

← Cinquante signes



Spirals for Scott



octobre 19, 2022

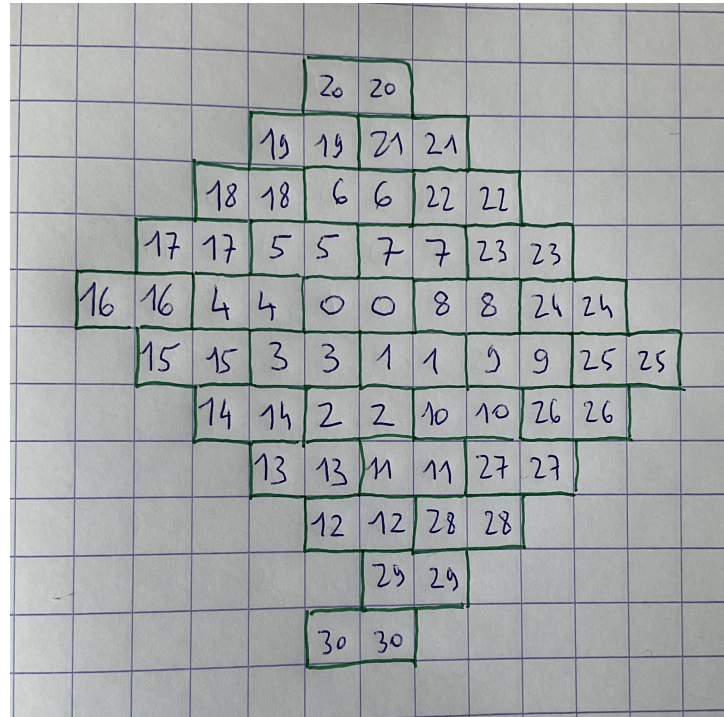
Hello Math-Fun,

Scott **S.** has accepted, in the past, to submit a few sequences together with me to the OEIS — and I take this opportunity to thank him again. Some sequences were related to a chess knight placed in the center of an infinite spiral of integers (see below the wonderful and surprising *Numberphile* video with Neil **Sloane**).

I had this first idea yesterday: instead of numbers in square cells, we could tile the grid with a spiral of horizontal dominoes (in the form of a diamond, see below — thank you **Maximilian!**-)

Those dominoes would be distinct « double-dominoes », thus we would start somewhere with the 0-0 domino, then spiral with the 1-1, followed by the 2-2, the 3-3, the 4-4, etc.

Cinquante signes



Note the position of the 30-30 domino: this is because two successive dominoes cannot share the same horizontal line in the "diamond-like" shape

We place now the knight on one of the two zeros and ask him, as before, to jump always on the smallest available integer (without repeat). Will this new path beat **Neil's** one (2084 jumps)?

Best,

É.

(What do you think, **Scott**?)

The *Numberphile* video:

<https://youtu.be/RGQe8waGJ4w>

(I'll post tomorrow another spiral challenge for **Scott**!-)

October 20 update.

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Many thanks and bravo, **Maximilian!**

> Hello Eric,
 > yes, I think this beats the record, with a tour of 2550 hops.

I understood well only after looking at the picture on your blog,
 showing that the dominoes are placed in a "diamond type" spiral,

```

_ _ _ 6 6 _ _ _ _
_ _ 5 5 7 7 _ _ _
_ 4 4 0 0 8 8 _ _
_ _ 3 3 1 1 9 9 _
_ _ _ 2 2 10 10 _ _
_ _ _ _ 11 11 _ _ _
  
```

This sequence is produced by the code for A326924 with domino instead of *norml2* in the following (ugly, inefficient) manner:

```

DD=Map(["pos",o; "side",o]); domino(x, z=[1,I]~)={
while(!mapisdefined(DD, x*z, &z),
my(pos=mapget(DD,"pos"), side=mapget(DD,"side"),
  
