Számítógépes számelmélet

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Ezek a programok csak szemléltetésre szolgálnak

16. Vegyes problémák

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

[*GIgcd*, *bigomega*, *cfrac*, *cfracpol*, *cyclotomic*, *divisors*, *factorEQ*, *factorset*, *fermat*, *imagunit*, *index*, *integral_basis*, *invcfrac*, *invphi*, *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*] (16.1)

16.1. Collatz–probléma.

```
> interface(echo=3);
```

1 (16.1.1)

```
> ;
> #
  # The 3*x+1 problem of Collatz
  #

> L:=[2,{3}];
```

$L := [2, \{3\}]$ (16.1.2)

```
> points:=[[2,nops(L[2])]];
```

$points := [[2, 1]]$ (16.1.3)

```
> #
  # This tests an odd x wether in n halfing steps became
  smaller then x
  #

  test:=proc(n::posint,x::posint) local m,y;
  y:=x;
  m:=n;
  while m>0 do
    y:=3*y+1;
    while m>0 and type(y,even) do m:=m-1; y:=y/2 od;
    if y<x then RETURN(true) fi
  od; false end;
```

test := **proc**(*n*::*posint*, *x*::*posint*) (16.1.4)

local *m*, *y*;

y := *x*;

m := *n*;

```
    while 0 < m do
        y := 3 * y + 1;
        while 0 < m and type(y, even) do
            m := m - 1;
            y := 1 / 2 * y
        end do;
        if y < x then
            RETURN(true)
        end if
    end do;
    false
end proc
```

```
> reduce:=proc(n,S) local x,SS;
  SS:={};
  for x in S do if not test(n,x) then SS:=SS union {x} fi od;
  SS end;
```

```
reduce := proc(n, S)                                              (16.1.5)
    local x, SS;
    SS := {};
    for x in S do
        if not test(n, x) then
            SS := union(SS, {x})
        end if
    end do;
    SS
end proc
```

```
> nextL:=proc(L) local n,S,x,y;
  n:=L[1]; S:=L[2]; S:=S union map(proc(x,y) x+2^y end,S,n);
  [n+1,reduce(n+1,S)] end;
```

```
nextL := proc(L)                                                  (16.1.6)
    local n, S, x, y;
    n := L[1];
    S := L[2];
    S := union(S, map(proc(x, y)
        x + 2 ^ y
```

```
    end proc, S, n));
    [n + 1, reduce(n + 1, S)]
end proc
```

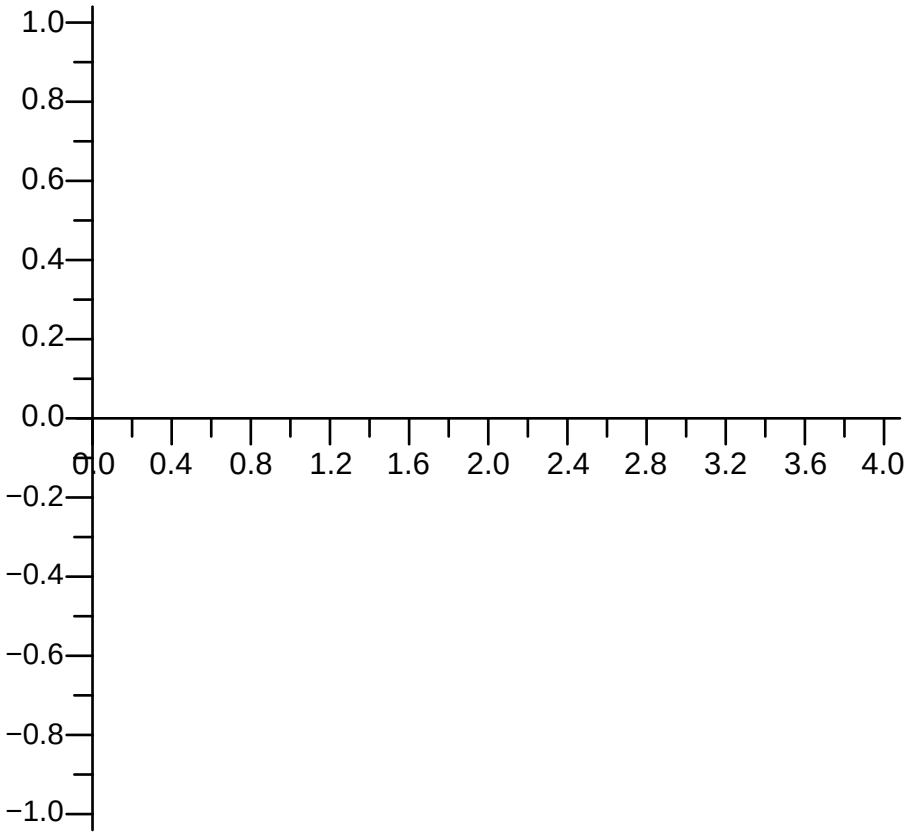
```
> cycle:=proc(n::posint) local L,points;
  L:=[2,{3}];
  points:=[[2,nops(L[2])]];
  while L[1]<n do
    L:=nextL(L);
    points:=[op(points),[L[1],nops(L[2])]];
  od end;
```

