

Apogee Program

Session 2

Instructor: TJ Leone

Teaching Assistant: TBA

Course Title

Bits and Blocks Level 2: Exploring Recursion with Logo

Course Description

Recursion is a powerful method used in computer science to break a problem down into simpler problems. In this course, recursion is used to solve puzzles, draw fractals, encode secret messages, translate sentences into Pig Latin, or simulate the growth of trees or the movement of animals. Students use Berkeley Logo, a free development environment with special functions and features that will enable MicroWorlds users to take the next step in programming with Logo. This course is great preparation for work with other list processing languages like Scheme, which is used in university computer science courses and is a valuable tool in computer science research.

Note: Additional \$120 lab fee is required.

Essential Questions

What is recursion? How is it used?

Outcomes

Upon successful completion of this course, students will:

- a. *Understand recursion as a distinct control structure among various control structures used in Logo and other computer languages.*
- b. *Recognize recursive calls and what they do*
- c. *Write recursive programs with appropriate stop rules, accumulation of data, and state changes.*

Instructional Strategies

Use one to two paragraphs to describe (in narrative format) the instructional strategies that will be utilized in the course to differentiate instruction (tiered assignments, flexible grouping, etc.).

Resources and Materials

- a. *Books: Harvey, Brian, Computer Science, Logo Style: Volume 1: Symbolic Computing, 1997/2nd Edition, ISBN 0-262-58148-5, available in free downloads at <http://www.eecs.berkeley.edu/~bh/v1-toc2.html>.*
- b. *Web sites: tjleone.com (Instructor's web site. Information for parents and students on course content as well as links to other sites relevant to the course.)*
- c. *Other Media (articles, course packs, etc.): Handouts developed by instructor.*
- d. *Materials: Journal (option for students who prefer using paper and pencil rather than electronic documents to record reflections on their work).*

Student Assessment

- a. *Pre-Assessment: On day one, students will be given programming challenges to test their understanding of concepts from the first Bits & Blocks class and their ability to transfer this understanding to the Berkeley Logo environment.*

- b. Documentation of learning: *Student work will be recorded in a range of coding challenges and projects, comments in their code, and a paper and pencil or electronic journal. The journal will be used to keep track of coding techniques, procedures, aspects of programming environments, and programming concepts learned in class.*
- c. Post-Assessment: *The Expo! activity will be an open house for parents at which students will have the opportunity to demo their programs.*

Schedule

Please indicate specific instructional strategies that you plan to use to present the topic and how you plan to differentiate instruction (tiered assignments, flexible grouping, etc.) for student's varied level of ability.

Date(s)	Topic(s)	In-class Activities	Documentation of Learning
7/18/2010	Overview of Berkeley Logo Environment	Exploration of environment and discussion	Code, code comments, paper or electronic record of procedures or concepts learned.
7/19/2010	Procedures, variables and predicates	Tracing procedures; Local variables	Code, code comments, paper or electronic record of procedures or concepts learned.
7/20/2010	Functions of functions	Numeric iteration, functions, map, filter, reduce, anonymous functions, cascade	Code, code comments, paper or electronic record of procedures or concepts learned.
7/21/2010	Project work	Mastermind	Code, code comments, paper or electronic record of procedures or concepts learned.
7/22/2010	Project work	Mastermind	Code, code comments, paper or electronic record of procedures or concepts learned.
7/26/2010	Introduction to recursion: Martin and the Dragon	recursively visiting items in lists, including numbers, turtles and other objects; stop rule	Code, code comments, paper or electronic record of procedures or concepts learned.
7/27/2010	Recursive math functions and series	Martin and the Dragon: factorial, exploration of other functions and series	Code, code comments, paper or electronic record of procedures or concepts learned.
7/28/2010	The three rules of recursion: <ul style="list-style-type: none"> • know when to stop • decide how to take one step • break the journey down into that step plus a smaller journey 	Write recursive procedures with bases, step changes, and stop rules	Code, code comments, paper or electronic record of procedures or concepts learned.
7/29/2010	Writing recursive procedures by building up (Harvey, chapter 7)	Manipulating words and lists with recursion	Code, code comments, paper or electronic record of procedures or concepts learned.

7/30/2010	Writing recursive procedures by leap of faith (Harvey, chapter 8)	Write and understand towers of Hanoi procedures	Code, code comments, paper or electronic record of procedures or concepts learned.
8/2/2010	How recursion works (Harvey, chapter 9)	Mini projects and challenges	Code, code comments, paper or electronic record of procedures or concepts learned.
8/3/2010	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.
8/4/2010	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.
8/5/2010	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.
8/6/2010	Final project work	Presentation of projects	Code, code comments, paper or electronic record of procedures or concepts learned.

Instructor Biography

TJ Leone has taught over twenty math and computer science courses at CTD over a period of eight years, including eight sessions of Bits & Blocks. For the last three years, he has taught at Chiaravalle Montessori School in Evanston. Before that, he worked as an educational software developer at Northwestern University. He has a BA in Math and an MS in Computer Science from the City College of New York and an M.Ed. in Montessori Elementary Education from Loyola College in Maryland, as well as graduate work in Computer Science and Learning Sciences at Northwestern. He holds a Montessori teacher certification from the Association Montessori Internationale and is a Sun certified Java programmer.

Contact Information

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CTD Statement on Third-Party Web Sites

Instructors are required to thoroughly review any third-party web sites they intend to use in their courses for inappropriate content. However, because web content continuously changes, CTD disclaims any responsibility for any of the content contained on third-party web sites used in course materials. If you become aware of anything that may be inappropriate, please notify CTD staff immediately.