web, can positively influence how students learn mathematics."

Lieutenant **Kurt Jacobs** provides a "fruitful" discussion on the use of JAVA Applets in mathematics instruction at the Naval Academy. Lieutenant Jacobs reports that useful JAVA Applets are becoming more and more prevalent on the world wide web and that many of these Applets can be co-opted directly for use in the classroom with little or no revision required. Lieutenant Jacobs believes that these Applets can therefore save both students and instructors time because of their ease of use and ready made nature. More importantly, he feels that they provide a low cost method of concept visualization which students seem to enjoy. He provides the URLs for two sites on the world wide web that index and rate Applets.

LTC **Dave Olwell** and MAJ **Mike Johnson** discuss the philosophy, goals, and implementation of the world wide web at the USMA Department of Mathematical Sciences. They explain that the philosophy regarding the use of technology at USMA is twofold: first consider the task to be accomplished before deciding upon a tool and secondly, adopt technology that provides the best "bang for the buck." With these tenets in mind, they describe several ways in which the Web and the Internet have helped to enhance classroom instruction. The most interesting of these is that the Web moves learning to the cadet rooms while improving their learning. They include a list of the key lessons learned from implementing the Web as a part of the classroom. They conclude that the "Web is a valuable educational tool for cadets and faculty."

Professor **Brad Kline** provides the final contribution for this issue. His discussion of Computer Algebra Systems (CAS) provides an initial foray into the theme for the next issue of *Mathematica Militaris* -- symbolic manipulation. Professor Kline outlines some of the issues raised because of the power, convenience and affordability of today's Computer Algebra Systems.

Chief among these he says is "how can we incorporate CAS to enhance learning ... in a traditional mathematics curriculum" and "to what extent do graduates of a computer-based course lose their pencil and paper skills?" Professor Kline poses these and other questions as possible suggestions for topics for the next issue.

Using Multimedia at the U. S. Coast Guard Academy

Commander George Rezendes
US Coast Guard Academy

The availability of multimedia tools and the world wide web provide mathematics faculty with tools which will have a tremendous impact on the teaching of mathematics. Research in Educational Psychology suggests that multimedia presentations of technical material improves a student's ability to transfer the learned material to new situations. (Mayer and Anderson 1992). In fact, Mayer and Anderson showed that when words and pictures are presented contiguously the effectiveness of instruction is increased. It is believed that humans process information in two ways, one that represents information verbally and the other represents information visually. This theory is known as dual coding theory (Clark & Paivio, 1991). If this is indeed true then it seems logical to conclude that by merging the verbal (analytical) representation of mathematics with the visual (graphical) representation of mathematics, student understanding would be improved. My personal observations over the last ten years tend to support this; students do understand concepts more fully when they are presented in both an analytical and graphical form.

The Department of Mathematics at the Coast Guard Academy has been using Data Desk, a graphical exploratory data analysis program, for the past ten years in the teaching of our Probability & Statistics course. Data Desk, along with classroom projection equipment, allows instructors to present statistical concepts in the context of actual data analysis. Data Desk provides an integrated analysis feature which links the data and all displays together. For example, consider a data set which contains information on SAT scores for both male and female students. Constructing a bar chart for the gender variable and a histogram for the SAT score, a user can highlight the cases for males in the bar chart and the corresponding cases will be highlighted on the histogram. This integrated analysis feature of Data Desk provides instructors with the ability to teach subject matter through actual data analysis problems. Students are provided the opportunity to see first hand the difficulties which arise when dealing with actual data.

The world wide web also provides material which can encourage learning subject matter in context. Specifically, I have found the Chance Database to be an invaluable resource. This database of statistical information provides teaching resources as well as many examples of current news articles that use probability and statistics. On several occasions throughout the semester students in the Probability & Statistics course are required to read an article contained in the Chance Database. In addition to reading the articles they must provide responses to discussion questions which are included with the article. This activity highlights the important role which statistics plays in everyday life. The URL for the Chance Database is *http://www.geom.umn.edu/docs/snell/chance/welcome.html* .

