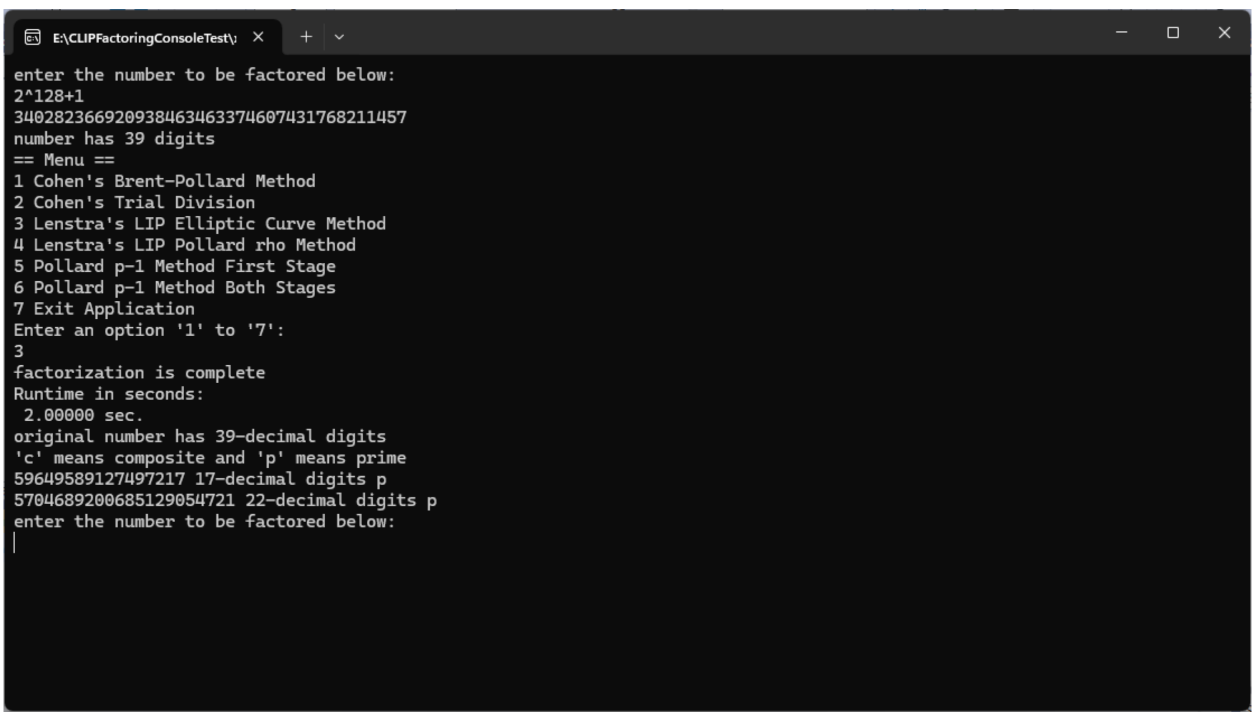
Blog Entry © Sunday, October 26, 2025, by James Pate Williams, Jr. More Factoring with Arjen K. Lenstra's LIP (Large Integer Package)

References:

1 - ***The development of the number field sieve*** © 1993 by A. K. Lenstra and H. W. Lenstra, Jr. with an initial paper by John M. Pollard ***Factoring with Cubic Integers***

2 – ***Prime Numbers and Computer Methods for Factorization Second Edition*** © 1994 by Hans Riesel

