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Featuring the Memorial University Undergraduate Mathematics Competition, March 2000; and the Bernoulli Trials 2000, from Christopher G. Small & Byung Kyu Chun of the University of Waterloo

261 The Olympiad Corner: No. 207 *R.E. Woodrow*

Featuring the Swedish Mathematical Competition, Final Round, November, 1996; the 48th Polish Mathematical Olympiad, Final Round, written April 4–5, 1997; the 18th Brazilian Mathematical Olympiad; the Selection Test for the Vietnamese Team 1997, written May 16–17, 1997; readers' solutions to problems of the Bundeswettbewerb Mathematik, Second Round 1995; to the First Round 1996 of the Bundeswettbewerb Mathematik; and to problems of the XLV Lithuanian Mathematical Olympiad 1996.

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Geometry from Africa — Mathematical and Educational Explorations by Paulus Gerdes, Reviewed by *Julia Johnson*, University of Regina, Regina, Saskatchewan.

280 Some bounds for $\phi(n)\sigma(n)$

Edward T.H. Wang

Let $\mathbb{N}$ denote the set of all natural numbers. In elementary number theory, three multiplicative functions which are discussed most frequently are $\tau(n)$, the number of (positive) divisors of $n \in \mathbb{N}$; $\sigma(n)$, the sum of all the divisors of n; and $\phi(n)$, Euler's totient function; that is, the number of positive integers in $\{1, 2, \ldots, n\}$ which are coprime with n.

Though there are well-known formulae for computing the exact values of these functions, these formulae all depend on the actual prime power factorization of the natural number n. Hence it is of interest to find upper and lower bounds for these functions, preferably in terms of n only. Indeed, examples of such bounds abound in the literature.

Read on!

This month's "free sample" is:

2551. *Proposed by Panos E. Tsaoussoglou, Athens, Greece.*

Suppose that a_k $(1 \leq k \leq n)$ are positive real numbers. Let $e_{j,k} = (n-1)$ if $j = k$ and $e_{j,k} = (n-2)$ otherwise. Let $d_{j,k} = 0$ if $j = k$ and $d_{j,k} = 1$ otherwise.

Prove that

$$\prod_{j=1}^{n} \sum_{k=1}^{n} e_{j,k} a_k^2 \;\geq\; \prod_{j=1}^{n} \left(\sum_{k=1}^{n} d_{j,k} a_k \right)^2 .$$