Another multimedia tool for statistics which has just become available in the past six months is ActivStats. This CD ROM, produced by Paul Velleman and published by Addison Wesley Interactive, incorporates DataDesk, Against All Odds video clips, text and audio into a multimedia presentation which covers a broad range of statistical concepts. We have used this tool on two occasions in class to demonstrate the ideas of correlation and introduce the ideas of regression. These presentations were well received by students and we anticipate using this package more frequently in the future.

The successes which we have had with the Probability & Statistics course have convinced us that technology, including multimedia tools and the world wide web, can positively influence how students learn mathematics. Beginning with the fall 1996 semester Mathematica was introduced into our Calculus I and Calculus II courses. The use of Mathematica will be expanded to the Multivariable Calculus and Differential Equations courses during the fall of 1997.

The challenge which we face as mathematics instructors is to use these tools to create a learning environment that presents subject matter in contexts akin to those which students may encounter during their the careers. Presenting subject material in this manner fosters an attitude that the subject matter is dynamic and can be applied in many different situations. Experiencing learning this way will encourage students to develop the ability to transfer their knowledge to new situations.

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Apples for Teachers, Applets for Teaching

Lieutenant Kurt E. Jacobs
US Naval Academy

The introduction of technology, namely computers and calculators, into the classroom has been a rough and rocky road. Much debate exists whether the technology is actually helping students learn the mathematical and analytical skills required. Some would say that there is a "dumbing down" of the student since a computer will give a solution without the student necessarily understanding the underlying processes. Others argue that the computer allows the student to tackle more difficult and complex problems since it performs the time consuming and tedious calculations.

Certainly computers are here to stay, and the ability to use them proficiently is a prerequisite for the successful military officer of the 21st Century. However, as I have discovered in introducing computers into the classroom at various levels, their use can become a time sink both in and out of the classroom. In instructing students to use computer aided algebra systems, spreadsheets, or hand held calculators, considerable time must be spent teaching the mechanics of the particular system. This takes away from the finite amount of time instructors have to teach the topic of the day.

Outside the classroom, students devote a significant amount of time overcoming the steep learning curve for these systems. Where a simple syntax error can stop all forward progress, student frustrations become very high with user unfriendly technology. Time spent by instructors can be no less taxing. Developing the projects, spreadsheets, and data sets needed to give students meaningful exercises is a considerable task when compared to simply assigning problems out of a text book.

Skepticism aside, the recent development of JAVA Applets available on the World Wide Web shows great promise as an efficient teaching tool. Simple to operate, and often visual, Applets provide an attractive new dimension for teaching mathematical concepts. For instance, an Applet from the University of Arkansas for performing vector addition will not only numerically calculate the resultant vector, but also draw it and the associated parallelogram all on one screen. While many other computer programs can do similar calculations and presentations, the ease with which Applets operate is what is significant. Anyone can use these programs if they have a recent version of an Internet browser and net access. The user does not need to know any syntax or complicated software nuances. Instructions and a description of the concept are typically part of the Applet.

User friendly Applets significantly reduce student frustrations and optimize time spent performing calculations and graphical presentations in class. For example, a ballistic trajectory Applet from the University of Utah not only calculates the time and distance to impact from various initial conditions, but also plots several real time projectile paths. Initial conditions are easily changed, allowing the student to quickly see the effects of those changes. The animation greatly enhances concept visualization, thereby speeding the learning process.

Since the Applets are "off-the-shelf," an instructor does lose some flexibility but enjoys a minimal investment of time to bring them into the classroom. Other disadvantages with Applets include finding them on the Internet and the limited selection currently available. Two of the web sites which index and rate Applets are ***http://www.gamelan.com*** and ***http://www.jars.com.*** Both sites list math specific Applets and are home to others such as engineering, physics, finance, and even game theory. Applets are being added at an increasing rate and soon it will be easy to find one for virtually any topic.

Most importantly, students enjoy seeing Applet demonstrations in class and being able to use them outside of class. While Applets are not a substitute for the teaching of mathematics, they can provide an enriching complement with minimal cost in terms of time or money. So let the students give apples to the instructor, and the instructor treat the students to Applets.

