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Problem Statement: BinaryKids

While most elementary-aged children are taught basic math concepts, they are rarely introduced to their real life applications and importance. Data show that this phenomenon decreases students' propensity to pursue technical careers in the long run, and weakens our national innovation gap with other countries. By 2020, the United States will have more than 1 million vacant programming/computing jobs with only 400,000 computer science graduates available to fill them.[1] This application attempts to fix the social/educational problem of students not being introduced to math/CS in a manageable way at an early age by teaching elementary-aged children about binary numbers and their application.

This applet consists of a tutorial and game to introduce young students to binary numbers, illustrating their importance to CS/computing, application, and conversion method from base-10 numbers. The tutorial will be an interactive walk-through of several examples--a series of screens that explain different parts of decimal to binary conversion, binary to decimal conversion, binary addition, and binary subtraction, allowing for user input to verify understanding at each step. After each teaching module (binary conversion, decimal conversion, addition, subtraction), the user will be tested with practice problems. In order to move forward in the tutorial, correct answers must be submitted; if they are not, the user is returned to the previous learning module to go through a new example illustrating that specific binary math concept. After the user has successfully gone through each learning module and practice problem in the tutorial, the game will be unlocked, and the user will be able to apply what they've learned with a fun game. The game component will be similar to snake, and will allow a user to maneuver a snake/object across a game board to hit the next correct number to answer a binary math question. The game will have multiple levels to give users conversion, addition, and subtraction problems of different difficulties.

The system will be deployed on any computer via an applet run in a web browser, but will not be supported on mobile computing devices. The target environment and audience are elementary-aged students (3rd-6th grade) with previous knowledge of basic computer skills (typing, maneuvering between pages) and who already have knowledge of basic math in base-10 (addition/subtraction/multiplication/division). A successful application will have an 80% "win" rate for the binary game, as that will indicate that most students were able to successfully understand, internalize, and apply the concepts being taught.

A prototype will be delivered to the client by April 23, 2015, and a final product will be completed by April 27, 2015. The client can expect deliverables in the form of a runnable .jar file that will run the tutorial and game in a web browser, a compressed eclipse directory containing the applet's source code, and a website that explains how to use the software and a discussion of its social benefit.

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[1] See TechCrunch "Closing the Computer Science Gap, From Classroom to Career." http://techcrunch.com/2015/02/01/integrate-california-schools-with-computer-science/