MATHEMATICS
(Iowa Section of the Mathematical Association of America)

1. NONSTANDARD MODELS FOR ARITHMETIC AND ANALYSIS

   Alexander ABIAN, Ames.

   Examples of Models (called Nonstandard Models) are given for the usual axioms of Peano's Arithmetic where object and the sets of objects have strikingly different properties than natural numbers and the sets of natural numbers.

   Similarly, Nonstandard Models are given for the Theory of the Real Closed Fields where objects and the sets of objects have properties which are not shared by the real numbers and the sets of real numbers.

2. TWO BOX-FILLING PROBLEMS, William H. Cutler, Waverly

Problem 1. Subdivide a rectangular solid into smaller rectangular solids such that all dimensions (lengths, widths, heights) of the smaller solids are different. This can be done, and the smallest number of pieces required is 23. Posed and solved independently by Cutler and Kim. Problem 2. For a,b,c > 0 we have the inequality $(a+b+c)^3 \geq 27abc$ (prove by repeated use of $(a+b)^2 \geq 4ab$). This makes an interesting box-filling problem: Fit 27 blocks a by b by c into a cube a+b+c on a side. To make it difficult, set a=4, b=5, c=6, a+b+c=15. There are 21 essentially different solutions, all of which are irregular. The pieces do not completely fill the cube. Problem discovered by Hoffman, computer results on number of solutions by Cutler. Models of the puzzles made in wood will be shown.

3. TYPESETTING MATHEMATICS ON A COMPUTER.
Michael Folk, Des Moines.

One of the problems involved in typing text which has mathematical symbols is the large amount of time needed to type mathematical expressions in the standard two-dimensional format. The paper will cover the design and implementation of a computer-based system for typing two-dimensional expressions, which can be described to the computer in one-dimensional, or linear, form. The system is being used for generation of tests in a precalculus course at Drake University.

For instance, the string   *[[x^2 + y^2]@[x + y]]
would produce:

$$\sqrt{\frac{x^2 + y^2}{x + y}}$$

4.   EXAMPLES FOR ELEMENTARY GROUP THEORY.   Irvin Roy Hentzel, Ames.

We present examples of group theory which are useful in motivating students in their first contact with the subject. These examples are short so that they may be included easily within the lecture, and they are self-explanatory so that no background information is needed. They have been used to enrich our first quarter group theory course.

5. COUNTING RECTANGLES ON A LATTICE: AN ILLUSTRATION OF MATHEMATICAL INDUCTION. Bonnie H. Litwiller* and David R. Duncan*, Cedar Falls.

This presentation concerns an example of mathematical induction used by the authors in courses for prospective secondary school teachers. It is proven that the number of rectangles on an n + 1 by n + 1 rectangular array of points is $\left[\sum_{i=1}^{n} i\right]^2$.   Reference is also made to a similar problem in three dimensions.