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R G Wilson, v

Letter to NJAS

6 pages

3 sequencs

Practical Nbrs.

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def: in 1948 A.K. Srinivasan

"a natural nbr. n is practical iff for all $k \leq n$, k is the sum of distinct proper divisors of n ." Ref. Ross Honsberger H073 Math. Gems I p113

RG Wilson ✓
to
NSAS

all ~~abseven~~ perfect nbrs are practical. In fact,
all nbrs of the form $2^{n-1}(2^n - 1)$. 6, 28, 120, 496, ...

all $n! \geq 3$ are practical. 6, 24, 120, ...

$\text{lcm}(1, 2, 3, \dots, n)$ is a practical nbr. 6, 12, 60, 420, ...
This implies that all practical nbrs. must be even.

if p is a practical number, then so is $n \cdot p$
a practical nbr. for all $n \leq p$.

~~X, X~~, 6, 12, 18, 20, 24, 28, 30, 36, 40, 42, 48, 54, 56, 60,

66, 72, 78, 80, 84, 88, 90, 96, 100, 104, 108, 112, 120, 126, 132,

140, 144, 150, ...

done

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Not all perfect & abundant nbrs are practical nbr.
Weird nbrs are not practical. Also are ~~110~~ 102,
114, 138,

Also all odd abundant nbrs. are ~~pract~~ not practical.