"Using the World Wide Web"
The US Military Academy, Department of Mathematical Sciences

LTC Dave Olwell and MAJ Mike Johnson
US Military Academy

Overview

The US Military Academy has been actively experimenting with using the World Wide Web and the Internet as learning tools, as communication avenues, and as supplemental teaching aids outside of the traditional classroom. This article discusses the USMA environment, our goals, what we have tried, what worked, and what we've learned. Some of the ideas in this article are extensions of [Olwell, 1996].

USMA Context

The US Military Academy has an integrated computer network system which allows cadets, staff and faculty easy access to electronic mail, local servers, and the Internet. The current structure maintains two Web servers.

The *external* server provides access from the entire Internet. The external server provides academy information and details important to the parents of the cadets, prospective cadets, and the general public, as well as other universities and

educational institutions. The academic departments and the academy administration use the external server for a slightly different purposes. The administration uses the external server to provide information regarding such topics as admission, curriculum, academy resources, sports teams, and other information of public interest. The Academic departments put Web materials they develop which they think might be useful to other institutions and students.

The *internal* server (accessible only from computer systems within the Academy), services exclusively the cadets, the staff, and the faculty. The existence of the internal server allows the faculty to distribute more freely grades (listed by student number), quiz solutions, and information specific and current to their classes, and their students. We will focus our discussion primarily to the internal server, and it's benefits to the faculty and cadets.

Every cadet at the Military Academy purchases a standard desktop personal computer (PC) and a standard software suite. The PCs are located in the cadet's rooms and are fully networked with fiber optics. This standardization helps to minimize software and hardware compatibility issues, and provides the instructors a *level playing field* regarding computer related discussions and use. The fiber optic intranet supports up to 100 MB/sec transfers, and makes it possible to pass very large files, such as video, quickly.

Faculty members have comparable computing equipment, although it generally lags behind the new cadet machines. Each entering class gets the state-of-the-art computer, while faculty machines are upgraded based on a longer expected useful life.

Goals

We subscribe to two philosophies about technology. First, despite the attraction of new tools, we want to be sure we consider the "task before the tool". We decide what tasks to accomplish, and then we select the technology to do them. The helps us avoid doing things just because we can. The second is a "most bang for the buck" attitude. We don't want to do hard or expensive things which in the end add only marginal value. We want to adopt the high payoff items first.

The leadership style of the department is surprisingly collegial, and we want to persuade others to use the technologies based on their merits. The Web and Internet offered clear first steps:

Provide quick accurate information and feedback to the cadets. The Web offers an inexpensive and efficient method to *post* information for cadets. Cadets can get information, updated daily, regarding their grades. They can also immediately access solutions to daily quizzes or see a board problem worked out in greater detail than was possible in the classroom. Additionally, copies of the course syllabus, recommended drill problems, class schedules and other pertinent information is available and easily updated.

Move learning to cadet rooms while improving the learning. We consider two types of resources, those generated by our department and those made elsewhere.

Resources generated by our department include MathCad animations, PowerPoint slide shows, images, and other simple local products. These can be offered course wide by a course director, or by an individual instructor. These are all public domain, and we know their quality. We can tailor them exactly to meet our needs. As we master the technologies involved, we have place more ambitious local products on the internal server. We also make many of these available on the external server for others to use.

The resources on the Web are growing daily. Some of these resources are informational; others are interactive. The Web offers a myriad of supplemental information sources which reach far beyond the library, and are accessible to the cadets via their Internet connection and desktop PC from their rooms. Examples include the wonderful mathematics history site at the University of St. Andrew in Scotland, the Math Forum site run by Swarthmore, and others.

With the emergence of Java, many pages now can offer very visual and intuitive applications and demonstrations of mathematical concepts. For instance, if a cadet is having difficulty conceptualizing the idea of a derivative, they can visit a site that can show them an animation which iteratively depicts the derivative as a limit using the slope of a curve. This sharing of these Java "applets" provide the instructors a tremendous supplemental learning aid, with very little effort. And most importantly the cadets can *discover* and internalize many important and fundamental mathematical concepts. We collect and catalog URLs of these useful instructional sites and post them on our course Web pages. This saves the

student the search effort, and offers some assurance to the student of the quality of the site.

