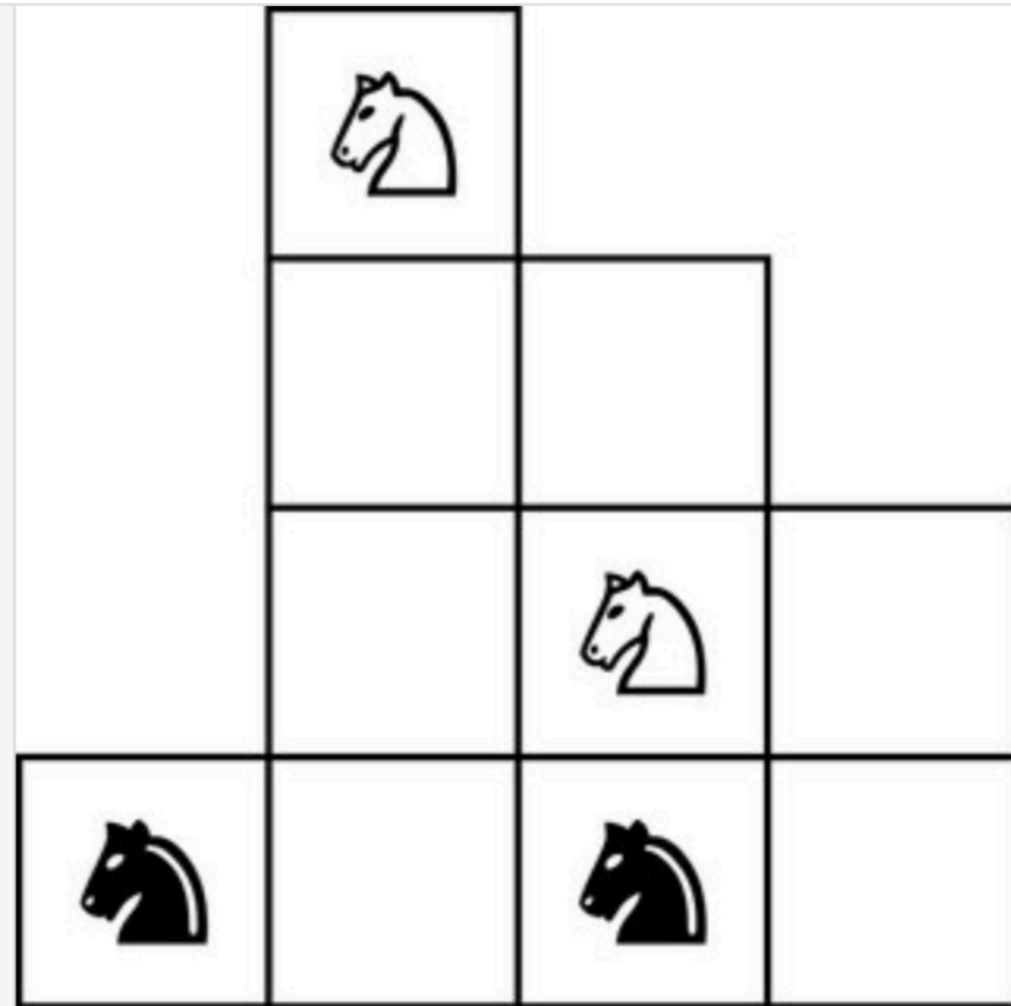


Mental exercise

Here is **the puzzle that June Huh beat**:

**Goal:** Exchange the positions of the black and white knights. →



The New York Times

These are knights - they move in L shapes in chess  
(2 any direction then 1 perpendicular)