```

Cinquante signes

```
mapput(DD,"pos",pos); mapput(DD,"side",side+1)); z}
```

To see the dominos:

```
printp(matrix(20,20,i,j,domino([j-9, i-9])))
```

Then the list of squares corresponding to the knight's tour is produced by A326924 with

```
{local(coords(n, m=sqrtint(n), k=m\2)=if(m<=n-
=4*k^2, [n-3*k, -k], n>=0, [-k, k-n], n>=-m, [-k-n, k], [k,
3*k+n]), U=[]/* used squares */, K=vector(8, i,
[(-1)^(i\2)<<(i>4), (-1)^i<<(i<5)])/* knight moves */,
pos(x, y)=if(y>=abs(x), 4*y^2-y-x, -x>=abs(y), 4*x^2-x-y,
-y>=abs(x), (4*y-3)*y+x, (4*x-3)*x+y), t(x, p=pos(x[1],
x[2]))=if(p<=U[1]||setsearch(U, p), oo, [domino(x), p]),
nxt(p, x=coords(p))=vecsort(apply(K->t(x+K), K))[1][2]);
my(A=List(o)/*list of positions*/); for(n=1, oo,
U=setunion(U, [A[n]]); while(#U>1&&U[2]==U[1]+1,
U=U[^1]); iferr(listput(A, nxt(A[n])), E,
/*print(E);*/break)); print("Index of last term: ", #A-1);
SQUARE(n)=A[n+1];}
```

Index of last term: 2550

Cinquante signes

`apply(SQUARE,[0..99]) \\ first 100 squares`

`= [0, 11, 14, 1, 4, 13, 10, 3, 18, 7, 2, 5, 22, 9, 28, 31, 60, 15, 32, 29, 52, 25, 8, 27, 12, 53, 26, 23, 6, 17, 34, 59, 30, 87, 126, 51, 24, 45, 20, 39, 16, 33, 58, 55, 86, 125, 50, 47, 76, 21, 40, 67, 36, 61, 94, 57, 54, 85, 176, 129, 56, 93, 138, 187, 92, 137, 96, 35, 38, 19, 68, 37, 62, 95, 136, 91, 88, 127, 84, 49, 78, 115, 44, 77, 114, 43, 70, 105, 66, 63, 140, 189, 246, 135, 188, 139, 248, 313, 186, 247]`

`apply(SQUARE,[2500..2550]) \\ last 51 squares`

`= [2514, 2127, 1944, 1769, 1446, 1295, 1440, 1757, 2106, 2487, 2900, 3345, 3822, 4331, 4872, 4595, 4868, 5149, 5438, 5145, 4860, 4583, 4314, 3803, 3326, 2879, 2464, 2267, 1900, 1565, 1730, 1899, 2080, 2269, 2668, 2463, 2266, 2077, 1726, 1561, 1408, 1405, 1718, 2063, 1884, 2059, 2242, 2635, 3060, 3283, 3056]`

The labels on the corresponding dominoes are:

