

Apogee Program Session 2

Course Title: Bits & 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, students use recursion to draw fractals, translate sentences into Pig Latin, or simulate the growth of trees or the movement of animals. In addition to MicroWorlds, the Berkeley Logo environment will be made available to students. Berkeley Logo is a free development environment with special functions and features that will enable MicroWorlds users to take the next step in programming with Logo. Picking up where Bits & Blocks 1 leaves off, students will also deepen their understanding of game genres and effective programming practices. 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.

Essential Questions

- What is recursion?
- How is it used?
- What are some of the different genres of video games, and how are they developed?

Outcomes

Upon successful completion of this course, students will:

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

Instructional Strategies

This course is given at an accelerated pace, exposing children to curriculum that would normally be covered over the course of a year. As a programming course, this course is heavily problem based. In order to accommodate the range of skills and interests that students bring to this course, we will rely heavily on independent study, using tiered activity as appropriate to make sure that each student is working at an appropriate level of challenge. We will use flexible grouping as opportunities arise for students to learn from one another.

Resources and Materials

- **Books**
 - 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>.
- **Web sites**
 - a. tjleone.com. Instructor's web site includes a "Camp Logo" section with lessons, articles, homework, online activities, sample projects, links and videos for self-paced learning.
 - b. microworlds.com. Publishers of MicroWorlds EX

c. Students may also search other appropriate sites for information and media as needed.

- **Materials**

- a. Microworlds EX/LOGO programming environment, Logo Computer Systems, Inc.

Student Assessment

- **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.

- **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.

- **Post-Assessment**

On the last day of class, students will demo their course projects.

Schedule

Date	Topic(s)	In-class Activities	Assignments/Assessments
7/18/2011	Plumbing Diagrams	Pre-assessment of skills, knowledge and goals, introduction to MDiagrammer.mwx	Code, code comments, paper or electronic record of procedures or concepts learned.
7/19/2011	Introduction to Case Study	Discussion of requirements for 1.0 version, plumbing diagrams of predicates, complete version 1.0	Code, code comments, paper or electronic record of procedures or concepts learned.
7/20/2011	Case study continued	Discussion of requirements for 2.0 version, review pre-assessment material, begin version 2.0	Code, code comments, paper or electronic record of procedures or concepts learned.
7/21/2011	Case study continued	Discussion and demonstration of breeds and sprites. Continue work on version 2.0	Code, code comments, paper or electronic record of procedures or concepts learned.
7/22/2011	Case study continued	Discussion and demonstration of movement of (nonplayer) characters. Optional discussion of requirements for version 3.0. Finish up version 2.0 or version 3.0.	Code, code comments, paper or electronic record of procedures or concepts learned.
7/25/2011	Turtle Geometry	Discussion and demonstration of turtle geometry. Design development.	Code, code comments, paper or electronic record of procedures or concepts learned.
7/26/2011	Recursive designs	Discussion and demonstration of SNOWFLAKE and other fractals. Design development.	Code, code comments, paper or electronic record of procedures or concepts learned.

Date	Topic(s)	In-class Activities	Assignments/Assessments
7/27/2011	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. Manipulating words and lists with recursion	Code, code comments, paper or electronic record of procedures or concepts learned.
7/28/2011	Practical Recursion, Part 1. Towers of Hanoi: Writing recursive procedures by leap of faith (Harvey, chapter 8)	Solving the towers of Hanoi problem (online game). Write and understand towers of Hanoi procedures.	Code, code comments, paper or electronic record of procedures or concepts learned.
7/29/2011	Practical Recursion, Part 2. Review of the SLANT problem and discussion of the SCRAMBLE project.	Complete the SCRAMBLE project	Code, code comments, paper or electronic record of procedures or concepts learned.
8/1/2011	Case Study 2: Debugging and Enhancing an existing project.	Students are given a partially completed project with faults. They fix the faults, add features, and fix any new faults they might have introduced. Students complete self-evaluations.	Code, code comments, paper or electronic record of procedures or concepts learned.
8/2/2011	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.
8/3/2011	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.
8/4/2011	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.
8/5/2011	Final project work	Completing session projects	Code, code comments, paper or electronic record of procedures or concepts learned.

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.