```
> with(numtheory):
> isprime(9834328418282238172872722771111188787111);
```
$$false \tag{1}$$

```
> FLTwitlist := proc(n)
  local a,b,witlist;
  witlist := [];
  for a from 2 to n-1 do
      b := a &^ n mod n;
      if b<>a then witlist := [op(witlist),a] end if;
  end do;
  witlist;
  end proc;
```

$FLTwitlist := \mathbf{proc}(n)$ **(2)**

    local $a, b, witlist;$

    $witlist := [\ ];$

    for a **from** 2 **to** $n-1$ **do**

        $b := mod(a \&^\wedge n, n);$ **if** $b <> a$ **then** $witlist := [op(witlist), a]$ **end if**

    end do;

    $witlist$

end proc

```
> FLTwitlist(2);
```
$$[\ ] \tag{3}$$

```
> FLTwitlist(3);
```
$$[\ ] \tag{4}$$

```
> FLTwitlist(4);
```
$$[2, 3] \tag{5}$$

```
> FLTwitlist(14);
```
$$[2, 3, 4, 5, 6, 9, 10, 11, 12, 13] \tag{6}$$

```
> FLTwitlist(21);
```
$$[2, 3, 4, 5, 9, 10, 11, 12, 16, 17, 18, 19] \tag{7}$$

```
> FLTwitlist(23);
```
$$[\ ] \tag{8}$$

```
> FLTwitlist(24);
```
$$[2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23] \tag{9}$$

```
> FLTwitlist(25);
```
$$[2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23] \tag{10}$$

```
> FLTwitlist(26);
```
$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25] \tag{11}$$

```
> FLTwitlist(27);
```
$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25] \tag{12}$$

```
> FLTwitlist(28);
```
$$[2, 3, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 22, 23, 24, 26, 27] \tag{13}$$

```
> FLTwitlist(29);
```
$$[\ ] \tag{14}$$

```
> FLTwitlist(559);
```
$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29,$ **(15)**

30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 80, 81, 82, 83, 84, 85, 86, 88, 89, 90, 91, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 167, 168, 169, 170, 171, 174, 175, 176, 177, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 252, 253, 254, 255, 256, 258, 260, 261, 262, 263, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 296, 297, 298, 299, 301, 303, 304, 305, 306, 307, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 382, 383, 384, 385, 388, 389, 390, 391, 392, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 468, 469, 470, 471, 473, 474, 475, 476, 477, 478, 479, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 511, 512, 513, 514, 515, 518, 519, 520, 521, 522, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557]

```
> FLTwitlist(560);
```

[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29,   **(16)**
30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320,

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540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557,
558, 559]

```
> FLTwitlist(561);
```
$$[\ ] \tag{17}$$

```
> ifactor(561);
```
$$(3)\,(11)\,(17) \tag{18}$$

```
> FLTwitlist(1105);
```
$$[\ ] \tag{19}$$

```
> ifactor(1105);
```
$$(5)\,(13)\,(17) \tag{20}$$

```
> FLTwitlist(1729);
```
$$[\ ] \tag{21}$$

```
> ifactor(1729);
```
$$(7)\,(13)\,(19) \tag{22}$$

So 561, 1105, and 1729 are all Carmichael numbers.

```
> RMwitlist := proc(n)
  local q,k,i,a,b,maybewit,witlist;
  witlist := [];
  q := n-1;
  k := 0;
  for i from 1 to 1000 while ((q mod 2) = 0) do
      q := q/2; k := k+1;
  end do;
  print("q and k are: ",q,k);
  for a from 2 to n-2 do
      b := a&^q mod n;
      maybewit := (b<>1);
      for i from 0 to k-1 while maybewit do
          maybewit := (b<>n-1);
          b := b*b mod n
      end do;
      if maybewit
          then witlist := [op(witlist),a]
      end if;
  end do;
  witlist;
```

```
   end proc;
```
$RMwitlist := \mathbf{proc}(n)$ **(23)**

    local $q, k, i, a, b, maybewit, witlist;$

    $witlist := [\ ];$

    $q := n - 1;$

    $k := 0;$

    for i **to** 1000 **while** $mod(q, 2) = 0$ **do** $q := 1/2 * q;\ k := k+1$ **end do**;

    $print($"q and k are: "$, q, k);$

    for a **from** 2 **to** $n - 2$ **do**

        $b := mod(a \&^ q, n);$

        $maybewit := b <> 1;$

        for i **from** 0 **to** $k - 1$ **while** $maybewit$ **do**

            $maybewit := b <> n - 1;\ b := mod(b * b, n)$

        end do;

        if $maybewit$ **then** $witlist := [op(witlist), a]$ **end if**

    end do;

    $witlist$

end proc

```
> for n from 3 to 35 by 2 do print("For n =",n); RMwitlist(n) end
  do;
```

$$\text{"For n ="}, 3$$
$$\text{"q and k are: "}, 1, 1$$
$$[\ ]$$
$$\text{"For n ="}, 5$$
$$\text{"q and k are: "}, 1, 2$$
$$[\ ]$$
$$\text{"For n ="}, 7$$
$$\text{"q and k are: "}, 3, 1$$
$$[\ ]$$
$$\text{"For n ="}, 9$$
$$\text{"q and k are: "}, 1, 3$$
$$[2, 3, 4, 5, 6, 7]$$
$$\text{"For n ="}, 11$$
$$\text{"q and k are: "}, 5, 1$$
$$[\ ]$$
$$\text{"For n ="}, 13$$
$$\text{"q and k are: "}, 3, 2$$
$$[\ ]$$
$$\text{"For n ="}, 15$$
$$\text{"q and k are: "}, 7, 1$$
$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]$$
$$\text{"For n ="}, 17$$
$$\text{"q and k are: "}, 1, 4$$

$$[\,]$$
"For n =", 19
"q and k are: ", 9, 1
$$[\,]$$
"For n =", 21
"q and k are: ", 5, 2
$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]$$
"For n =", 23
"q and k are: ", 11, 1
$$[\,]$$
"For n =", 25
"q and k are: ", 3, 3
$$[2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23]$$
"For n =", 27
"q and k are: ", 13, 1
$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25]$$
"For n =", 29
"q and k are: ", 7, 2
$$[\,]$$
"For n =", 31
"q and k are: ", 15, 1
$$[\,]$$
"For n =", 33
"q and k are: ", 1, 5

$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29,$$
$$30, 31]$$
"For n =", 35
"q and k are: ", 17, 1

$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, \qquad \textbf{(24)}$$
$$30, 31, 32, 33]$$

```
> RMwitlist(561);
```
"q and k are: ", 35, 4

$$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, \qquad \textbf{(25)}$$
$$30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51, 52, 53, 54,$$
$$55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,$$
$$79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 102,$$
$$104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121,$$
$$122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139,$$
$$140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157,$$
$$158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175,$$
$$176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193,$$
$$194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211,$$
$$212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229,$$

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541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558,
559]

> RMwitlist(1105);

"q and k are: ", 69, 4

$[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29,$ **(26)**
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80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 99, 100, 101, 102, 103,
104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121,
122, 124, 125, 126, 127, 128, 129, 130, 131, 133, 134, 135, 136, 137, 138, 139, 140, 141,
142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159,
160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177,
178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195,
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