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10 ! Impractical Nbr. Candidates; Rev'd Sat.02July94
15 ! Tested up to 0.
20 ! required: MatROM, SortLex, FactorLx, Divisors
25 ! Constants Used: M() F$ S$ B C D E F G I J K L N S T P
30 N=0 @ S$=''
40 F$='FACTLIST' @ OPTION BASE 1 1 @ PURGE F$
50 N=N+2
60 IF SUMDIV(N)<2*N THEN 50
70 IF D<0 THEN 50
100 !
110 G=N @ F=2 @ B=1
120 CREATE SDATA F$ @ ASSIGN #1 TO F$ @ PRINT #1;1
130 IF G=1 THEN 190 ELSE F=FACTOR(G,F) @ G=G/F
140 IF F=B THEN 150
150 GOSUB 170 @ B=F
180 MAT M=(F)+M @ PRINT #1;M @ GOTO 130
170 T=RECORDS(F$) @ DIM M(T) @ READ #1,0;M @ RETURN
180 ASCSORT #1 @ GOSUB 170 @ PURGE F$ @ U=T
190 !
200 FOR P=3 TO N/2 @ D=P @ T=U @ GFLAG 1
210 C=1 @ E=1 @ CSE= 0+M(1)
220 FOR I=2 TO T-1
230 IF M(I)>P THEN T=I-1 @ GOTO 260
240 C=C+M(I) @ IF E+M(I)<=P THEN E=E+M(I) @ L=I
250 NEXT I
260 IF E=P THEN 400 ! Sum from I=1 to L Equals E with no skips
270 IF C<P THEN 410
300 !
310 FOR K=1 TO T-1
320 FOR J=1 TO L+1 STEP -1
330 E=D-M(J) @ S=0
340 FOR I=J-1 TO 1 STEP -1
350 IF M(I)>E THEN 380
360 S=S+1 @ IF S=K THEN 380 ! which member to skip in successive M(I)<E
370 E=E-M(I)
380 NEXT I @ IF NOT E THEN SFLAG 1 @ GOTO 400
390 NEXT J @ NEXT K
395 IF FLAG(1) THEN 410 Not
400 NEXT P @ GOTO 50
410 S$=S$&STR$(N)&',' @ DISP S$
420 GOTO 50

```

if not Rmd(N,P) then 400 is it one of the proper Divisors

the accumulator is C

AS101

~~AS~~

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Even Abundant Number < 250

6, 12, 18, 20, 24, 28, 30, 36, 40, 42, 48,
 54, 56, 60, 66, (70), 72, 78, 80, 84, 88, 90,
 96, 100, (102), 104, 108, 112, (114), 120, 126,
 132, (138), 140, 144, 150, 156, 160, 162, 168,
 (174), 176, 180, (186), 192, 196, 198, 200, 204,
 208, 210, 216, 220, (222), 224, 228, 234, 240,
 (246),

circled nbers. are impractical = A7621

« { } 2 250 For i i Dup S Div

Swap 2* - \emptyset If \neq Then i Dup 1

Disp 1 \rightarrow List + End 2 Step \Rightarrow

MIRA, new seq to enter please!

~~MIRA~~

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Impractical nbers. are
even abundant nbers which are not practical;
hence their name. Even weird nbers. are a subset.

%A njas, rgnw



- 70, 102, 114, 138, 174, 186, 222, 246, 258, 282,
- 318, 350, 354, 366, 372, 402, 426, 438, 444, 474,
- 490, 492, 498, 516, 534, 550, 564, 572, 582, 606,
- 618, 636, 642, 650, 654, 678, 708, 732, 738, 748,
- 762, 770, 774, 786, 804, 822, 834, 836, 846, 852,
- 876, 894, 906, 910, 940, 942, 948, 954, 978, 996,
- 1002, 1038, 1060, 1062, 1068, 1074, 1086, 1098,
- 1146, 1158, 1164, 1180, 1182, 1190, 1194, 1206,
- 1212, 1220, 1236, 1266, 1278, 1284, 1308, 1314,
- 1330, 1338, 1340, 1356, 1362, 1374, 1398, 1420, 1422, 1430,
- 1434, 1446, 1460, 1494, 1506, 1524, 1542, 1572, 1578, 1580,
- 1602, 1608, 1610, 1614, 1626, 1644, 1652, 1660, 1662, 1668,
- 1686, 1698, 1704, 1708, 1734, 1746, 1750, 1752, 1758, 1780,

Impractical numbers: even abundant numbers that are not practical (2).
%R rgnw.
%0 1, 1

%N

1788, 1812, 1818, 1842, 1854, 1866, 1870, 1876, 1878,

1884, 1896, 1902, 1926, 1938, 1940, 1956, 1962, 1986, 1988,

1992, 2002, 2004, 2020, 2022, 2030, 2034, 2044, 2060, 2076,

at what $k < n$ does n fail?

Impractical nbers. are

even abundant nbers which are not practical;
hence their name. Even weird nbers. are a subset.

$$\sqrt[3]{3 \cdot n} < 2 \cdot \sqrt{n}$$

⁴70, ¹³102, ¹³114, ¹³138, ¹³174, ¹³186, ¹³222, ¹³246, ¹³258, ¹³282,

¹³318, ⁴350, ¹³354, ¹³366, ²⁹372, ¹³402, ¹³426, ¹³438, ²⁹444, ¹³474,

⁴490, ²⁹492, ¹³498, ²⁹516, ¹³534, ⁴550, ²⁹564, ⁸572, ¹³582, ¹³606,

¹³618, ²⁹636, ¹³642, ⁴650, ¹³654, ¹³678, ²⁹708, ²⁹732, ⁴⁰738, ³748,

¹³762, ⁴770, ⁴⁰774, ¹³786, ²⁹804, ¹³822, ¹³834, ⁴³836, ⁴⁰846, ²⁹852,

²⁹876, ¹³894, ¹³906, ⁴910, ⁴³940, ¹³942, ²⁹948, ⁴⁰954, ¹³978, ²⁹996,

¹³1002, ¹³1038, ⁴³1060, ⁴⁰1062, ²⁹1068, ¹³1074, ¹³1086, ⁴⁰1098,

¹³1146, ¹³1158, ²⁹1164, ⁴³1180, ¹³1182, ⁴1190, ¹³1194, ⁴⁰1206,

²⁹1212, ⁴³1220, ²⁹1236, ¹³1266,



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160 MAT M=(F)*M @ PRINT #1;M @ GOTO 130
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190 !
200 FOR P=3 TO N @ D=P @ T=U @ SFLAG 1
210 C=1 @ E=1 ! C&E= 0+M(1)
220 FOR I=2 TO T-1
230 IF M(I)>D THEN T=I-1 @ GOTO 260
240 C=C+M(I) @ IF E+M(I)<=0 THEN E=E+M(I) @ L=I
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350 IF M(I)>E THEN 380
360 S=S+1 @ IF S=K THEN 380 ! which member to skip in successive M(I)<E
370 E=E-M(I)
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390 NEXT J @ NEXT K
395 IF FLAG(1) THEN 410
400 NEXT P @ GOTO 50
410 S$=S$&STR$(N)&' ,' @ DISP S$
420 GOTO 50

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