Froggy Hopscotch

Hopscotch was originally a training exercise for Roman infantry. These frogs don't know that history. They are just interested in jumping about on their lily pads. Each frog jumps a different distance:

This means that when the green frog jumps, it only jumps to a nearby lily pad and when the yellow frog jumps, it jumps over three lily pads and lands on the fourth.

Arrange these four frogs on the five lily pads so that all of them can jump at the same time every minute, and never share a lily pad? The above arrangement doesn't work because the blue and the yellow frogs will be jumping to the same lily pad:

The following arrangement also doesn't work because the red frog won't have a lily pad to itself after jumping:

Extensions:

Arrange 5 frogs with jumps 1,2,3,4 & 5 on six lily pads.

Is it always possible to arrange N frogs on N+1 lily pads?

Can you find the number of lily Pads required for N frogs which jump 0, 1, 2... N-1?

What happens if each jumping frog owns two lily pads and refuses to let other frogs touch them? Is it possible that N frogs can be happy on 2N lily pads? *

For example:

is a solution for the four frogs which jump 1, 2, 3, and 4.

The Math in This Problem:

In this math puzzle, students are investigating different number values assigned to frogs and their placements on lily pads in a game of hopscotch. With the goal of correctly placing the frogs on certain lily pads to have them never land on the same one, students will practice mathematical analysis in examining the various arrangements.