replaced by the "lucky numbers." That is fitting, since this sequence was invented by the Los Alamos school of number theory. No good heuristic estimate was found for the number of "lucky" decompositions.

D. S.

1. A. SCHINZEL, "A remark on a paper of Bateman and Horn," *Math. Comp.*, v. 17, 1963, pp. 445–447, especially p. 446.

37[F].—THOMAS R. PARKIN & LEON J. LANDER, *Abundant Numbers*, Aerospace Corporation, Los Angeles, 1964, 119 unnumbered pages, 28 cm. Copy deposited in UMT File.

Leo Moser had shown [1] that every integer $> 83{,}160 = 88 \cdot 945$ can be expressed as the sum of two abundant numbers. This proof is first improved here to include all integers $> 28{,}121$. This is done by showing that every odd $N \geqq 28{,}123 = 89 \cdot 315 + 88$ can be written as $N = M \cdot 315 + B \cdot 88$ with $3 \leqq M \leqq 89$ and $B \geqq 1$. But $M \cdot 315$ and $B \cdot 88$ are both abundant. Further, it is easily shown that all even numbers > 46 can be written in the required manner [2].

The smallest odd N so representable is clearly 957, since 945 and 12 are the smallest odd and even abundant numbers, respectively. To examine the odd numbers between 957 and 28,123, the authors use two methods: (a) covering sets; and (b) trial and error based upon lists of abundant numbers. They thus find that 20,161 is, in fact, the largest integer not so decomposable. This had been previously found by John L. Selfridge.

The main table here (90 pages) gives a decomposition, if one exists, for every odd N satisfying $941 \leqq N \leqq 28{,}999$. There are, all in all, only 1455 integers not decomposable into a sum of two abundant numbers.

In their discussion of method (a) mentioned above, the authors erroneously state that a prime multiple of a perfect number is a *primitive abundant* number, where that is defined to be an abundant number that has no abundant proper divisor. A counterexample is $84 = 3 \cdot 28$, since this has the abundant number 12 as a divisor.

In connection with these computations (on a CDC 160A) a table of $\sigma(N)$ was computed up to $N = 29{,}000$ by the use of Euler's pentagonal number recurrence relationship. This table is reproduced up to $N = 1000$ in Appendix C. The authors planned to extend this table (on tape) up to 10^5 or 10^6, but believe that the use of the canonical factorization of the integers will be faster than Euler's method. Presumably that is because of the limited high-speed memory in the small computer which was being used.

D. S.

1. LEO MOSER, *Amer. Math. Monthly*, v. 56, 1949, p. 478, Problem E848.
2. F. A. E. PIRANI, *Amer. Math. Monthly*, v. 57, 1950, pp. 561–562, Problem E903.

38[F].—KARL K. NORTON, "Remarks on the number of factors of an odd perfect number," *Acta Arith.*, v. 6, 1961, pp. 372–373. Table in Section IV.

Let $\alpha(n)$ be defined by

$$\prod_{r=n}^{n+\alpha(n)-2} \frac{p_r}{p_r - 1} < 2 < \prod_{r=n}^{n+\alpha(n)-1} \frac{p_r}{p_r - 1},$$

where p_r is the rth prime. If an odd perfect number N has p_n as its smallest prime