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The First Occurrence of Certain Large Prime Gaps

By Richard P. Brent

Abstract. The first occurrence of a string of $2r - 1$ consecutive composite numbers between two primes (denoted by $f(r)$ and $f(r) + 2r$) is tabulated for $f(r)$ in the range $2.6 \times 10^{12} < f(r) \leqslant 4.444 \times 10^{12}$. This extends earlier computations in the range $f(r) \leqslant 2.6 \times 10^{12}$.

Let $p_1 = 2, p_2 = 3, \ldots$ be the sequence of primes. For integer $r \geqslant 1$, define

$$f(r) = \begin{cases} p_j & \text{if } j \geqslant 1 \text{ is minimal such that } p_{j+1} - p_j = 2r, \\ \infty & \text{if no such } j \text{ exists.} \end{cases}$$

See [1] and [3] for a discussion of the asymptotic behavior of $f(r)$, and for additional references. All $f(r) \leqslant 2.6 \times 10^{12}$ are tabulated in [1] and [2]. In Table 1 we give all eleven values of $f(r)$ in the range $2.6 \times 10^{12} < f(r) \leqslant 4.444 \times 10^{12}$.

The maximal gap has $r = 326$, i.e. $p_{j+1} - p_j \leqslant 652$ for all $p_j \leqslant 4.444 \times 10^{12}$, and $p_{j+1} - p_j = 652$ for $p_j = 2{,}614{,}941{,}710{,}599$. The minimal r for which $f(r)$ is still unknown is $r = 268$, and the next is $r = 279$.

The computation of Table 1 was performed over the period April 1973 to September 1978, on an IBM 360/50 computer with 256K bytes of memory. The method used was the same as that described in [1], except that the sieve size had to be reduced to fit into the 208K bytes available. About 61 seconds were required to sieve each block of 2,661,120 numbers near 3×10^{12}.

TABLE 1

r	$f(r)$	r	$f(r)$
271	2707053887651	285	4442109925217
272	2652427555639	287	3108794067079
274	3380058341279	296	3410069454097
277	3621153039299	309	4165633395149
278	4338624362173	326*	2614941710599
280	4260199366373		

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Department of Computer Science
Australian National University
Canberra, A.C.T. 2600, Australia

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