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SPECIAL ADVANCED PROBLEM

H-182S Proposed by Paul Erdös, University of Colorado, Boulder, Colorado.

Prove that there is a sequence of integers $n_1 < n_2 < \cdots$ satisfying

$$\frac{\sigma(n_k)}{n_k} \to \infty \quad \text{and} \quad \frac{\sigma(\sigma(n_k))}{\sigma(n_k)} \to 1 ,$$

where

$$(n) = \sum_{d|n} d$$

(the sum of the integer divisors of n.)

[From Conference on NUMBER THEORY, March 24-27, Washington State University, Pullman, Washington.]