# A Modification of Riesel Primality Test

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**Abstract:** Conjectured polynomial time primality test for specific class of numbers of the form $k \cdot 2^n - 1$ is introduced .
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## 1 Introduction

In 1969 Hans Riesel provided polynomial time primality test for numbers of the form $k \cdot 2^n - 1$ with $k$ odd , $k < 2^n$ and $n > 2$ , see Theorem 5 in [1] . In this note I present modified Riesel primality test that is faster in some cases than original Riesel test .

## 2 The Main Result

**Definition 2.1.** Let $P_m(x) = 2^{-m} \cdot \left( \left(x - \sqrt{x^2-4}\right)^m + \left(x + \sqrt{x^2-4}\right)^m \right)$ , where $m$ and $x$ are nonnegative integers .

**Conjecture 2.1.** *Let $N = k \cdot 2^n - 1$ such that $n > 2$ , $k$ odd , $3 \nmid k$ , $k < 2^n$ , and $f$ is proper factor of $n - 2$ .*

$$\text{Let } S_i = P_{2^f}(S_{i-1}) \text{ with } S_0 = P_k(4) \text{ , thus}$$
$$N \text{ is prime iff } S_{(n-2)/f} \equiv 0 \pmod{N}$$

*Remark* 2.1. Speed comparison between Maxima implementation of modified test and Maxima implementation of original Riesel test :
For $f = 2$ modified primality test is approximately $1.8$ times faster than original test .
For $f = 3$ modified primality test is approximately $2$ times faster than original test .
For $f = 4$ modified primality test is approximately $1.5$ times faster than original test .
For $f = 5, 6...$ modified primality test is slower than original test .

# References


[1] Riesel, Hans (1969) , ”Lucasian Criteria for the Primality of $N = h \cdot 2^n - 1$” , *Mathematics of Computation* (AmericanMathematical Society), 23 (108): 869-875 .