LIP was mainly developed in the period 1989 to 1997 while Arjen K. Lenstra was at Bell Communications Research, Inc (Bellcore). LIP is a large integer package written in the computer language C. In this research we factor some large integers using LIP's implementation of the Elliptic Curve Method (ECM) originally developed by Arjen's brother Hendrik W. Lenstra, Jr. The ECM is the best factoring method available in the original LIP source code. The first number factored is F_7 = Seventh Fermat Number 2^128+1 which was first factored by Morrison, Michael A. and Brillhart, John using the continued fraction factorization method (CFRAC) in 1975. Later, John M. Pollard factored the number using factoring with cubic integers on an 8-bit Philips P2012 personal computer with 64k of store and two-disc drives (640k each). It took him 20.1 hours to factor F_7. The next two numbers 2^144-3 were factored by Pollard in 47 hours and 2^153+3 was factored in 61 hours.


```
enter the number to be factored below:
2^128+1
340282366920938463463374607431768211457
number has 39 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 2.00000 sec.
original number has 39-decimal digits
'c' means composite and 'p' means prime
59649589127497217 17-decimal digits p
5704689200685129054721 22-decimal digits p
enter the number to be factored below:
```

```
E:\CLIPFactoringConsoleTest\
enter the number to be factored below:
2^144-3
22300745198530623141535718272648361505980413
number has 44 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 1.00000 sec.
original number has 44-decimal digits
'c' means composite and 'p' means prime
492729991333 12-decimal digits p
45259565260477899162010980272761 32-decimal digits p
enter the number to be factored below:
```

```
E:\CLIPFactoringConsoleTest\
enter the number to be factored below:
2^153+3
11417981541647679048466287755595961091061972995
number has 47 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
37.00000 sec.
original number has 47-decimal digits
'c' means composite and 'p' means prime
55 2-decimal digits c
600696432006490087537 21-decimal digits p
345598297796034189382757 24-decimal digits p
enter the number to be factored below:
```

E:\CLIPFactoringConsoleTest\

```
enter the number to be factored below:
2^109+1
649037107316853453566312041152513
number has 33 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 33-decimal digits
'c' means composite and 'p' means prime
3 1-decimal digits p
104124649 9-decimal digits p
2077756847362348863128179 25-decimal digits p
enter the number to be factored below:
```

E:\CLIPFactoringConsoleTest\

```
enter the number to be factored below:
2^162+1
5846006549323611672814739330865132078623730171905
number has 49 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 49-decimal digits
'c' means composite and 'p' means prime
37 2-decimal digits p
65 2-decimal digits c
109 3-decimal digits p
246241 6-decimal digits p
279073 6-decimal digits p
3618757 7-decimal digits p
106979941 9-decimal digits p
168410989 9-decimal digits p
4977454861 10-decimal digits p
enter the number to be factored below:
```

E:\CLIPFactoringConsoleTest\

```
enter the number to be factored below:
2^179+1
766247770432944429179173513575154591809369561091801089
number has 54 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 54-decimal digits
'c' means composite and 'p' means prime
3 1-decimal digits p
58745093521 11-decimal digits p
4347868190665879373495950562775707707143803 43-decimal digits p
enter the number to be factored below:
```

E:\CLIPFactoringConsoleTest\

```
enter the number to be factored below:
2^188+1
392318858461667547739736838950479151006397215279002157057
number has 57 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 1.00000 sec.
original number has 57-decimal digits
'c' means composite and 'p' means prime
17 2-decimal digits p
1198107457 10-decimal digits p
23592342593 11-decimal digits p
4501946625921233 16-decimal digits p
181352306852476069537 21-decimal digits p
enter the number to be factored below:
```