Try to solve it

Trial and error is probably not going to work

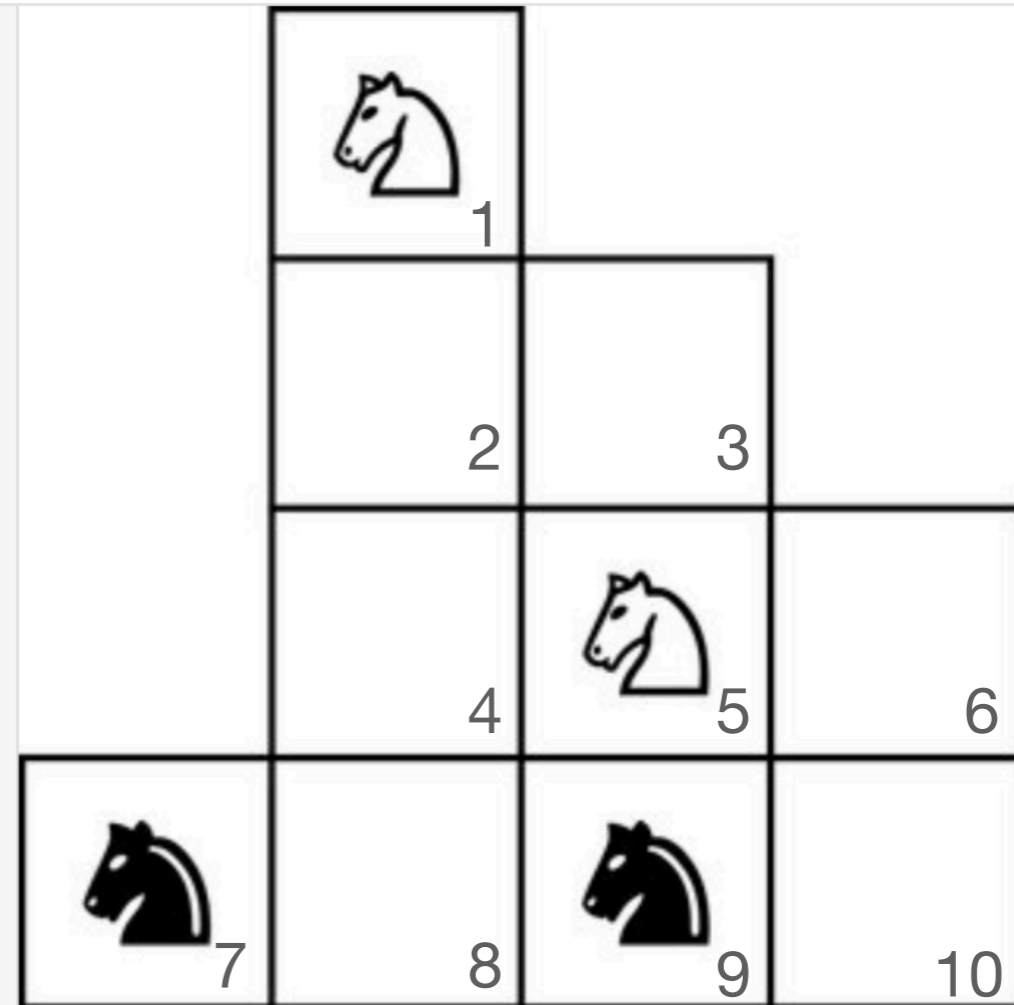
Can we convert the problem to something more easily solved?

## Number the tiles

Here is the puzzle that June Huh beat:

**Goal:** Exchange the positions of the black and white knights. →

The New York Times

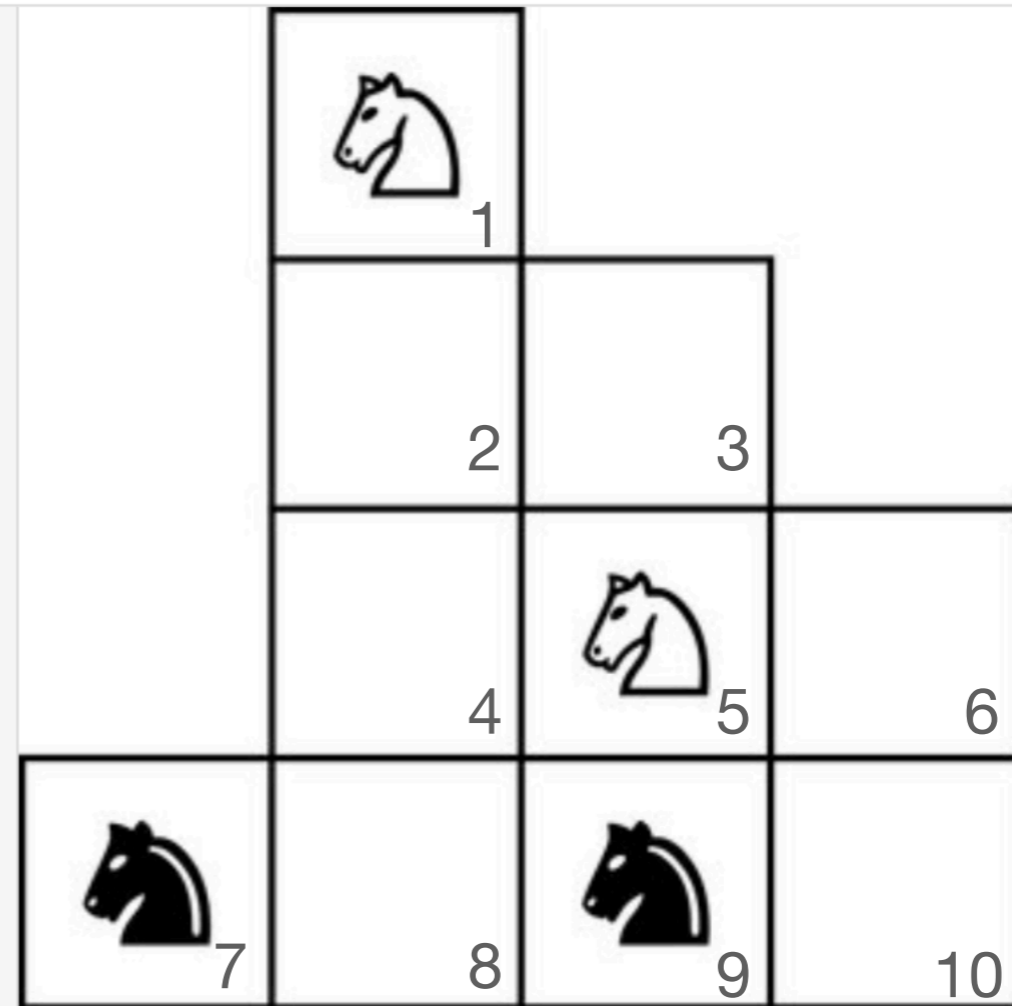


Part of the problem here is the Ls get tangled, it's (intentionally) confusing

Let's ditch space. It's not necessary. Only the legal moves matter.

Here is the puzzle that June Huh beat:

**Goal:** Exchange the positions of the black and white knights. →



The New York Times

Let's first see if there are dead ends - spaces with only one possible way in or out