`[domino(coords(SQUARE(n))) | n <- [0..99]]`

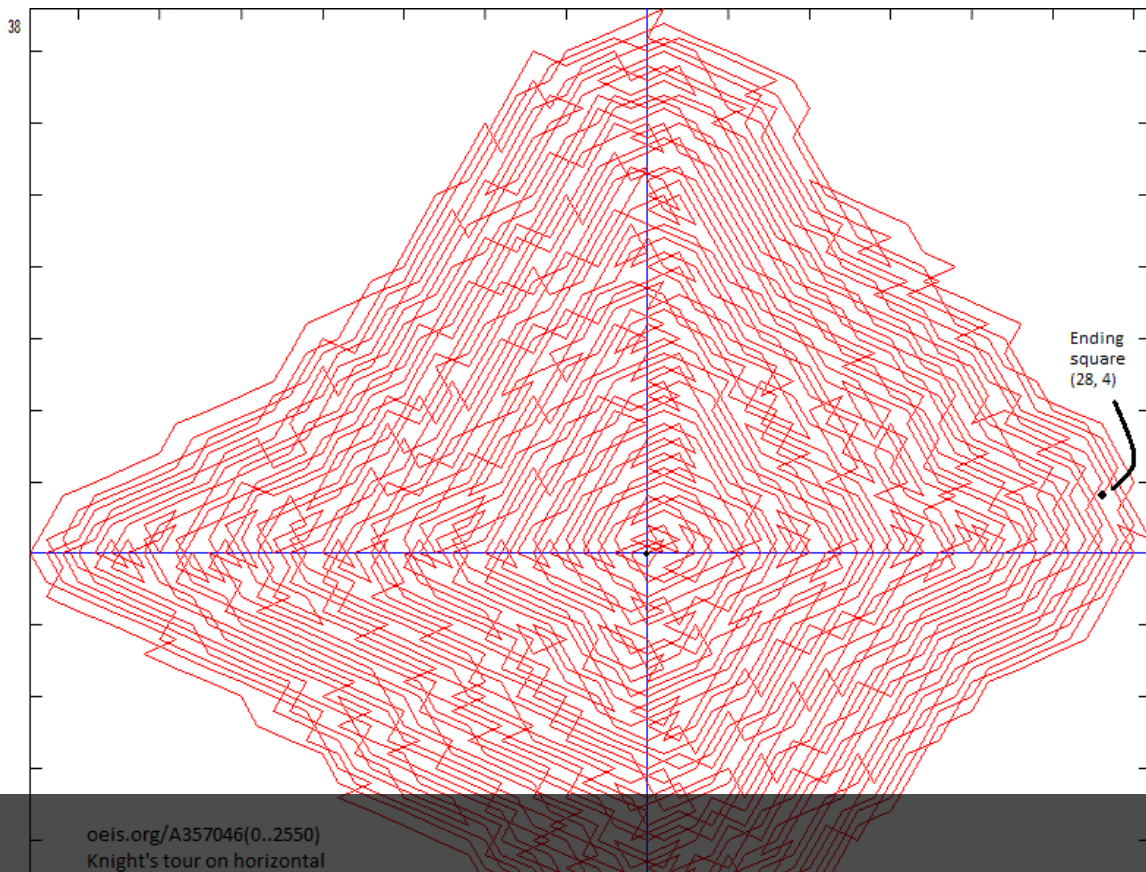
`= [0, 1, 2, 0, 3, 2, 8, 3, 4, 5, 1, 4, 6, 7, 9, 11, 12, 14, 11, 10, 24, 22, 7, 8, 10, 9, 23, 6, 5, 15, 13, 12, 27, 26, 48, 23, 22, 19, 18, 16, 14, 13, 28, 27, 25, 47, 46, 21, 20, 18, 17, 35, 33, 32, 29, 28, 26, 24, 49, 51, 52, 29, 30, 55, 53, 30, 31, 33, 15, 17, 16, 34, 32, 31, 54, 53, 51, 25, 47, 45, 44, 41, 19, 20, 41, 39,`

Cinquante signes

%216 = [1285, 1284, 1282, 1428, 1279, 1278, 1137, 1275, 1273, 1419, 1417, 1571, 1569, 1731, 1729, 1566, 1409, 1408, 1405, 1404, 1555, 1554, 1713, 1551, 1397, 1251, 1249, 1248, 1246, 1108, 1109, 1246, 1247, 1112, 1250, 1249, 1392, 1391, 1389, 1388, 1243, 1242, 1385, 1384, 1238, 1100, 1098, 1097, 1232, 1094, 964]

So, we get stuck on the domino labelled with number 964. It is at position $(x, y) = (28, 4)$.

