Math Competition

April's Fools
PROBLEM #4*:*
April 1, 2016 to April 15, 2016

(1) Insert a math sign between 5 and 6 to get a real number strictly between 5 and 6.

(2) There are $n > 1$ identical coins one of which is fake: it's either heavier or lighter than a real coin. It turns out that it's impossible to determine the fake coin using weighings on the standard balance. Find all possible values of n.

(3) A rectangle is divided into 4 smaller rectangles by two segments parallel to the rectangle's sides. The areas of the four small rectangles are 4, 8, 12, and A, where A is not an integer. Find A.

(4) A wise man noticed: "*For the first time in the Common Era, a year has come such that the number of grains equal to the number of this year, can be placed on the cells of an eight × eight chessboard so that no two cells contain the same number of grains.*" What was that "*first-time-in-history*" year?

(5) The 2016 numbers $1, 2, 3, \ldots, 2015, 2016$ are written on 1008 cards without a repetition. Every card contains two numbers, one number on each side. On each of the cards, the difference between its two numbers is exactly 1. You pick a card with the number 1950 visible on one side. Which number is written on the other side of this card and why?

Provide a justification to your answers.

Direct any questions to
Gregory Galperin (OM 3361), Grant Lakeland (OM 3630), or Peter Andrews (OM 3341)

Rules & Rewards

- Any undergraduate currently enrolled at EIU is eligible to participate.
- Each solution is to be the work of one individual and is to be submitted with the solver's name, year in school, email address, local address, and home address.
- Each solution is to be written or typed and is due in the main Mathematics Department office (OM 3611) by **2:00pm, Friday, April 15, 2016**.
- Entries will be judged on the basis of clarity of exposition and elegance of the solution. That is to say, the *explanation* is more important than the answer.
- An award of $25 will be given for the best solution. In the case of a two-way tie, the award will be evenly split. If there are more than two 'best' solutions, a drawing will be held for the reward. In the case no award is made for this week's challenge, $25 will be added to the next week's award.
- Names of all solvers will be posted on the Challenge of the Week bulletin board and on the Challenge of the week homepage: `http://www.eiu.edu/math/challenge.php`