WISCONSIN MATHEMATICS, SCIENCE & ENGINEERING TALENT SEARCH

PROBLEM SET I (2013-2014) **October 2013**

1. What is the smallest positive integer n such that a cube of side length n can be cut into 2013 smaller cubes with integer side lengths?

2. The equilateral triangle ABC has sides AC and BC tangent to a circle with center O at A and B, respectively. If $AO = \sqrt{3}$, what is the area of the quadrilateral $AOBC$?

3. We distributed 100 balls into 100 boxes, and we didn't put all the balls into a single box. (There may be empty boxes.) Show that there is an integer k with $1 \leq k < 100$ so that we can choose k boxes which, together, contain exactly k balls.

4. A palindrome is a number which reads the same forward and backwards such as 1441 or 35253. Find the largest five-digit palindrome that is divisible by 101.

5. We multiplied four consecutive integers, and the result was the same as the product of two consecutive integers. What are the possible values of the product?

You are invited to submit a solution even if you get just one problem. Please do not write your solutions on this problem page. Remember that solutions require a proof or justification.

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