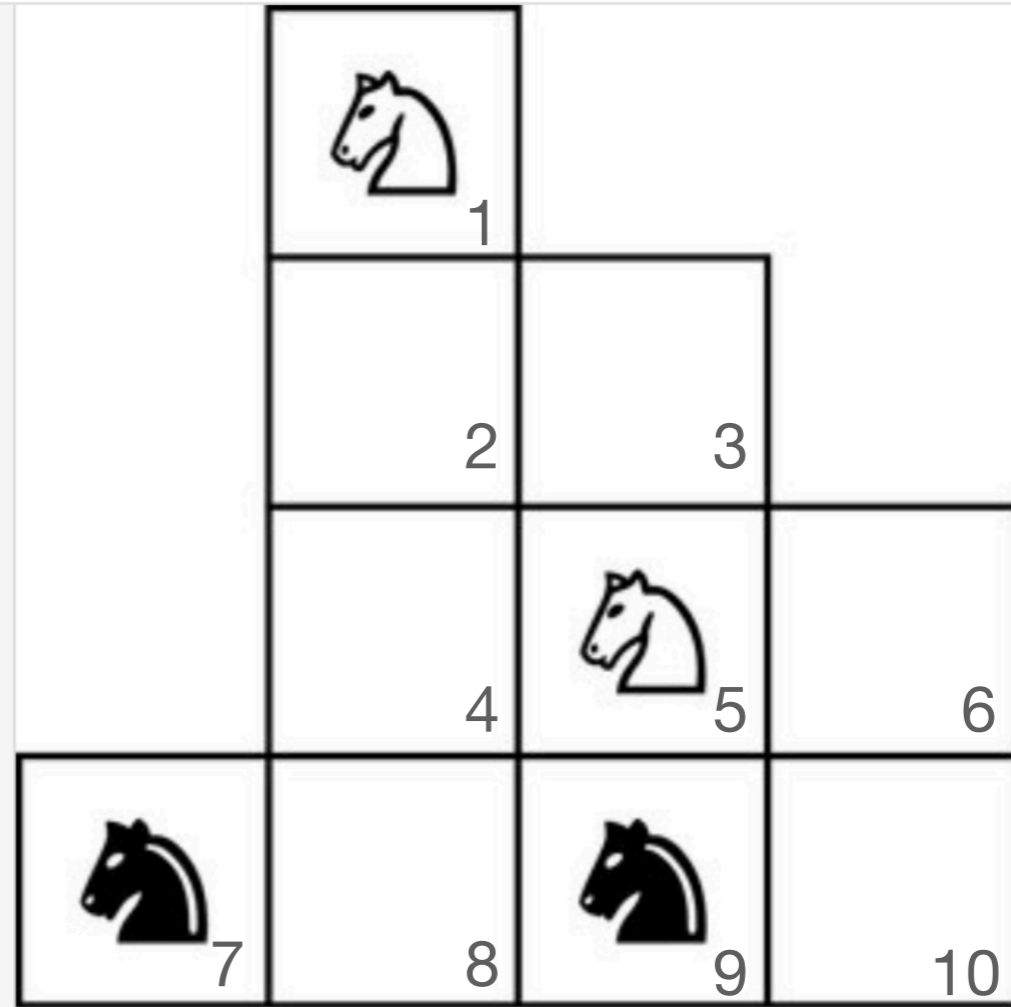
7 goes to 2 or 5 - no good

2 goes to 7, 9, and 6 - no good

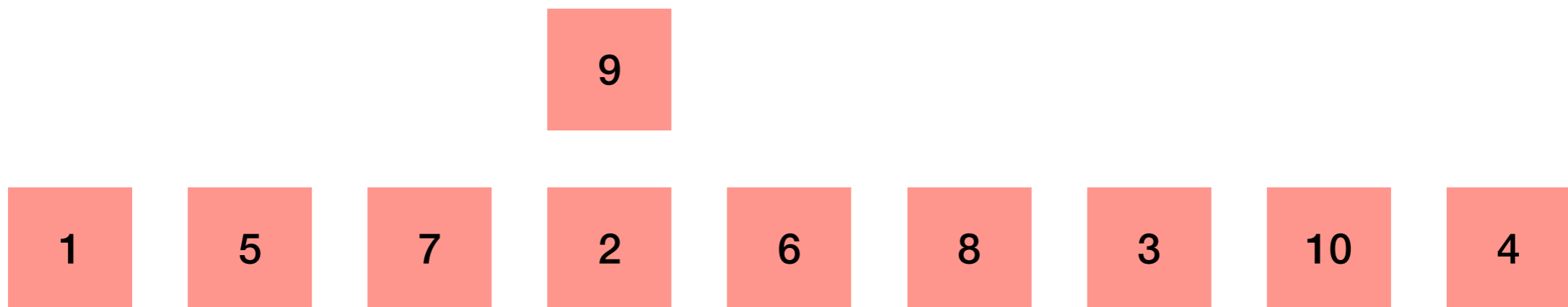
1 goes to 5 - start here

Here is the puzzle that June Huh beat:

