MATHEMATICS OF COMPUTATION, VOLUME 32, NUMBER 143
JULY 1978, PAGE 941

Four New Factors of Fermat Numbers

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Using a System 370, Model 158, IBM Computer, I was able to extend the research of R. M. Robinson [1] and others [2] and [3] concerning the exploration of factors of Fermat Numbers. I wrote my own arithmetic routines to operate on a bit string with a length of 1024 bites (128 8-bit BYTES). Thus, I was able to test possible factors which were larger than the $2^{32} - 1$ fixed word maximum.

I tested numbers of the form $K \cdot 2^n + 1$, where $23 \leqslant n \leqslant 100$ and $3 \leqslant K \leqslant 29999$, K is odd; and $101 \leqslant n \leqslant 256$ and $101 \leqslant K \leqslant 293$, K is odd. I refound all previously found factors within these ranges, as well as:

$$
\begin{aligned}
697\cdot 2^{64} + 1 &\quad \text{divides } F_{62},\\
7551\cdot 2^{69} + 1 &\quad \text{divides } F_{66},\\
683\cdot 2^{73} + 1 &\quad \text{divides } F_{71},\\
1421\cdot 2^{93} + 1 &\quad \text{divides } F_{91}.
\end{aligned}
$$

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1. RAPHAEL M. ROBINSON, "A report on primes of the form $K \cdot 2^n + 1$ and on factors of Fermat numbers," *Proc. Amer. Math. Soc.*, v. 9, 1958, pp. 673–681.

2. JOHN C. HALLYBURTON, JR. & JOHN BRILLHART, "Two new factors of Fermat numbers," *Math. Comp.*, v. 29, 1975, pp. 109–112.

3. G. MATTHEW & H. C. WILLIAMS, "Some new primes of the form $K \cdot 2^n + 1$," *Math. Comp.*, v. 31, 1977, pp. 797–798.

Received October 19, 1977.
AMS (MOS) subject classifications (1970). Primary 10A25, 10A40, 10–04.
Key words and phrases. Fermat numbers, factoring.