Problems

Problem 1. Suppose that $ax^2 + bx + c = 0$ where a, b, c are odd integers. Prove that x cannot be a rational number.

Problem 2. Prove that $(p-1)! + 1$ is divisible by p for each prime number p.

Problem 3. There are 117 college football teams in Division 1-A of the NCAA. Prove that it is not possible to create a schedule such that each team plays exactly 11 games against Division 1-A opponents.

Problem 4. Find all integer solutions for $(5x^3+10x^2+6)^{101}-(75x^2+4)^{999} = 3$. [Hint: consider arithmetic modulo 5.]

Problem 5. Prove that every polyhedron must have two faces that are bounded by the same number of edges.

Problem 6. Let A be an $m\times n$ matrix such that the entries of each row are arranged in strictly increasing order from left to right, and also such that the entries of each column are arranged in strictly increasing order from top to bottom. Given a particular value k, our goal is to determine whether or not k is contained anywhere within matrix A. Describe a way to determine this by examining fewer than $m+n$ of the total $m \times n$ entries of matrix A.

Problem 7. Given 14 four-sided dice, show how to label each face of each die with one of the letters $\{A, B, C, D, E, F, G, H\}$ such that each subset of 3 letters can be found on some die. Also, given 130 six-sided dice, determine whether or not it is possible to label each face of each die with one of the letters $\{A, B, C, \ldots, Z\}$ such that each subset of 3 letters can be found on some die.

Solutions, comments, and discussions should be sent to:

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