**Goal:** Exchange the positions of the black and white knights. →

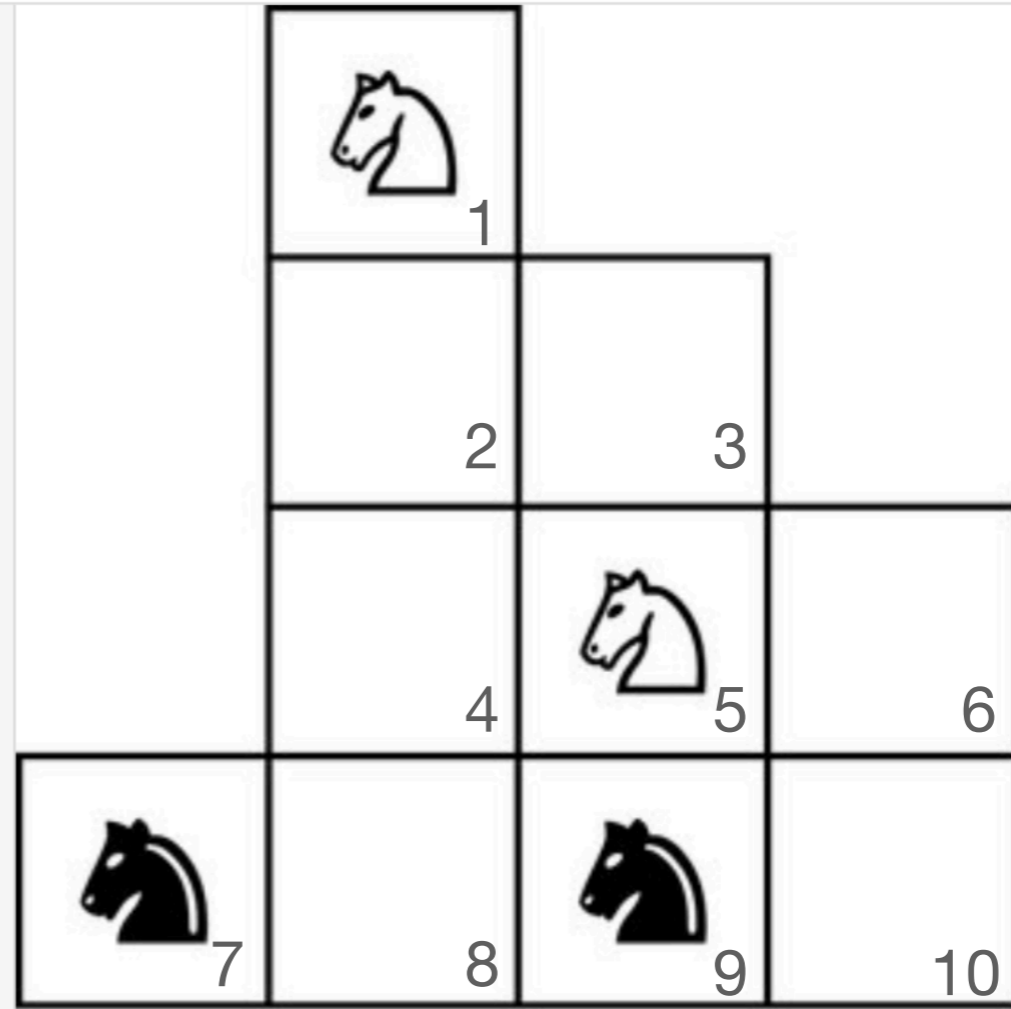


The New York Times

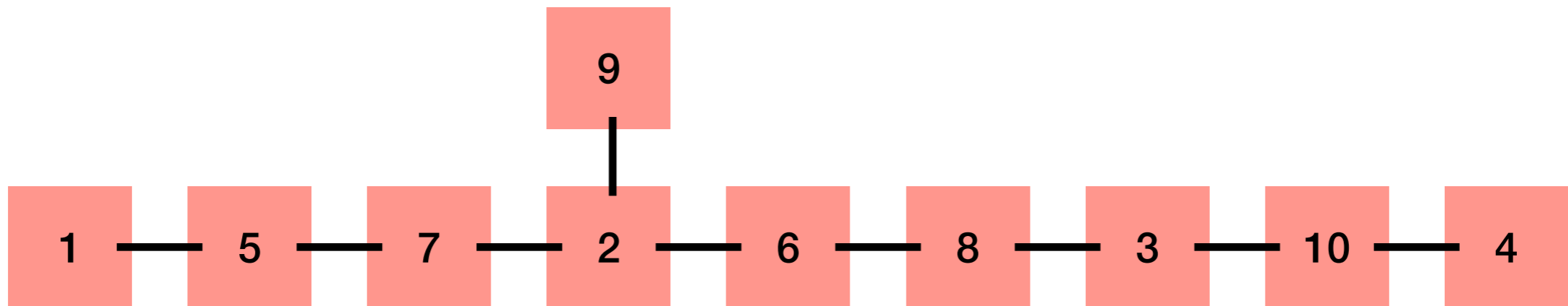


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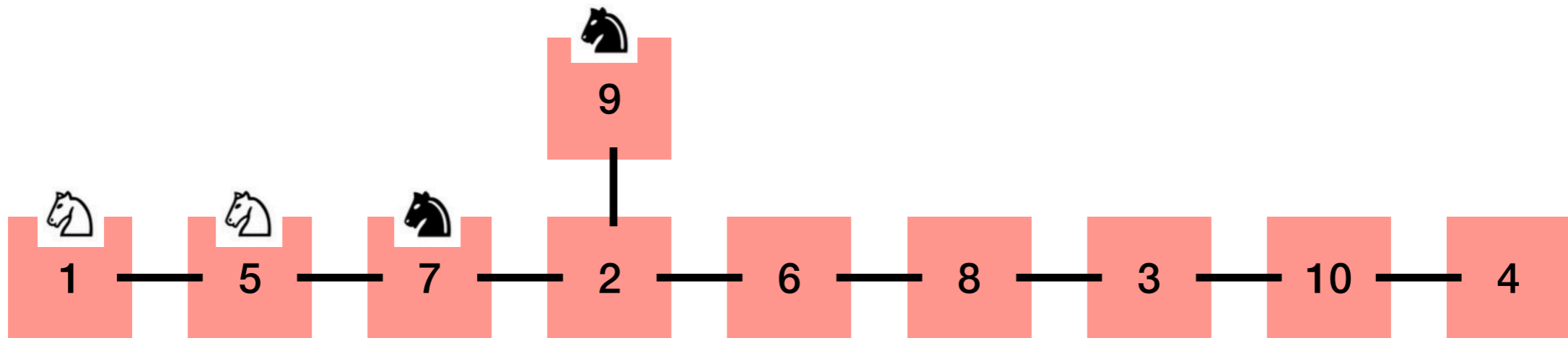