Better use of resources. Using the technology of the Internet and the Web can and have freed up some critical resources at the Academy. For instance, the Systems Engineering Department physically does not have the computer lab facilities to accommodate the current number of cadets enrolled in some of their courses. They have been able to reduce the time of the lab session from 2 hours to 1 hour by creating a *virtual lab*. This allows the cadets the opportunity to complete some of the requirements in their room prior to coming to the computer lab session in the academic building. This has been well received by the cadets and the faculty of that department and could serve as a model for other departments and universities.

Prepare cadets for life in a technological world. Throughout all this we have accomplished another implicit goal (and have done the cadets a great favor) by preparing them for life in this world of ever increasing technology. It is inevitable that the Internet will become more a part of our personal and professional lives. Hopefully through repeated exposure to the Web and it's many uses, they can be more scrutinizing, more productive, and more efficient users of the Internet.

How implemented

In the math department constructing a Web page is completely voluntary, and we have decentralized the use of the Web. Each course director can coordinate the instructor pages for the faculty members teaching in his or her course. Typically each course will have a home page, and this page links to the individual instructor pages. We maintain the instructor pages primarily to *supplement* the classroom instruction and not as the *sole source* of information. This allows its use by the cadets to be voluntary as well. However, it's been our experience that nearly every cadet has found the Web resources helpful.

It is not easy to convince all of the faculty that efforts to create and maintain a Web page reap appropriate benefits. We have used a chain teaching technique to help promote the use of the Web within the department. In the math department, it started with a few individual instructors creating and maintaining a Web page. They then helped other faculty members. We used existing files as templates. With some editing to personalize the pages, the new Web authors were soon up and running. It only requires a few minutes a day to keep the pages current.

As new instructors join the department, they receive formal training on the Web and Web authoring tools. They are expected to construct a biography page and a class page as part of their new instructor training program.

We used AOLPRESS as our Web authoring language. It offered a "what you see is what you get" (WYSIWYG) interface, and was easy to learn. This helped get authors trained quickly.

This method of implementing the Web works. It provides an easy, relatively painless approach to overcome the learning curve for the instructors not familiar with hypertext transfer mark-up language (HTML) and authoring a Web page. It also provides the department some minimal standardization through the use of templates for each new page being created.

Lessons learned

Over the past two semesters using the Web as a part of the classroom we have learned a great deal regarding the use of the Web in the classroom. Here are some specific topics and recommendations we can pass on to others based on our experiences.

- By putting a *counter* on all your pages you can easily determine which pages are being visited the most frequently. You can then put more emphasis on the pages and areas that are most widely used.
- Do the *easy* things first. For instance, scanning a hand written solution to a quiz may not be as neat as a type written solution on a word processor, but it is fast, easy and accomplishes the mission just as well. Later, as time allows you can continue to improve and *upgrade* the site as you see fit.
- Motivational material is very effective. Post audio links, verbal "attaboys", pictures of students, fun icons, and anything else that makes the student more motivated to explore your site and your course materials.
- Create links to other academic departments. This promotes interdisciplinary learning and helps the students understand some practical applications to the concepts discussed in class.
- Plan your structure carefully before you start to build, so everyone knows where everything will be placed. This standardizes addresses, and allows people to build pointers to future material with confidence.

- Offer lots of training, and repeat it frequently.
- Publicize what works, and use it for templates for more of the same.
- Be aware of the material being posted on the Web site. Pay close attention to copyright laws and proprietary software, and watch for inadvertent violations.
- Put someone in charge with authority to resolve conflicts and set standards. Choose a mellow person for this job, because we want to encourage growth not stifle initiative -- powers must be used sparingly and wisely. Choose a coach over an emperor.
- Use a standard WYSIWYG HTML editor such as AOLPress. It is not necessary for the Web site authors to learn HTML code. There are many freeware and shareware editors available now which greatly reduce the time required to construct and maintain a Web page.
- Scan the entire Web site for computer viruses daily. This should be done by the Web site administer with an automated process. It is essential that no viruses are passed on to the students from the department Web page. The most prolific virus we have found is the CONCEPT virus, a macro virus embedded in Microsoft Word documents. Since we post many Word documents, this is of special concern to us.
- Solicit input from the students. They can (and will) tell you what they like and dislike on the Web site, as well as what additions they would like to see.
- Automate what you can. Daily server uploads can be accomplished using scheduled batch files, for example. Students know exactly when they can extract information from the Web site, and the faculty are freed from remembering to routinely update their Web pages.

