**College of Science and Health
Department of Mathematics
Course Outline**

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| **1.** | **Title of Course, Course Number and Credits**:Logo in Mathematics - MAEN 5080,  3 credits |
| **2.** | **Description of Course:**The course presents mathematical concepts that are suitable for exploration and extension through the use of the computer language; Logo. Topics covered range from mathematical patterning in geometry and number systems, to isometries and Fractals. The theory of programming in a procedural language is taught as it relates to the development of problem solving skills within the mathematics classroom. |
| **3.** | **Course Prerequisites**:The prerequisites for this course are MAEN 5020 or a knowledge of algebra. |
| **4.** | **Course Objectives:**  1. to learn the programming language, Logo with its structure
2. to use applications of programming in the mathematics curriculum
3. to explore relationships between turtle mathematics and standard curriculum mathematics
4. to understand and experience different areas in problem solving theory using programming
5. to build simulations based on mathematics using programming
6. to develop levels of programming activities consonant with the thinking skills hierarchy
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| **5.** | **Student Learning Outcomes**.Students will be able to:1. Understand the principles of programming
2. Develop and apply the both types of recursions
3. Understand the types of questions that programming answers, such as random walks, space-filling curves
4. Use the technology of programming to present theories of mathematics
5. Work with the MicroWorlds plug-in to develop a web page demonstrating a mathematical concept
6. Review the research and literature about the role of Logo in Education
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| **6.** | **Topical Outline of the Course Content**:

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|  | Patterning with Geometric Figures, Tail-End Recursion, Variables, and Utility Procedures |
|  | Mazes and Tessellations with Coordinates |
|  | Transformations and Sound |
|  | Probability, Random Walks, Probabilistic Grids with Random |
|  | Fractals and Space-Filling Curves with Embedded Recursion |
|  | The Internet with Project Presentation |
|  | Descriptive Statistics with Tools |
|  | Simulations with Text Box Manipulations |
|  | Turtle Ecology with StarLogo and Excel |

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| **7.** | **Guidelines/Suggestions for Teaching Methods and Student Learning Activities:**Course is being offered on-line. Each week includes readings, programming problems, and discussion postings.  |
| **8.** | **Guidelines/Suggestions for Methods of Student Assessment (Student Learning Outcomes**)Students will have1. Twelve short homework assignments demonstrating knowledge of Logo commands (60%)
2. Logo Project to explore any mathematical topic (25%)
3. Short paper (at least 750 words) on one of the readings/articles from the semester.(15%) The paper is to analyze one of the readings: either from the Internet, or from the text in terms of your own learning and thinking about Logo.

Questions to be answered are:1. what is the premise of the reading/article?
2. how does that premise speak to learning the Logo language?
3. how does that reading/article speak to learning of mathematics?
4. does the article/reading help your understanding of and learning about Logo?
5. does the article/reading help your teaching of Logo?
6. where do you see your future with Logo and your students?
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| **9.** | **Suggested Reading, Texts and Objects of Study**:Maddux, C. D. and D. L. Johnson, Ed. Logo: A Retrospective. New York, Haworth Press, 1997.ISBN 0-7890-0374-0 |
| **10.** | **Bibliography of Supportive Texts and Other Materials**:**Websites**