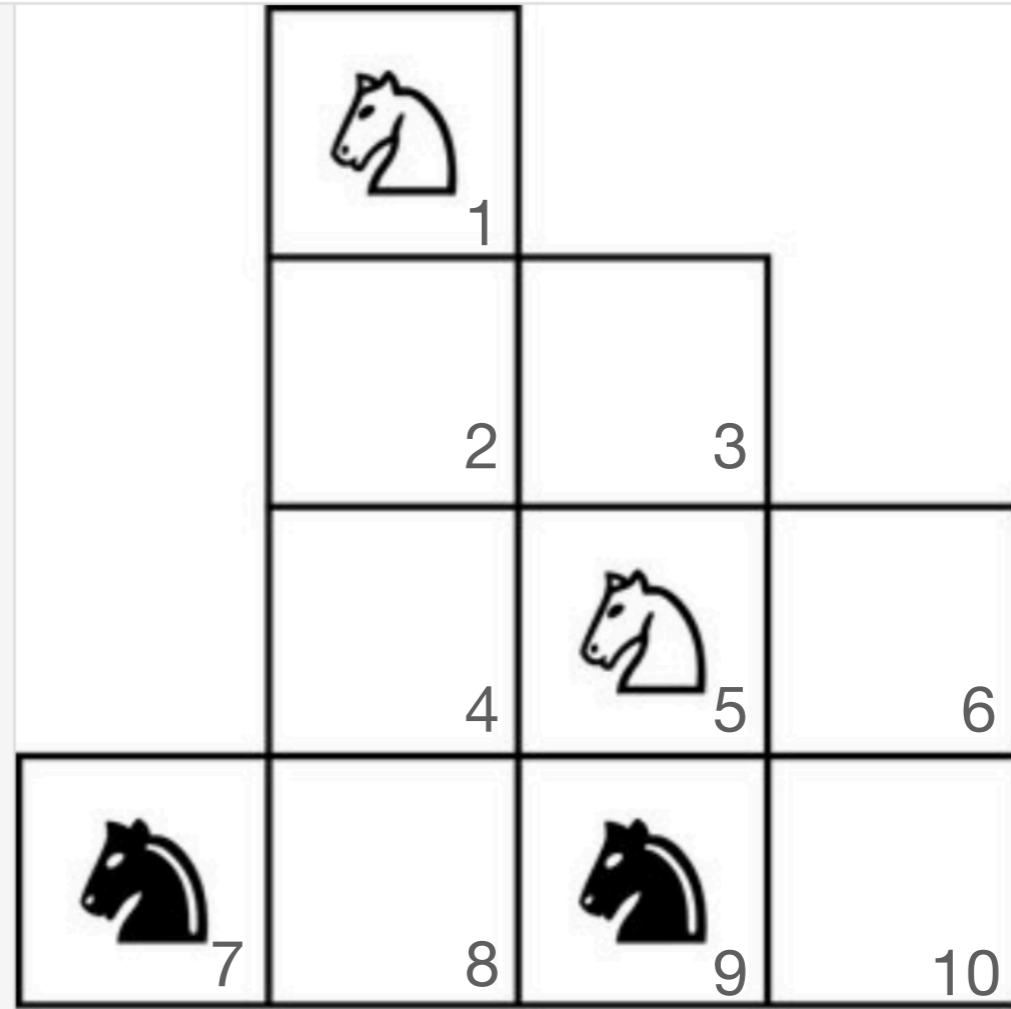
The New York Times



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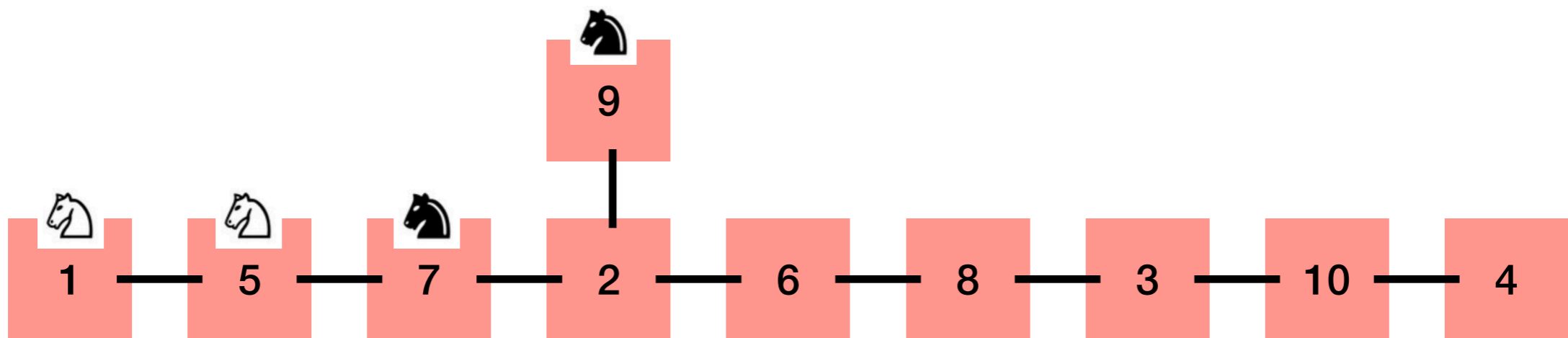
**Goal:** Exchange the positions of the black and white knights. →