The gif:

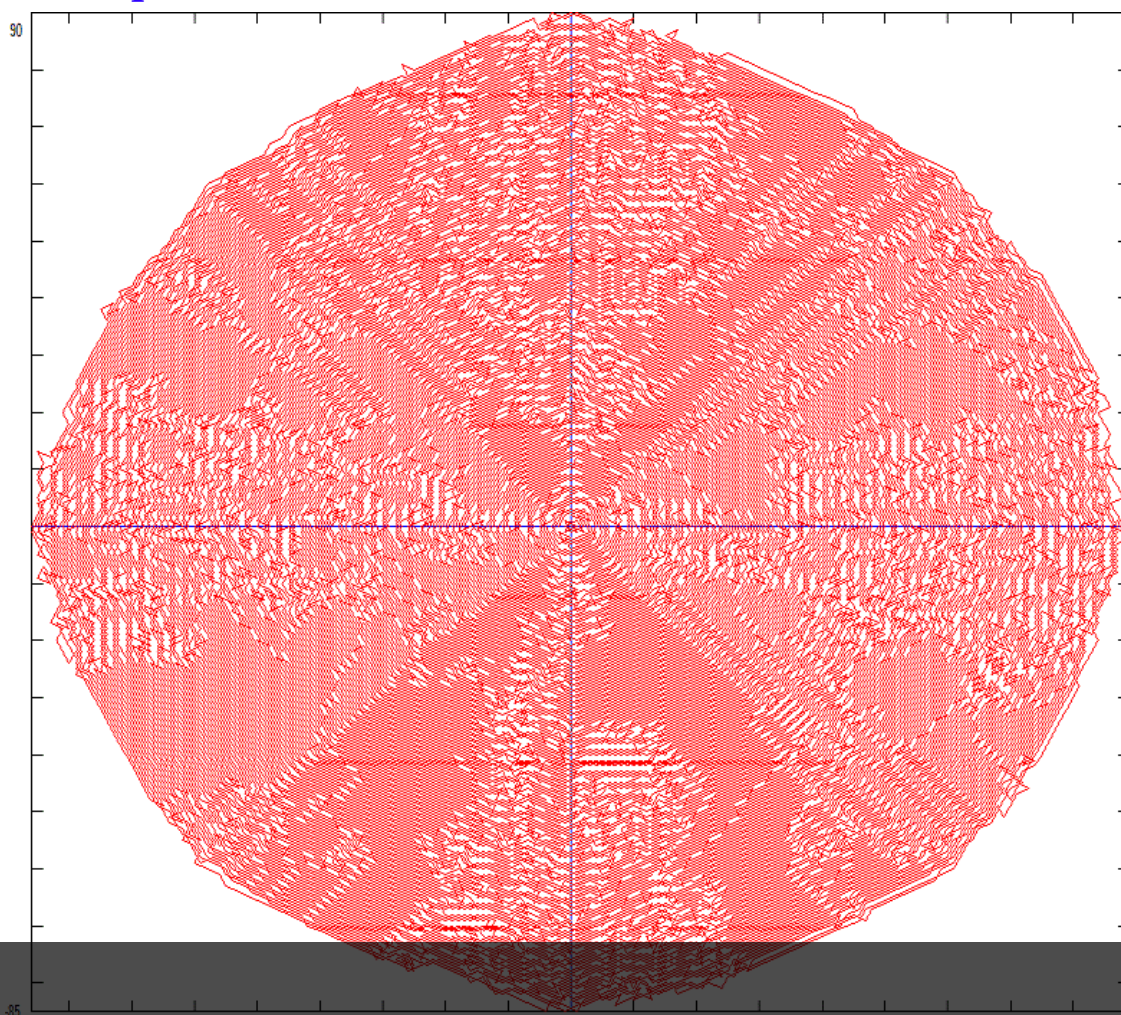


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This has been submitted to the OEIS
as <https://oeis.org/A357046>

P.-S.

That said, I had already found a much longer knight's tour
than Neil's, namely precisely that of
<https://oeis.org/A326924> (quite natural: minimizes the
distance from the origin) which stops after 22325 jumps.
Here is "plot":



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Magnifique – merci !



MFH 19 octobre 2022 à 14:04

Yes, if I'm not wrong, the knight gets stuck only after 2550 jumps, on the square at position $(x,y) = (28, 4)$, labelled 964.

[RÉPONDRE](#)

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