```
> restart; with(numtheory);
```

[GIgcd, bigomega, cfrac, cfracpol, cyclotomic, divisors, factorEQ, factorset, fermat, imagunit, index, integral_basis, invcfrac, invphi, iscyclotomic, issqrfree, jacobi, kronecker, λ, legendre, mcombine, mersenne, migcdex, minkowski, mipolys, mlog, mobius, mroot, msqrt, nearestp, nthconver, nthdenom, nthnumer, nthpow, order, pdexpand, ϕ, π, pprimroot, primroot, quadres, rootsunity, safeprime, σ, sq2factor, sum2sqr, τ, thue] (1)

```
> M := 2^n-1 : seq(M, n=[2, 3, 5, 7, 11, 13, 17]);
```

3, 7, 31, 127, 2047, 8191, 131071 (2)

```
> lucas := proc(n)
    local M, L, k;
    M := 2^n-1; L := 4;
    for k from 2 to n-1 do L := (L^2 - 2) mod M; od;
    evalb(L=0);
    end;
```

```
lucas := proc(n)
    local M, L, k;
    M := 2^n - 1;
    L := 4;
    for k from 2 to n - 1 do L := mod(L^2 - 2, M) end do;
    evalb(L = 0)
end proc
```
(3)

```
> n := 2281 : length(M); debut := time( ) : lucas(n); time( ) - debut;
```

687

true

0.079 (4)

```
> n := 15281 : length(M); debut := time( ) : lucas(n); time( ) - debut;
```

4601

false

9.140 (5)

```
> sigma(6);
```

12 (6)

```
> lucas := proc(n)
    local M, L, k, i;
    for i to n do
    M := 2^(prim[i])-1; L := 4;
```

```
    for k from 2 to prim[i]-1 do L := (L^2 - 2) mod M;od;
   print(prim[i]); print(M, length(M) );
    print(evalb(L=0)); print( ) :
   od;
    end;
lucas := proc(n)
    local M, L, k, i;
    for i to n do
        M := 2^prim[i] - 1;
        L := 4;
        for k from 2 to prim[i] - 1 do L := mod(L^2 - 2, M) end do;
        print(prim[i]);
        print(M, length(M) );
        print(evalb(L=0));
        print( )
    end do
end proc
```

(7)

```
prim := [3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97,
    101, 103, 107, 109, 113, 2203, 4253]
```

(8)

```
> nops(prim);
```

31 (9)

```
> lucas(13) :
```

3
7, 1
true

5
31, 2
true

7
127, 3
true

11
2047, 4
false

13

8191, 4

true

17

131071, 6

true

19

524287, 6

true

23

8388607, 7

false

29

536870911, 9

false

31

2147483647, 10

true

37

137438953471, 12

false

41

2199023255551, 13

false

43

8796093022207, 13

false

(10)

```
> sigma(2^30·2147483647) − 2^30·2147483647;
```

2305843008139952128 **(11)**

```
> 2^30·2147483647;
```

>