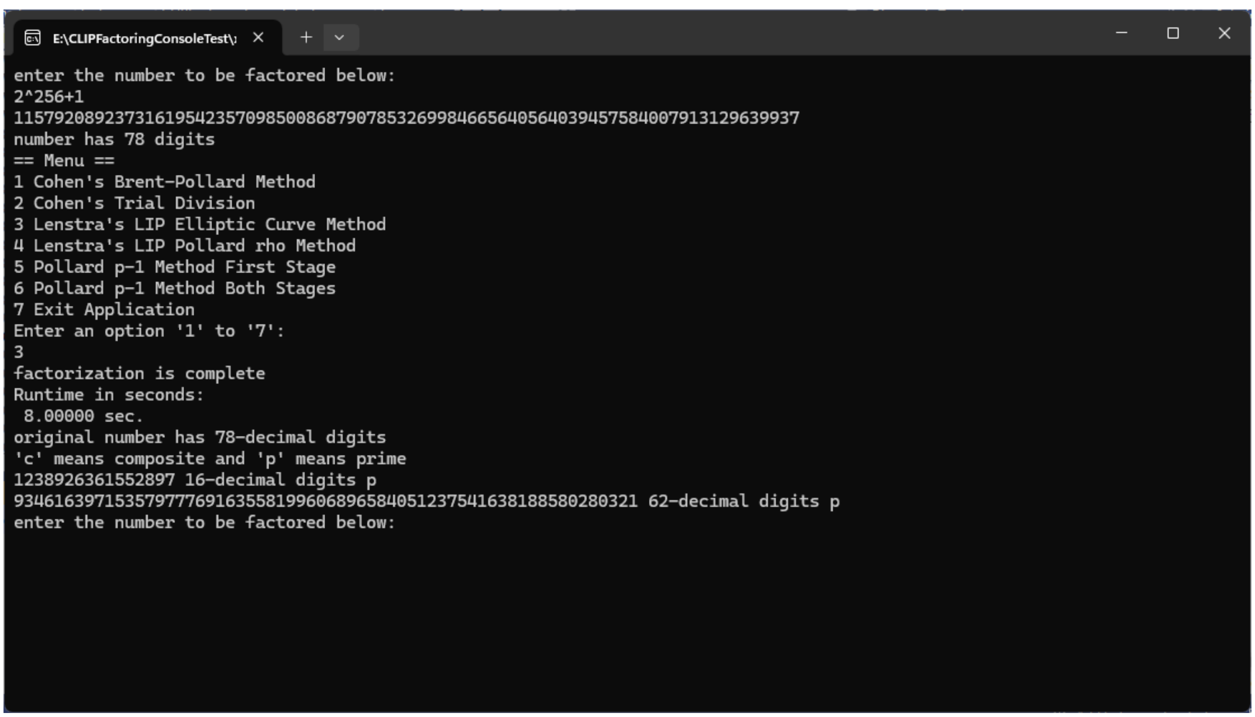
E:\CLIPFactoringConsoleTest\

```
enter the number to be factored below:
2^216+1
105312291668557186697918027683670432318895095400549111254310977537
number has 66 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 66-decimal digits
'c' means composite and 'p' means prime
577 3-decimal digits p
673 3-decimal digits p
24929 5-decimal digits c
209924353 9-decimal digits p
4261383649 10-decimal digits p
487824887233 12-decimal digits p
24929060818265360451708193 26-decimal digits p
enter the number to be factored below:
```

```
enter the number to be factored below:
2^220+1
1684996666696914987166688442938726917102321526408785780068975640
577
number has 67 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 1.00000 sec.
original number has 67-decimal digits
'c' means composite and 'p' means prime
17 2-decimal digits p
353 3-decimal digits p
61681 5-decimal digits p
109121 6-decimal digits p
148721 6-decimal digits p
3404676001 10-decimal digits p
11035465708081 14-decimal digits p
7465809840892311955362977 25-decimal digits c
```

Notice that the previous number has a composite factor, but one more iteration of the elliptic curve method factors the composite number correctly.

```
enter the number to be factored below:
7465809840892311955362977
7465809840892311955362977
number has 25 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 25-decimal digits
'c' means composite and 'p' means prime
2931542417 10-decimal digits p
2546717317681681 16-decimal digits p
```


```
enter the number to be factored below:
2^256+1
115792089237316195423570985008687907853269984665640564039457584007913129639937
number has 78 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 8.00000 sec.
original number has 78-decimal digits
'c' means composite and 'p' means prime
1238926361552897 16-decimal digits p
93461639715357977769163558199606896584051237541638188580280321 62-decimal digits p
enter the number to be factored below:
```

Next, we factor to some Mersenne Numbers. Mersenne Numbers are of the form M_n = 2^n -1.

```
E:\CLIPFactoringConsoleTest\
enter the number to be factored below:
2^67-1
147573952589676412927
number has 21 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 21-decimal digits
'c' means composite and 'p' means prime
193707721 9-decimal digits p
761838257287 12-decimal digits p
enter the number to be factored below:
```

```
E:\CLIPFactoringConsoleTest\
enter the number to be factored below:
2^149-1
713623846352979940529142984724747568191373311
number has 45 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
16.00000 sec.
original number has 45-decimal digits
'c' means composite and 'p' means prime
86656268566282183151 20-decimal digits p
8235109336690846723986161 25-decimal digits p
enter the number to be factored below:
```

```
E:\CLIPFactoringConsoleTest\
enter the number to be factored below:
2^157-1
182687704666362864775460604089535377456991567871
number has 48 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 48-decimal digits
'c' means composite and 'p' means prime
852133201 9-decimal digits p
60726444167 11-decimal digits p
1654058017289 13-decimal digits p
2134387368610417 16-decimal digits p
enter the number to be factored below:
```

```
E:\CLIPFactoringConsoleTest\
enter the number to be factored below:
2^199-1
803469022129495137770981046170581301261101496891396417650687
number has 60 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 2.00000 sec.
original number has 60-decimal digits
'c' means composite and 'p' means prime
164504919713 12-decimal digits p
4884164093883941177660049098586324302977543600799 49-decimal digits p
enter the number to be factored below:
```