$$cycle := \mathbf{proc}(n::posint) \tag{16.1.7}$$

```
    local L, points;
    L := [2, {3}];
    points := [[2, nops(L[2])]];
    while L[1] < n do
        L := nextL(L);
        points := [op(points), [L[1], nops(L[2])]]
    end do
end proc
```

```
> logpoints:=map(`x`->[x[1],evalf(ln(x[2]))],points); plot
  (logpoints);
```

$$logpoints := [[2, 0.]]$$



16.2. Iteration of the lambda function.

```
> #
  # Definition of the lambda function
  #

  la:= proc(x) sigma(x)-x end;
```

$$la := \mathbf{proc}(x)\ numtheory:-\sigma(x) - x\ \mathbf{end\ proc} \tag{16.2.1}$$

```
> lacycle:=proc(x::posint) local y,z;
  z:=x; y:=la(x); print(y);
  while not y=z do
    y:=la(y); print(y);
    y:=la(y); print(y);
    z:=la(z); od;
  end;
```

$$lacycle := \mathbf{proc}(x::posint) \tag{16.2.2}$$

$$\mathbf{local}\ y, z;$$

```
    z := x;
    y := la(x);
    print(y);
    while not y = z do
        y := la(y);
        print(y);
        y := la(y);
        print(y);
        z := la(z)
    end do
end proc
> lacycle(16777778);
                                8924494
                                4530794
                                2361334
                                1418666
                                 716758
                                 511994
                                 365734
                                 182870
                                 146314
                                 109160
                                 136540
                                 150236
                                 128476
                                  96364
                                  72280
                                 104120
                                 144280
                                 180440
                                 258040
                                 322640
                                 454840
```

588440

768040

1368920

2151880

2902520

3685480

4666520

5833240

9407720

14784280

26050520

36330280

62021720

83821480

105128120

136915000

187824800

270704446

138273914

76289146

38195354

20495194

10275194

5614438

3173450

3573142

2064458

1349206

674606

354634

263414

131710

105386
67414
36554
27400
36770
29434
14720
22000
36032
35596
32444
24340
26816
26524
22476
29996
22504
21596
16204
12160
18440
23140
29780
32800
49226
25558
15770
14470
11594
9142
6554
3706

2234
1120
1904
2560
3578
1792
2296
2744
3256
3584
4600
6560
9316
8072
7078
3542
3370
2714
1606
1058
601
1
0
0
0
0
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0
0
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0

0

0

0

0

0 (16.2.3)

16.3. Blum–rejtjelzés.

>

16.2. Lánctörtek.

>

16.3. Kvadratikus irracionális számok lánctört alakja.

16.4. Faktorizálás lánctörtekkel.

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16.5. Négyzetes szita.

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16.6. Többpolinomos négyzetes szita.

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16.7. letlen négyzet módszere.

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