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|  | The main MicroWorlds web resource is the MicroWorlds Logo website with lots of projects, lessons, staff development resources and software!<http://www.microworlds.com/>  |
|  | Basic tutorial in MicroWorlds - prepared by Hunter Ballew from University of North Carolina<http://www.unc.edu/~hballew/ballew.html>  |
|  | Blake Lower School Lego Student Projects - a good site for seeing what lower schools are doing with Lego Logo.<http://www.blake.pvt.k12.mn.us/campus/projects/lower/lego/index.html>  |
|  | Curry Center for Technology and Teacher Education, University of Virginia. - MicroWorlds Logo Activities - several interesting activities with complete details.<http://curry.edschool.virginia.edu/teacherlink/math/activities/mwactivities.html>   |
|  | Gary Stager's Logo Resources -lots of ready-to-use programs and applications as well as papers<http://www.stager.org/logo.html>  |
|  | The Great Logo Adventure pdf files - published by Doone Publications. However, some of the material from the book is located in pdf files, Since this seems to be a public ftp site, there are more than one set of files there. The Great Logo Adventure files start with gla\_ch1.pdf and continue through gla\_ch12.pdf<http://www.doone.com/pdf/>  |
|  | Greatest Places Games - Sample Games written in MicroWorlds<http://www.greatestplaces.org/games/>  |
|  | The "Kids and Computers" Web Site - main topic is MicroWorlds Logo with the focus on how a Dad and his daughter learn Logo<http://www.kidsandcomputers.com/SiteToc.cfm>  |
|  | LOGO - Computer Programming Language for Learners - links to other sites, reference books, and teacher materials<http://www.atlantic.net/~caggiano/logo/logo.html>  |
|  | LOGO - Welcome - A ThinkQuest site with a complete tutorial on learning how to program Logo in English, French or German. However, the site requires a browser capable of Java!<http://library.thinkquest.org/18446/>  |
|  | The Logo Users Ring - a collection of sites dedicated to Logo, the computer programming language for learners. Both commercial and noncommercial sites are welcome to join the ring.<http://www.atlantic.net/~caggiano/logo/logoring.html>  |
|  | The Logo FoundationThe Logo Foundation is a nonprofit educational organization devoted to informing people about Logo and supporting them in their use of Logo-based software and learning environments.<http://el.www.media.mit.edu/groups/logo-foundation/>  |
|  | Logo list serverAn email logo discussion group. Messages sent to the list are mirrored in comp.lang.logo. To join send email with subscribe yourname@youraddress in the body of the mail message.  |
|  | Logo discussion group and discussion archives - in conjunction with the Global SchoolNet Foundation, is now managing a Logo discussion group. The objectives of this Logo discussion group are to: |
|  | 1. Promote active sharing of ideas among Logo using educators.
2. Provide a forum for questions to be asked about using Logo in the classroom.
3. Provide a meeting place for Logo educators interested in collaborating on telecomputing projects involving their students sharing Logo creations.
4. Provide a forum for discussion of educational philosophy on the use of technology in education and how Logo fits into that philosophy.
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It also has archives of the logo list, so you can search for past postings and such.<http://archives.gsn.org/logo-l/>

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|  | MIT Epistemology & Learning Group -The Epistemology and Learning Group at the MIT Media Lab explores how new technologies can enable new ways of thinking, learning, and designing. The group creates new "tools to think with" and explores how these tools can help bring about change in real-world settings, such as schools, museums, and under-served communities.<http://el.www.media.mit.edu/groups/el/> See in particular the Going in Circles project which is a way to think about circles.<http://el.www.media.mit.edu/groups/el/projects/circles/>  |
|  | StarLogoStarLogo is a programmable modeling environment for exploring the workings of decentralized systems -- systems that are organized without an organizer, coordinated without a coordinator. With StarLogo, you can model (and gain insights into) many real-life phenomena, such as bird flocks, traffic jams, ant colonies, and market economies.<http://lcs.www.media.mit.edu/groups/el/Projects/starlogo/>  |
|  | StarLogoT - new version from Tufts - only still available on the Macintosh platform - free to download with lots of manuals, and examples.<http://www.ccl.tufts.edu/cm/starlogoT/>   |
|  | St. Clair's Logo Information - John St. Clair teaches Technology at Vina Danks Middle School in Ontario, California and has developed a >Logo reference page with handouts, projects, and Logo information aimed at the Middle School Logo classroom<http://www.cyberg8t.com/jstclair/logo.html>   |
|  | Terrapin Logo, another version of Logo, which has been around for some time. This site has the program as well as an extensive Logo library<http://www.harvassoc.com/library/> Terrapin logo  |