Note: The preceding factorizations can be found in the references.

```
2^300-1
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 91-decimal digits
'c' means composite and 'p' means prime
331 3-decimal digits p
525 3-decimal digits c
1201 4-decimal digits p
1801 4-decimal digits p
4051 4-decimal digits p
4141 4-decimal digits c
8101 4-decimal digits p
63901 5-decimal digits p
90751 5-decimal digits c
100801 6-decimal digits p
268501 6-decimal digits p
331571 6-decimal digits c
4056195 7-decimal digits c
10567201 8-decimal digits p
13334701 8-decimal digits p
1182468601 10-decimal digits p
1133836730401 13-decimal digits p
```

```
2^300+1
factorization is complete
Runtime in seconds:
 1.00000 sec.
original number has 91-decimal digits
'c' means composite and 'p' means prime
17 2-decimal digits p
241 3-decimal digits p
401 3-decimal digits p
61681 5-decimal digits p
340801 6-decimal digits p
40358626310265848029053761 26-decimal digits c
1461503031127477825099979369543473122548042956801 49-decimal
digits p

2^325-1
factorization is complete
Runtime in seconds:
10.00000 sec.
original number has 98-decimal digits
'c' means composite and 'p' means prime
601 3-decimal digits p
1801 4-decimal digits p
7151 4-decimal digits p
253921 6-decimal digits c
51879585551 11-decimal digits p
145295143558111 15-decimal digits p
4613679391936953610429590532014122532260339739644049093601 58-
decimal digits p

2^325+1
factorization is complete
Runtime in seconds:
 4.00000 sec.
original number has 98-decimal digits
'c' means composite and 'p' means prime
33 2-decimal digits c
131 3-decimal digits p
251 3-decimal digits p
2731 4-decimal digits p
409891 6-decimal digits p
5840251 7-decimal digits p
7623851 7-decimal digits p
13169801 8-decimal digits c
7812610577851 13-decimal digits p
9860942209386451 16-decimal digits p
1245660907214169781926561543788801 34-decimal digits p
```

```
2^350-1
factorization is complete
Runtime in seconds:
 9.00000 sec.
original number has 106-decimal digits
'c' means composite and 'p' means prime
43 2-decimal digits p
71 2-decimal digits p
127 3-decimal digits p
251 3-decimal digits p
1023 4-decimal digits c
1801 4-decimal digits p
4051 4-decimal digits p
39551 5-decimal digits p
86171 5-decimal digits p
110251 6-decimal digits p
631651 6-decimal digits c
34540801 8-decimal digits c
60816001 8-decimal digits p
347833278451 12-decimal digits p
34010032331525251 17-decimal digits p
```

The preceding factorizations used the following ECM call:

```
zecm(*zN, &zfactor, 1, 5000, 5000, 1, 25, 0)
```

Now we use:

```
zecm(*zN, &zfactor, 1, 10000, 10000, 1, 25, 0)
```

Could not crack 3^350+1 using the previous parameters. Next is the line of code:

```
zecm(*zN, &zfactor, 1, 25000, 25000, 1, 25, 0)
```

```
2^330-1
factorization is complete
Runtime in seconds:
 2.00000 sec.
original number has 100-decimal digits
'c' means composite and 'p' means prime
7 1-decimal digits p
151 3-decimal digits p
331 3-decimal digits p
683 3-decimal digits p
881 3-decimal digits p
1023 4-decimal digits c
1541 4-decimal digits c
2937 4-decimal digits c
201961 6-decimal digits p
599479 6-decimal digits p
48912491 8-decimal digits p
415365721 9-decimal digits p
197733975077 12-decimal digits c
2252127523412251 16-decimal digits p
2048568835297380486760231 25-decimal digits p
```