Conclusion

Cadets like these tools. Cadets particularly praise the fast and accurate feedback they receive from instructors. These methods reach the cadets and enhance their learning experience.

The Web delivers a lot of *bang for the buck*. We need to continue to evaluate the *opportunity costs* associated with the time and effort spent on constructing and maintaining the Web sites to make sure that the faculty works efficiently.

We have grown in our conviction that the Web is a valuable educational tool for cadets and faculty. Currently a rather immature technology, its use is growing by leaps and bounds every day as we learn how to best use it. It is used in our department because our faculty is willing and is encouraged to try new innovative methods. Every faculty member in the math department who has implemented the Web into their teaching has an increased belief in it's utility and potential to provide the cadets with a better learning environment.

Our site is at
http://www.dean.usma.edu/math/main.htm.

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CAS: Convenient, Affordable...and Stirring up Debate!

Professor Bradford Kline,
USAir Force Academy

CAS. To an instructor at the U. S. Air Force Academy, this three-letter acronym probably brings to mind the "Cadet Accountability System." However, there is a more global significance of the acronym CAS -- one which has swept through the mathematical community at large and which has pervaded a large portion of the mathematics curriculum at the Air Force Academy. CAS presents numerous exciting educational opportunities and possibilities for curriculum enhancement. But, as with any innovation which presents the potential for widespread and radical changes, CAS raises just as many questions, doubts, concerns, and fears...if not more.

I am referring, of course, to CAS as an acronym for "Computer Algebra Systems." Like it or not, computer algebra systems are here to stay, and they are becoming ever more powerful, convenient, and affordable.

Today, probably the most convenient and user-friendly CAS for the price is the version of *Derive* available on the Texas Instruments TI-92. Already, a number of cadets at the Air Force Academy own the TI-92, and they are *quite* familiar with its symbol-manipulating capabilities.

The convenience and availability of CAS raise a number of questions for the mathematical community at large. Many of these questions are vaguely reminiscent of those asked 7-8 years ago when graphing calculators first hit the streets!

How can we incorporate CAS technology to enhance the learning of topics in a traditional mathematics curriculum? Most "traditional" calculus textbooks on the market today incorporate technology by including problems in the homework sets to be solved with a calculator or computer (See, e.g., [2], [3], [4]). A typical problem might ask the student to use a computer-generated graph to analyze the validity of their pencil and paper skills, or to make guesses about the existence of critical points or zeros of functions.

But, *how far should we go in adapting technology to a traditional curriculum?* Does it make sense to have students use a computer algebra system to evaluate five integration by parts problems or to differentiate several functions highlighting the product and quotient rules? Several traditional books ask students to do just this. And any instructor who has ever assigned such problems has had the experience of being confronted by disillusioned students with the challenge: "Okay, so why did we spend several days learning how to do all this by hand if the computer can do it in a second?!"

Indeed, in light of the abilities of computer algebra systems, many in the mathematics community question the usefulness of spending an entire three to four weeks on such topics as techniques of integration, standard to any traditional calculus text. Many such topics in the traditional curriculum are becoming obsolete in light of technology, and there are certain limits to how well we can adapt technology to these topics.

So, *how can we modify the* ***mathematics curriculum*** *to support and benefit from the possibilities of CAS technology?* The Calculus&*Mathematica* package of Davis, Porta, and Uhl [1] gives us a flavor of the possibilities. This reform project, considered one of the more radical, teaches students calculus almost exclusively through the use of interactive *Mathematica* notebooks. In designing the course, the authors divorced themselves from many of the traditional approaches and skills of a standard calculus course.

But to what extent do graduates of a computer-based course lose their pencil and paper skills? And just how concerned do we need to be about these lost skills, anyway? The world is certainly not ready for a generation of students who cannot find the antiderivative of x^2 without a computer. On the other hand, the world seems ready to accept students who do not know how to make a trigonometric substitution. Where do we draw the line when it comes to pencil and paper skills?

