mathematics ever conceived. That is where Lobachevski develops the geometry of the horosphere and then establishes that the geometry of the sphere is independent of the parallel postulate (that is, the geometry and trigonometry of a sphere is the same in imaginary geometry as in Euclidean geometry); these results lead him directly to the key formulas of imaginary geometry.

Unsolved Crux Problems

As remarked in the problem section, no problem is ever closed. We always accept new solutions and generalizations to past problems. Recently, Chris Fisher published a list of unsolved problems from *Crux*[2010 : 545, 547]. Below is a sample of two of these unsolved problems:

342$\star$. [1978 : 133, 297; 1980 : 319-22] *Proposed by James Gary Propp, Great Neek, NY, USA.*

For fixed $n \geq 2$, the set of all positive integers is partitioned into the (disjoint) subsets S_1, S_2, $\ldots$, S_n as follows: for each positive integer m, we have $m \in S_k$ if and only if k is the largest integer such that m can be written as the sum of k distinct elements from one of the n subsets.

Prove that $m \in S_n$ for all sufficiently large m. (If $n = 2$, this is essentially equivalent to Problem 226 [1977 : 205]).

1754$\star$. [1992 : 175; 1993 : 151-2; 1994 : 196-9; 1995 : 236-8] *Proposed by Walther Janous, Ursulinengymnasium, Innsbruck, Austria.*

Let n and k be positive integers such that $2 \leq k < n$, and let x_1, x_2, $\ldots$, x_n be non-negative real numbers satisfying $\sum_{i=1}^{n} x_i = 1$. Prove or disprove that

$$\sum x_1 x_2 \ldots x_k \;\leq\; \max\left\{\frac{1}{k^k}, \frac{1}{n^{k-1}}\right\},$$

where the sum is cyclic over x_1, x_2, $\ldots$, x_n. [The case $k = 2$ is known — see inequality (1) in the solution of ***CRUX* 1662** [1992 : 188].]

Good luck solving these problems. We would love to receive your solutions so that we could cross them off our list.