2^330+1

factorization is complete
Runtime in seconds:
 1.00000 sec.
original number has 100-decimal digits
'c' means composite and 'p' means prime
5 1-decimal digits p
2113 4-decimal digits p
8581 4-decimal digits p
162565 6-decimal digits c
312709 6-decimal digits p
4327489 7-decimal digits p
391249826881 12-decimal digits p
415878438361 12-decimal digits p
1144301080957 13-decimal digits c
3630105520141 13-decimal digits p
12127627350301 14-decimal digits p

```
2^335-1
factorization is complete
Runtime in seconds:
 6.00000 sec.
original number has 101-decimal digits
'c' means composite and 'p' means prime
31 2-decimal digits p
464311 6-decimal digits p
193707721 9-decimal digits p
1532217641 10-decimal digits p
761838257287 12-decimal digits p
2150540932840592106005778315614421361848546084491128444866178264
1 65-decimal digits p

2^335+1
factorization is complete
Runtime in seconds:
 6.00000 sec.
original number has 101-decimal digits
'c' means composite and 'p' means prime
33 2-decimal digits c
93131 5-decimal digits p
7327657 7-decimal digits p
6713103182899 13-decimal digits p
4629689728506054877262164229146116662803731118505256673270938653
4682781\
8121 75-decimal digits p
```

```
2^340-1
factorization is complete
Runtime in seconds:
64.00000 sec.
original number has 103-decimal digits
'c' means composite and 'p' means prime
953 3-decimal digits p
1021 4-decimal digits p
4421 4-decimal digits p
5115 4-decimal digits c
26317 5-decimal digits p
28085 5-decimal digits c
43691 5-decimal digits p
131071 6-decimal digits p
550801 6-decimal digits p
23650061 8-decimal digits p
7226904352843746841 19-decimal digits p
9520972806333758431 19-decimal digits p
26831423036065352611 20-decimal digits p

2^345-1
factorization is complete
Runtime in seconds:
10.00000 sec.
original number has 104-decimal digits
'c' means composite and 'p' means prime
217 3-decimal digits c
7097 4-decimal digits c
14951 5-decimal digits p
178481 6-decimal digits p
4036961 7-decimal digits p
10052678938039 14-decimal digits p
2646507710984041 16-decimal digits p
162383614111595675973306320509614573241829932932497191 54-
decimal digits p
```

```
2^345+1
factorization is complete
Runtime in seconds:
 9.00000 sec.
original number has 104-decimal digits
'c' means composite and 'p' means prime
3 1-decimal digits p
33 2-decimal digits c
331 3-decimal digits p
96049 5-decimal digits c
2796203 7-decimal digits p
1884103651 10-decimal digits p
168749965921 12-decimal digits p
345767385170491 15-decimal digits p
74078343132499989110265409250618045323263715522281571 53-decimal
digits p

2^347-1
factorization is complete
Runtime in seconds:
624.00000 sec.
original number has 105-decimal digits
'c' means composite and 'p' means prime
14143189112952632419639 23-decimal digits p
2027034530254598711604006944281449672934166611209605788599264312
0463337\
596490211193 83-decimal digits p

2^347+1
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 105-decimal digits
'c' means composite and 'p' means prime
3 1-decimal digits p
9556244233291964631711753730425362253319020788201171348906620164
11217865\
03686867002917439712921903606443 104-decimal digits p
Prime number
```

