From: Mike Pearson <gmp26@cam.ac.uk>
Date: 18 November 2010 23:32:10 GMT
To: j.h.mason@open.ac.uk
Subject: **Re: 3x3 9 hole light golf added**

On 18 Nov 2010, at 17:00, John Mason wrote:

Hi mike,

you're right about the 3 by 3 Light Golf!

I wouldn't be surprised if all 512 states were reachable in not many clicks - possibly just 3. It might be interesting to make a route matrix and start cranking. Perhaps a video of the matrix, frame n = power n, encoding the results in greyscale.

Corresponding to the Polydials that I am trying to get someone to help build, this could be used to introduce algebra, as follows.

For each button, provide an icon showing which lights it alters. Then I can treat these icons as the number of times I press that button. In fact of course it is only ever 0 or 1. For each light, I want an equation that says which buttons affect it. Now I put in values (0 or 1) for each of those equations, and solve the equations, to find which buttons to press. So I want to be able to give numbers (0 or 1) to each of the 'equations'.

I need to think about that with a fresh mind - it's sounding like 9 simultaneous boolean equations with 3, 4 or 5 terms in each? Or 4 simultaneous equations with 3 boolean terms for the 2x2 case?

I'm finding it easier to analyse by counting states starting from 0 so the lights end up as the bits of a binary encoded state number. Then the buttons are bidirectional edges taking me from state to state. But 3x3 light golf is still 512 states so a bit much to analyse by hand.

2x2 light golf looks more tractable so here goes...

I'm going to number the buttons like this:
b1 b0
b3 b2
and number the states 0 to 15 in binary - so S12 is the state with b3 and b2 lit.

And the state transition diagram looks like this. Really nice - it tiles the plane or wraps a torus!

S_8 b_3 S_6 b_0 S_1 b_3 S_{15} b_0
b_2 b_2 b_2 b_2
S_5 b_3 S_{11} b_0 S_{12} b_3 S_2 b_0
b_1 b_1 b_1 b_1
S_{14} b_3 S_0 b_0 S_7 b_3 S_9 b_0
b_2 b_2 b_2 b_2
S_3 b_3 S_{13} b_0 S_{10} b_3 S_4 b_0
b_1 b_1 b_1 b_1

S0 is no more than 3 button presses away from any state, and all states are reachable. Finding the best solution becomes a shortest path problem.

Still hard to imagine the 3x3 case this way but it should be computable.

Don't know of this makes sense
It is a two-dimensional version of what I call Flipping Cups where you have a bunch of cups in a row and you are allowed to flip some specified number (the number of hands you are allowed to use) of consecutive cups. Similar task then: some array f cups show and you want to get them all up, say. again you could use the icon idea to assemble equations which when solved tell you which cups to flip. Another special case of PolyDials (where there are multiple states etc. See http://mcs.open.ac.uk/jhm3/Applets%20&%20Animations/Applets%20&%20Animations.html item 3 (the menu on the left doesn't seem to work for that one ... will have to repair it)

Sorry but the Polydials zip download seems to be broken too. I'm getting a 404 on it.

What fun!

Yes - I enjoyed that!

M

Cheers

J

On 17/11/10 14:48, Mike Pearson wrote:
At http://nrich.maths.org/7383.
7376 is now 18 hole with appropriate end of game message.
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