The New York Times





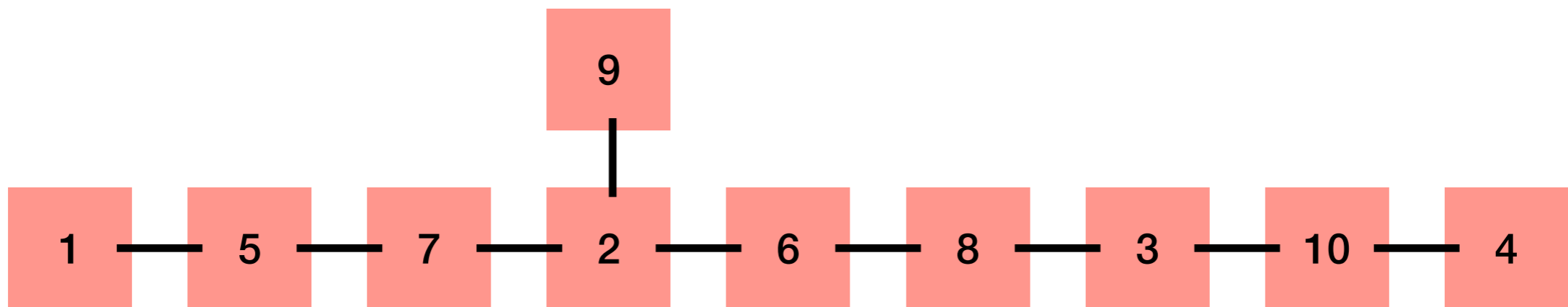
Same puzzle, now much easier to solve



Graphs: a collection of objects, and a collection of relationships between objects

Objects = nodes

Relationships = edges



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Objects = nodes

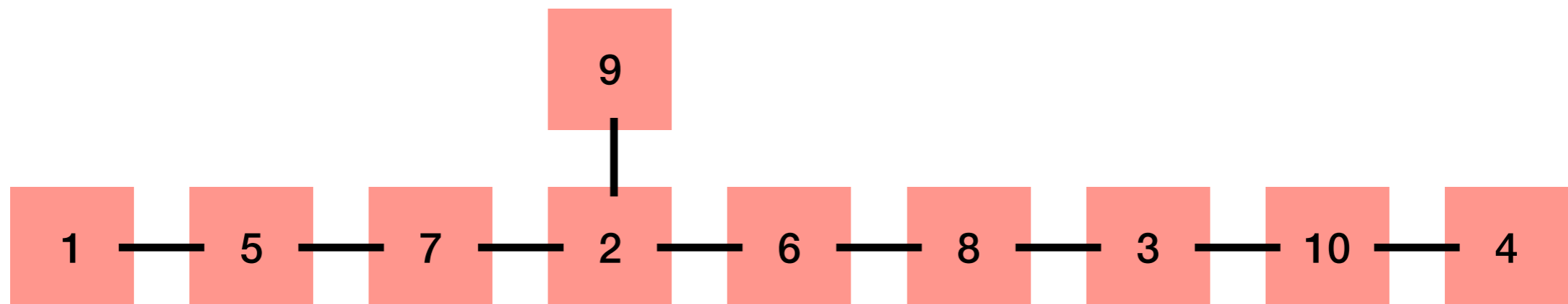
Relationships = edges

Graphs can either be a natural framework for a situation

Or a compelling simplification of a situation

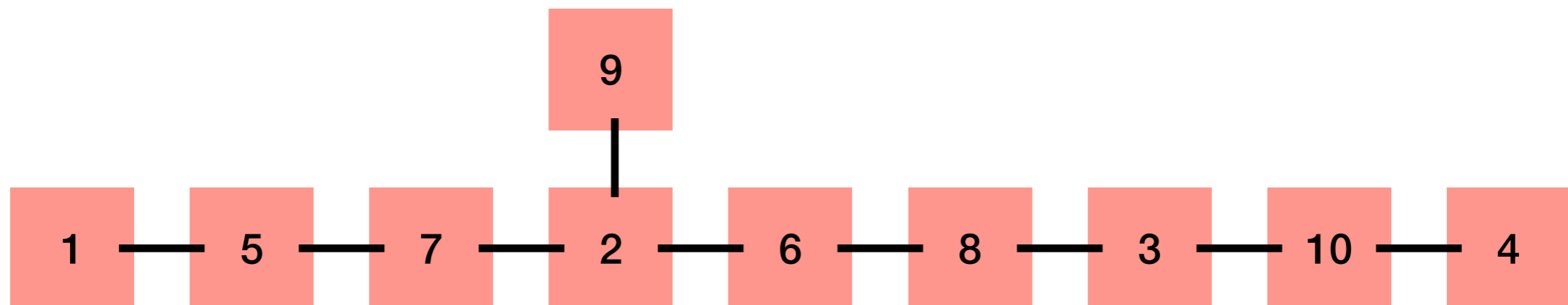
Graphs are often shown or stored as adjacency matrices

