A Brief Introduction to *Logic 2010*

Logic 2010 is a system for computer and Internet-assisted classroom instruction in first order logic. Versions of the program have been used at UCLA since 1985 and have been adopted at more than 40 other institutions in 5 different countries. The system is provided, without cost, by the UCLA Logic Software Project to enhance the teaching of elementary logic.

The system consists of four parts, the first three of which are customized for the particular course in question:
- A desktop program that runs on the student's and the instructor's local machines (the instructor's version has additional facilities)
- Separate websites for Instructors and for Students
- An electronic Gradebook for instructors.
- Our own on-line textbook, *An Exposition of Symbolic Logic*, written by Terry Parsons.

The Desktop Program: The desktop program contains modules for doing derivations, learning the inference rules, symbolizations, truth tables, invalidity by finite models, and parsing. The system of derivation is based on the natural deduction system created by Kalish and Montague. Students may create their own User Problems, and in the derivation module, students can create and justify their own rules. Derived rules become available as soon as the student proves the underlying theorem. Command Mode allows students to construct complete derivations by providing only the justification (which may be "queued") for each line; the program then enters the appropriate formula. The desktop program contains a variety of handy tools to simplify the mechanics of entering work. The program corrects the student's work, and provides several layers of detailed error messages, along with hints and explanations. When satisfied, students submit their work over the Internet to the on-line database. The desktop program is supported on the Windows and Mac operating systems. It is also known to have run successfully on some distributions of Linux and other operating systems. When there are changes in the program, the desktop program automatically updates itself when it is opened.

The Instructors' and Students' Websites: The Instructors' Website, which is the second leg of the system, contains facilities for instructors to create assignments and to review student-submitted work, plus a number of useful ways of viewing these data. A student can view the instructor-created assignments on the Students' Website. Each student has access to his or her own webpage, which shows the assignments, the work the student has completed, and the score on each problem. Instructors can view the scores of all students in the class, individual student assignment pages, a statistical summary of the difficulty students have had with each problem, and other data. Instructors can also adjust the score of any submission (used primarily to give partial credit on an exam problem or to give credit for excused, late homework submissions).

The Electronic Gradebook: The third leg of the system is our electronic Gradebook, which automatically imports data from the on-line database. The Gradebook imports data more quickly than the time it would take to log into the website, and view it there. When used in combination with our new *Blue Book facility*, which allows one to enter scores from a pencil & paper exam into the Logic 2010 database as quickly and easily as copying them into a

traditional, paper grade-book, the Gradebook provides a complete and flexible, automated system of record keeping, analysis of scores, a graphical representation of the distribution of scores, and grade assignment.

The Textbook, *An Exposition of Symbolic Logic*: The fourth leg of the system is our on-line textbook, written by Terry Parsons. Like the program, the text covers first-order logic through identity and descriptions. Although keyed to the program, it contains its own exercises and could serve as a stand-alone text. Parsons continues to update and expand the text.

How We Teach

In the classroom, we use a "big-font" version of the desktop program on a laptop connected to a data projector (this version of the program is available only to Instructors). Students learn the program while observing its use in learning logic. (We do recommend an initial session on using the program.) Following class, work done in class can be printed to a pdf and posted to the Students' Website or to a course website maintained by the instructor's university. Many universities have classrooms containing built-in data projectors. Most instructors and TAs experience little difficulty learning to lecture using a laptop and projector rather than a blackboard. Although it is possible to use Logic 2010 without using the program in the classroom, the benefits to student learning of using the program in class are manifest and measurable.

At UCLA we give exams in a computer lab using cardboard "privacy" screens. The program contains facilities to allow instructors to create their own exams to be administered on the computer. At universities lacking the facilities for computer exams, traditional pencil and paper exams, which we call "Blue Book exams", are given. The program contains special problems (in blue-book *mode*) that simulate the conditions of a paper exam. These problems are often used to construct a computerized Practice Exam for a traditional pencil and paper exam. The Instructors' website also contains special facilities for entering the scores from traditional paper exams into the on-line database, from which they are automatically imported into the Gradebook, whose facilities are described above. Our current project is to enhance the facility to allow instructors to add their own Instructor Problems to the desktop program.

Our aim has been to construct a system in which instructors instruct, while tutorials, grading, and clerical work are done by the system. At UCLA, where we now teach classes up to 300 students, we use a single TA to teach four weekly discussion sections, and six to eight undergraduate 'tutors' to hold additional office hours. All office hours are held using the program on a laptop.

To Demo the Program

You can easily demo the desktop program that is used by students without being associated with a class. To install and start the program, begin at our Portal at **<http://logiclx.humnet.ucla.edu/>**. When you reach the Download site, follow instructions. Note that there are separate instructions for the Windows and Mac operating systems. You must install the program before you run it, unless the program has already been installed on the computer you are using. You install the program by downloading and running the appropriate installer for your computer. The Download site also contains instructions for starting the program. After starting the program, select "Demo" as the Institution, and click

OK. You will not have access to an assignments page and will not be able to submit work or back up your work files, but you can experiment with the problems in each module. All of the program's facilities for correcting work, providing error messages, and providing hints will be active. Each module contains a "Help" file that explains how to use the module. Be sure to read the Help file before attempting to use each module. It is also useful to read "Using Logic 2010", accessible from the program menu.