Could not factor 2^349-1 in a reasonable amount of time.

```
2^349+1
factorization is complete
Runtime in seconds:
 1.00000 sec.
original number has 106-decimal digits
'c' means composite and 'p' means prime
3 1-decimal digits p
131282633 9-decimal digits p
29116552631274434088206484190259536471420468199175046554426190029
16349\
2980939432163976096966699987 97-decimal digits p

2^350-1
factorization is complete
Runtime in seconds:
18.00000 sec.
original number has 106-decimal digits
'c' means composite and 'p' means prime
43 2-decimal digits p
71 2-decimal digits p
127 3-decimal digits p
251 3-decimal digits p
1023 4-decimal digits c
1801 4-decimal digits p
4051 4-decimal digits p
39551 5-decimal digits p
86171 5-decimal digits p
110251 6-decimal digits p
631651 6-decimal digits c
34540801 8-decimal digits c
60816001 8-decimal digits p
347833278451 12-decimal digits p
34010032331525251 17-decimal digits p
535347624791488552837151 24-decimal digits p
```

```
2^350+1
Could not factor within ten minutes.

2^351-1
factorization is complete
Runtime in seconds:
 4.00000 sec.
original number has 106-decimal digits
'c' means composite and 'p' means prime
7 1-decimal digits p
6553 4-decimal digits p
8191 4-decimal digits p
86113 5-decimal digits p
121369 6-decimal digits p
262657 6-decimal digits p
446473 6-decimal digits p
5403679 7-decimal digits c
29121769 8-decimal digits p
7830118297 10-decimal digits p
571890896913727 15-decimal digits p
93715008807883087 17-decimal digits p
150832426800173710177 21-decimal digits p

2^351+1
factorization is complete
Runtime in seconds:
144.00000 sec.
original number has 106-decimal digits
'c' means composite and 'p' means prime
3 ^ 4 1-decimal digits p
19 2-decimal digits p
2731 4-decimal digits p
87211 5-decimal digits p
22366891 8-decimal digits p
5302306226370307681801 22-decimal digits p
4247713303224552237738169 25-decimal digits p
24841125429051585062538961751269988364169 41-decimal digits p

2^353-1,2^353+1
Could not factor within a reasonable amount of time.
```

```
2^355-1
factorization is complete
Runtime in seconds:
 8.00000 sec.
original number has 107-decimal digits
'c' means composite and 'p' means prime
31 2-decimal digits p
228479 6-decimal digits p
48544121 8-decimal digits p
212885833 9-decimal digits p
121932688511 12-decimal digits p
8223125624363292839815514592697905768406610797334099385507174111
37929\
2321 73-decimal digits p
```

```
enter the number to be factored below:
2^355+1
7339195571168228837154626864966678210549007965338499595960284286
0381532034831513858240593699524021969747969
number has 107 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 5.00000 sec.
original number has 107-decimal digits
'c' means composite and 'p' means prime
33 2-decimal digits c
56409643 8-decimal digits p
216609005890831415905225481491 30-decimal digits c
1820139440299162539848505992909490647210895874589068099185525812
77361 69-decimal digits p
enter the number to be factored below:
216609005890831415905225481491
216609005890831415905225481491
number has 30 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
 3.00000 sec.
original number has 30-decimal digits
'c' means composite and 'p' means prime
13952598148481 14-decimal digits p
15524635883992211 17-decimal digits p
```

```
enter the number to be factored below:
2^357-1
2935678228467291534861850745986671284219603186135399838384113714
41526128139326055432962374798096087878991871
number has 108 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
16.00000 sec.
original number has 108-decimal digits
'c' means composite and 'p' means prime
7 ^ 2 1-decimal digits p
103 3-decimal digits p
127 3-decimal digits p
239 3-decimal digits p
4999 4-decimal digits p
20231 5-decimal digits p
722191 6-decimal digits c
1457378449 10-decimal digits c
62983048367 11-decimal digits p
131105292137 12-decimal digits p
245262248913715001137177 24-decimal digits p
8889432124593512497963252165417 31-decimal digits p
```

Two more factorizations using Lenstra’s Pollard rho Method were needed to complete the factorization of 2^357-1.

```
enter the number to be factored below:
722191
722191
number has 6 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
4
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 6-decimal digits
'c' means composite and 'p' means prime
337 3-decimal digits p
2143 4-decimal digits p
enter the number to be factored below:
1457378449
1457378449
number has 10 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
4
factorization is complete
Runtime in seconds:
 0.00000 sec.
original number has 10-decimal digits
'c' means composite and 'p' means prime
11119 5-decimal digits p
131071 6-decimal digits p
```

```
enter the number to be factored below:
2^357+1
29356782284672915348618507459866712842196031861353998383841137l4
4152612813932605543296237479809608787899l873
number has 108 digits
== Menu ==
1 Cohen's Brent-Pollard Method
2 Cohen's Trial Division
3 Lenstra's LIP Elliptic Curve Method
4 Lenstra's LIP Pollard rho Method
5 Pollard p-1 Method First Stage
6 Pollard p-1 Method Both Stages
7 Exit Application
Enter an option '1' to '7':
3
factorization is complete
Runtime in seconds:
36.00000 sec.
original number has 108-decimal digits
'c' means composite and 'p' means prime
3 ^ 2 1-decimal digits p
43 2-decimal digits p
307 3-decimal digits p
2857 4-decimal digits p
5419 4-decimal digits p
6529 4-decimal digits p
43691 5-decimal digits p
428401 6-decimal digits p
823679683 9-decimal digits p
143162553165560959297 21-decimal digits p
11075231221618592513745760466207434363249588723425331 53-decimal
digits p
```

2^359-1 Could not factor using ECM in a reasonable amount of time.

2^361-1, 2^361+1 Could not factor using ECM in a reasonable amount of time.