Day 1

1. Do there exist a sequence $a_1, a_2, a_3, \ldots$ of real numbers and a non-constant polynomial $P(x)$ such that $a_m + a_n = P(mn)$ for every positive integral m and n?

2. In the plane are given 100 lines such that no 2 are paraller and no 3 meet in a point. The intersection points are marked.Then all the lines and k of the marked points are erased. Given the remained points of intersection for what max k one can reconstruct the lines?

3. An acute triangle ABC is inscribed in a circle of radius 1 with centre O; all the angles of ABC are greater than 45°. B_1 is the foot of perpendicular from B to CO, B_2 is the foot of perpendicular from B_1 to AC. Similarly, C_1 is the foot of perpendicular from C to BO, C_2 is the foot of perpendicular from C_1 to AB. The lines B_1B_2 and C_1C_2 intersect at A_3. The points B_3 and C_3 are defined in the same way. Find the circumradius of triangle $A_3B_3C_3$.

4. There are many opposition societies in the city of N. Each society consists of 10 members. It is known that for every 2004 societies there is a person belonging at least to 11 of them. Prove that the government can arrest 2003 people so that at least one member of each society is arrested.

Day 2

2 The incircle of triangle ABC touches its sides AB and BC at points P and Q. The line PQ meets the circumcircle of triangle ABC at points X and Y. Find $\angle XBY$ if $\angle ABC = 90^\circ$.

3 Zeroes and ones are arranged in all the squares of $n \times n$ table. All the squares of the left column are filled by ones, and the sum of numbers in every figure of the form [asy]size(50); draw((2,1)–(0,1)–(0,2)–(2,2)–(2,0)–(1,0)–(1,2));[/asy] (consisting of a square and its neighbours from left and from below) is even. Prove that no two rows of the table are identical.

4 m and n are positive integers such that m¿n$^n - 1 andthenumbers m+1, m+2, .., m+n arecompositenumbers. Provethe$
$ifor all li between 1 and n. : D$