	1	2	3	4	5	6	7	8	9	10
1					1					
2						1	1		1	
3								1		1
4										1
5	1						1			
6		1						1		
7		1			1					
8			1			1				
9		1								
10			1	1						



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10			1	1						

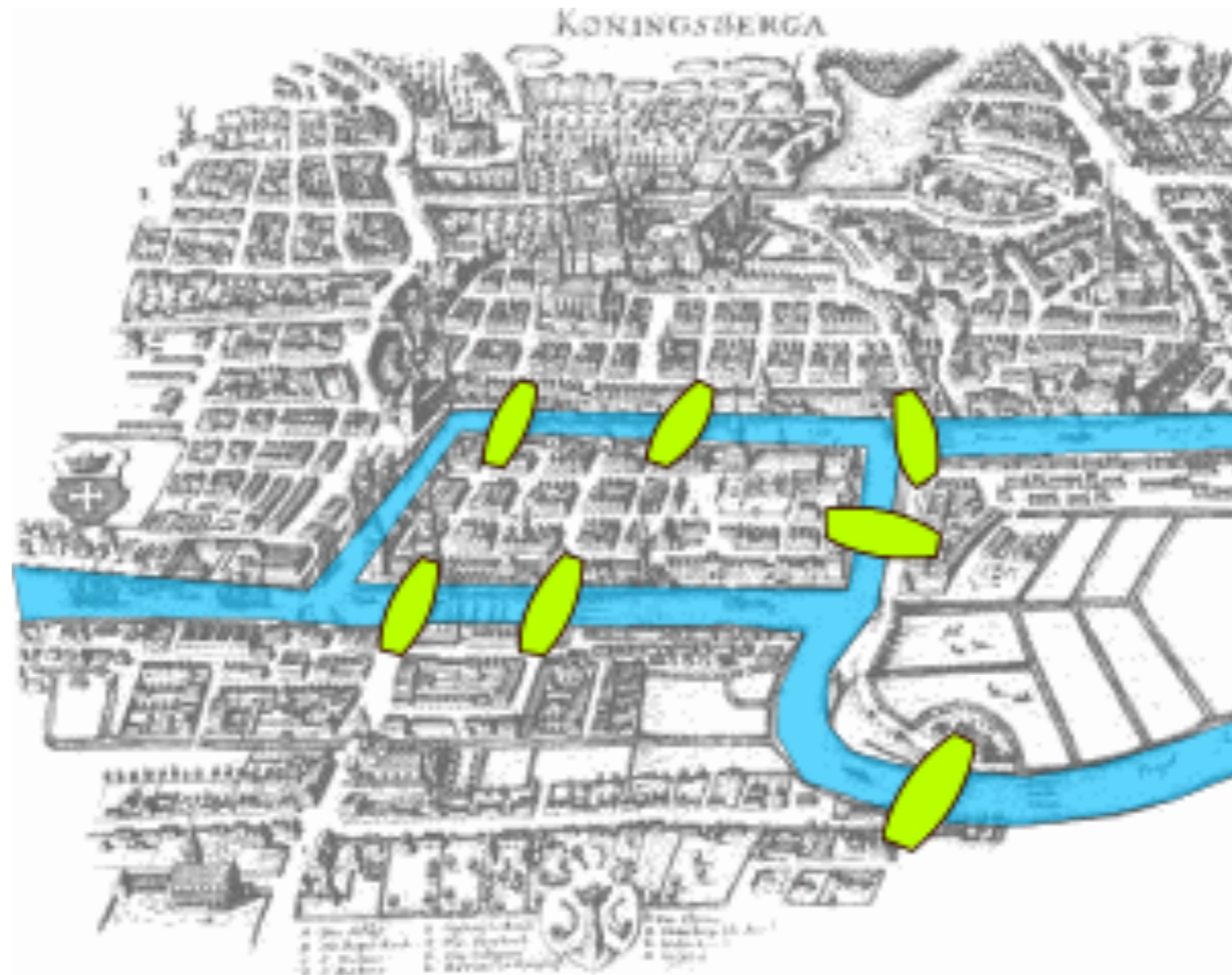


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6		1						1		
7		1			1					
8			1			1				
9		1								
10			1	1						

Now we have a 2D, square array - ripe for manipulation

An ancient riddle: can you stroll over each bridge just once?



Graphs can either be a natural framework for a situation

Or a compelling simplification of a situation

They can also be poor analogues of a situation