

```
> restart; with(numtheory);
[Glgcd, bigomega, cfrac, cfracpol, cyclotomic, divisors, factorEQ, factorset, fermat, imagunit,
index, integral_basis, invcfrac, invphi, iscyclotomic, issqrfree, jacobi, kronecker,  $\lambda$ ,
legendre, mcombine, mersenne, migcdex, minkowski, mipolys, mlog, mobius, mroot, msqrt,
nearestp, nthconver, nthdenom, nthnumer, nthpow, order, pdexpand,  $\phi$ ,  $\pi$ , pprimroot,
primroot, quadres, rootsunity, safeprime,  $\sigma$ , sq2factor, sum2sqr,  $\tau$ , 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)
```

(3)

```
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
```

```
> 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)
```

(7)

```
    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
```

```
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(230.2147483647) - 230.2147483647;  
2305843008139952128
```

(11)

```
> 230.2147483647;
```



2305843008139952128

(12)