**Books**

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|  | Abelson, H.A. and A. diSessa. Turtle Geometry: The Computer as a Medium for Exploring Mathematics. Cambridge, Massachusetts: MIT Press., 1981. |
|  | Bearden, D., J. Muller, and K. Martin. The Turtle's Sourcebook. Richardson, Texas: Young People's LOGO Association, 1982. |
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|  | Clayson, J. Visual Modeling with LOGO, Cambridge, MA: The MIT Press, 1988. |
|  | Corbitt, M.K. and R. Kalin. Geometry. Englewood Cliffs, NJ: Prentice Hall, 1992. |
|  | Cuoco, A. Investigations in Algebra. Cambridge, MA: The MIT Press, 1990. |
|  | Delaunay, S.  Sonia Delaunay Fashion Design Postcards, New York: Dover Publications. 1990. |
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|  | \_\_\_\_\_\_\_\_\_\_ Math Activities Using LogoWriter: Investigations. Eugene, OR: ISTE, 1993. |
|  | \_\_\_\_\_\_\_\_\_\_ Math Activities Using LogoWriter: More Patterns and Designs. Eugene, OR: ISTE, 1994. |
|  | \_\_\_\_\_\_\_\_\_\_ Math Activities Using LogoWriter: Numbers and Operations. Eugene, OR: ISTE, 1993. |
|  | \_\_\_\_\_\_\_\_\_\_ Math Activities Using LogoWriter: Patterns and Designs. Eugene, OR: ISTE, 1993. |
|  | \_\_\_\_\_\_\_\_\_\_ Math Activities Using LogoWriter: Probability and Statistics. Eugene, OR: ISTE, 1994. |
|  | Friendly, M. Advanced Logo: A Language for Learning. Hillsdale, NJ: Lawrence Erlbaum Ass., 1990. |
|  | Gardner, M. Penrose Tiles to Trapdoor Ciphers. New York: W. H. Freeman & Company, 1989. |
|  | Gnanadesikan, M., R. L. Schaeffer, and J. Swift. The Art and Techniques of Simulation.Palo Alto, CA: Dale Seymour, 1987. |
|  | Harper, Dennis. LOGO: Theory and Practice. Belmont, CA: Brooks/Cole Publishing Company, 1989. |
|  | Harvey, B. Computer Science LOGO Style, Cambridge. MA: MIT Press, 1997 |
|  | \_\_\_\_\_\_\_. Computer Science Logo Style : Advanced Techniques, Cambridge. MA: MIT Press, 1997 |
|  | \_\_\_\_\_\_\_. Computer Science Logo Style : Symbolic Computing, Cambridge, MA; The MIT Press, 1997 |
|  | Heller, Martin, and Wright. LOGOWORLDS. Rockville, MD: Computer Science Press, 1985. |
|  | Lewis, P. Approaching Precalculus Mathematics Discretely. Cambridge, MA: The MIT Press, 1990. |
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|  | Macdonald, R. Logo Musings: Ten Mathematical Encounters Using LogoWriter. Eugene, OR: 1996. |
|  | Maddox, C.D., ed. LOGO in the Schools. Binghamton, NY: Haworth Press, 1990. |
|  | Moore, M. Geometry Problems for LOGO Discoveries. Palo Alto, CA: Creative Publications, 1984. |
|  | Muller, J.  The Great Logo Adventure : Discovering Logo on and Off the Computer. Doone, Pubns. 1998 (has CD) |
|  | Papert, S. Mindstorms: Children,\_Computers, and Powerful Ideas. New York: Basic Books, 1980. |
|  | Schattschneider, D. and W. Walker. M. C. Escher Kaleidocycles. Corte Madera, CA: Pomegranate Artbooks, Inc., 1977. |
|  | Solomon, C. APPLE LOGO: Introduction to Programming through Turtle Graphics. New York: Logo Computer Systems, Inc., 1982. |
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|  | Yoder, S. MicroWorlds 2.0: Hypermedia Project Development and Logo Scripting. Eugene, OR:, ISTE, 1997. |

**Journals/Newsletters**

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|  | LCSI LOGO LINK published by Logo Computer Systems Inc. 220 Fifth Avenue, Suite 1604, New York, N.Y. 10001 |
|  | Logo ExchangeJournal of the ISTE Special Interest Group for Logo-Using Educators1787 Agate StreetEugene, OR 97403-1923a sample Logo Exchange, Vol 16, Fall, 1997 has been put on the web at http://moon.pepperdine.edu/~gstager/logoexchange/contents.html |

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| **11.** | **Preparer’s Name and Date**:Dr. Beva Eastman, 1996 |
| **12.** | **Original Department Approval Date**: |
| **13.** | **Reviser’s Name and Date**:Dr. Beva Eastman, Fall 2001 |
| **14.** | **Departmental Revision Approval Date**: |
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