letters

that the "hertz" designation would be a relatively recent usage for cycles per second. Kilohertz were indicated on the radio receiver I used as a high-school boy in the 1920s. Problem 1502 in a book with physics problems for high school, published around 1930, asks: "What should be the capacitance of a closed circuit with a self-inductance of 1 henry for obtaining an eigenfrequency of 50 hertz?" (I am translating from the Dutch, as I took my high school education in the Netherlands.)

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Computer-assisted testing

The controversy in your pages about computer-assisted education, exemplified by the letters of Thomas L. Clarke, Julius Sumner Miller and Alfred Bork in December (page 15), prompts me to write. Although use of computers in the classroom for teaching will continue to be debated, there is an area of our school activities in which I think that using the computer could only be a boon, and that area is testing.

The most primitive use of computers in testing would be to automate multiple-choice examinations. It is also possible to imagine computer-assisted testing in which constructed answers of the student (either formulas or numbers) are examined by the computer, searching for trivial computational errors, units errors or errors of manipulation, with a prompt to the student that his or her answer is in error, and that the student should check this or that detail of his or her work. Computer-assisted testing holds out the promise that a student who does poorly on traditional examinations could demonstrate ability with instantaneous correction. It also allows a student to know when he or she did *not* know some material, as self-delusion would be impossible under computer-assisted testing.

If oral examination is the paradigm of testing, but is irreproducible and therefore intrinsically unfair *between* students, then computer-assisted testing appears to be the closest fair approximation to the ideal that a society could construct.

In arguments with colleagues, I have never yet failed to convince them that the concept of computer-assisted testing would be a significant improvement over conventional testing, if we indeed mean testing to really measure something. This then brings me to the second interesting piece in December, by F. Curtis Michel, on refereeing (page 9). For over three years, I have been searching, fruitlessly, for support to attempt the introduction of computer-assisted testing in a technical class (physical chemistry) that is heavily dependent on calculus and physics, but is attended by students who, in the main, are not exceptionally proficient in either of these two subjects. From the NSF to the Department of Education, from one foundation to another, I have wandered, searching for help and getting none.

The arguments made against the proposal by referees, I generally can dispose of in face-to-face encounters, but re-submission of a proposal involves facing a new battery of referees, who in turn raise a new set of arguments. Perhaps the idea is no good.

But, if there is merit in the idea, and the referees are wrong, then I have no recourse. Endless proposal preparation is a waste of life.

I would like to suggest that the major problem with anonymous referees is that they are not judged themselves. The program managers are only taking an average of their "good," "excellent" and so on, and acting on that average. It would make more sense to me to have referees know, ahead of time, that if there is a wide disparity between remarks of the set of referees, then these remarks will be circulated *with author's name and address* to the other referees, for rebuttal.

Referees, knowing that they were not absolutely anonymous and that a nasty remark could be challenged by peers engaged in the same judging task, might be less apt to exhibit inappropriate nastiness. If a referee knew that pushing the career of ex-graduate students by favorable remarks was likely to be challenged, that referee might tend not to exhalt obviously cloned research so highly.

In judging the evaluations that students make of faculty, I have always been impressed when a student who did poorly in a subject lauded his or her teacher, and when a student who did well thought poorly of his or her teacher. The judging of judges should be improved if the refereeing system is to be improved. Otherwise, it would appear better to abandon the effort of judging completely. And testing should be improved, or we should stop testing.

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Saudi research center

I have read the comments by Mujaddid Ijaz (May, page 11) and Eli Mishkin (December, page 15), in reference to the so-called nuclear-energy center at King Abdulaziz University in Jeddah. Since I am responsible for the research center to be developed within King Abdulaziz