And if we are not ready to throw pencil and paper skills completely out the window, where does that leave us at examination time? How much technology should a student be permitted to have during an examination? Even reform calculus books still expect students to work derivative and antiderivative problems by hand, and to practice these skills in entire homework sets. However, these same reform books have exercises which lend themselves well to calculator and computer solutions. How are we to permit the use of calculators or computers on exams while still allowing ourselves to assess a student's ability to compute a derivative by hand?

The next issue of *Mathematica Militaris* will be devoted to symbolic manipulation. We are currently seeking articles which describe the role of computer algebra systems at the various service academies. How are the different math departments incorporating CAS into the curriculum? Have any changes to the curriculum been made due to CAS? How do the students respond to the systems? What kind of orientation or training programs exist to bring students up to speed on the systems? What role do calculators and computers play on exams?

For those inclined to write editorial articles, here is some food for thought: In light of symbolic manipulation technology, should the quadratic formula be dropped from algebra courses? Should techniques of integration be dropped from calculus courses? Should students be permitted/encouraged to make use of CAS technology on exams? Should visualization and intuition become a replacement for rigor? (For example, should a graphical approach to power series convergence, as supported by technology, replace a rigorous study of series convergence tests?)

The above questions are merely suggestions for article topics. Any articles addressing related issues of symbolic manipulation and CAS are encouraged.

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Random Notes

Results of the 7th Annual SASMC Held at USAFA

The seventh annual Service Academy Student Mathematics Conference (SASMC) was held at the Air Force Academy 18 April 1997. Twentyfive cadets and midshipmen presented papers summarizing their senior research projects.

Major **Eric Bussian** of USAFA organized this year's session, which included a recreational ski day after the conference for interested participants. All participants expressed their gratitude to Major Bussian and Colonel **Litwhiler** for the excellent organization and execution of this year's conference.

USMA Cadets participating included Cadets **Sam Donnelly, Doug Fletcher, Hise Gibson, Jorn Pung, Michael Harding, Joe Losievski, Andre Rivier, Jonathan Sloan,** and **Mark Zais.** Their topics ranged over a wide variety of mathematical, statistical, and modeling issues. For example, Cadet Donnelly briefed on "Statistics in Sports Medicine", while Cadet Losievski discussed "Solving Non-linear Integral Equations using Neural Networks."

USNA was represented by Midshipmen **Laura Booth, Lani Hay, William Getchius, Michael Wheeler,** and **Glenn Truitt.** Their topics included "The application of Graph Theory to Mass Transit Systems", "A Spatially Oriented Form of the Prisoner's Dilemma", "Factors Adversely Impacting Promotion in the Marine Corps", and "Symmetry in Nullity Sequences: Using nullities of Toeplitz matrices generated from binary bitstreams."

USAFA was represented by Cadets **Erin Brewer, Severine Colborg, Chris Dotur, Jeremy Haas, David Koewler, Justin Riddle, Ryan Wilson, Sharon Rocha,** and **Joshua Davis**. Their topics included "A mathematical view of Rubik's cube", "Application of Experimental Design in Developmental Flight Tests: The CV-22 Radar System", and "A Simple Holographic Microscope". Cadets Wilson, Rocha and Davis were from the classes of 1998 and 1999, and they presented their solution to the 1997 Mathematical Competition in Modeling.

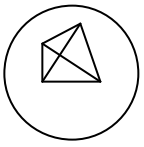
USCGA was ably represented by **Midshipmen Kevin Mahoney** and **Michael Krause**. Mr. Mahoney is the senior student in the midshipman chain of command at the Coast Guard Academy. He presented a paper on "Simulation using a Discrete Kalman Filter, and its application to positioning". Mr. Krause presented a paper on "Modeling Allocation of Coast Guard Cutters".

Faculty members from the several academies enjoyed the opportunity to discuss matters of common interest, including the abilities of entering students, testing standards, uses of technology, and content of the mathematics major.

The eighth SASMC is scheduled for 16-19 April 1998 at West Point. LTC Dave Olwell (DSN 688-5987, olwell@euler.usma.edu) is the organizer.

Problem

Choose any four points uniformly from the interior of the unit sphere. What is the expected volume of the tetrahedron formed by the four points?



(Problem contributions are gratefully accepted!
Forward to any member of the editorial staff.)