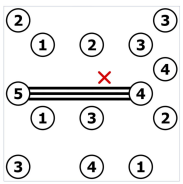
Mathematics Society
Weekly Questions (Week 1)

October 18, 2023

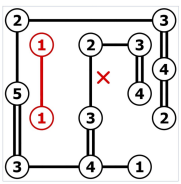
Question 1 (Puzzle) *Bridges*[1]
Connect the numbered Islands by drawing Bridges between them, with the following conditions:

1. The Bridges must be straight horizontal or vertical lines that start and end at different islands.
2. Bridges can't cross each other, or pass through Islands.
3. The number of Bridges connected to each Island must match the number on that Island exactly.
4. At most 2 Bridges connect a pair of Islands.
5. The Bridges must connect the Islands into a *single* connected group.

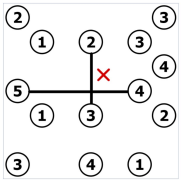
Below are some examples for your reference.[2] The first three figures show errors and the next two show correct applications of the rules:



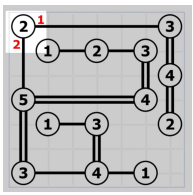
Breaks rule 4



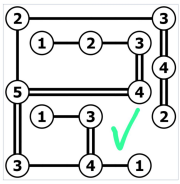
Breaks rule 5



Breaks rule 2



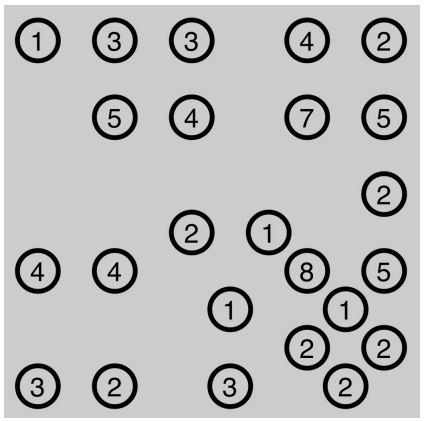
Shows rule 3



Correctly Solved

[1] Another name for this type of puzzle is *Hashiwokakero*
[2] Credit to PuzzleTeam on YouTube for making these 5 pictures.

Question 1 Cont'd. The figure below is the puzzle set for this week:



Question 1

Question 2 (Logic Puzzle) *Day-knights and Night-knights*
You live in an underground city with no clocks. Here, the only people who know for sure if it's day or night are the Day-knights and the Night-knights. The Day-knights always tell the truth during the day, but always lie during the night, while the Night-knights always do the opposite. You can't tell apart Day-knights and Night-knights before talking to them.
You stop a knight on the streets, and ask a question. Based on the knight's response, think about the following problems:

a If you ask "Is it day?":

   i Can you always tell if it's day or night?

   ii Can you always tell from this question if the knight is a Day-knight or a Night-knight?

b Now, if you instead ask "Are you a Day-knight?":

   i Can you still always tell if it's day or night?

   ii Can you still always tell from the question if the knight is a Day-knight or a Night-knight?

Question 3 (Olympiad) *Clock hands*[3]
A clock has an hour hand of length 3 and a minute hand of length 4. From 1:00 am to 1:00 pm of the same day, find the number of occurrences when the distance between the tips of the two hands is an integer.

[3]IMOHK Prelim 2002 Q2