PROOF THAT THE MERSENNE NUMBER M_{167} IS COMPOSITE

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The Mersenne numbers are of the form

$$M_p = 2^p - 1,$$

where p is a prime. It is known, except in a few instances, whether M_p is prime or composite for all p not greater than 257. The unknown cases are those for which $p = 167$, 193, 199, 227, and 229.

The author of this paper has recently completed the proof that M_{167} is composite. This proof is based upon the well known theorem of Lucas, which subsequently was amplified by Lehmer.[1] The most recent contribution is that of H. S. Uhler,[2] who proved that M_{157} is composite.

The method employed by the author was direct computation upon an eight-bank electric calculating machine. Each residue was checked by computing it two ways, that is, by calculating r_i from both

$$(r_{i-1})^2 - 2, \quad \text{and} \quad (M_{167} - r_{i-1})^2 - 2.$$

Obviously one cannot list the whole series of residues, so only the last one will be given here. This final residue was found to be

$$163\ 32098278\ 81677538\ 71550317\ 93792426\ 84838281\ 73373557.$$

Since this residue is not zero, it follows that M_{167} is composite.

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[1] D. H. Lehmer, *On Lucas's test for the primality of Mersenne's numbers*, J. London Math. Soc. vol. 10 (1935) pp. 162–165.

[2] H. S. Uhler, *First proof that the Mersenne number M_{157} is composite*, Proc. Nat. Acad. Sci. U.S.A. vol. 30 (1944) pp. 314–316.