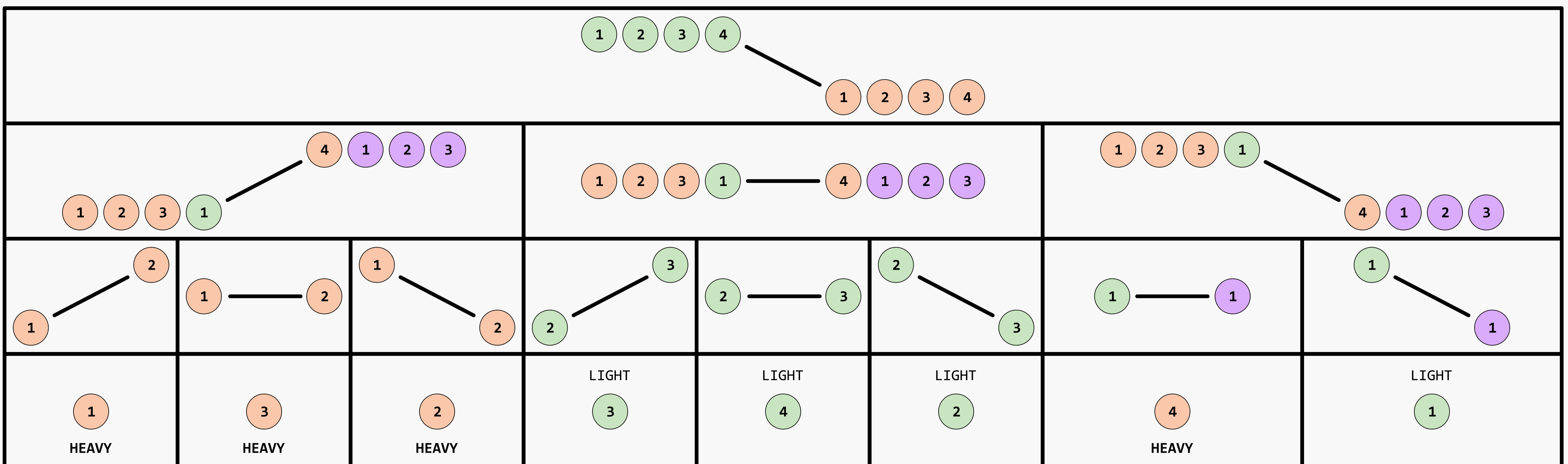
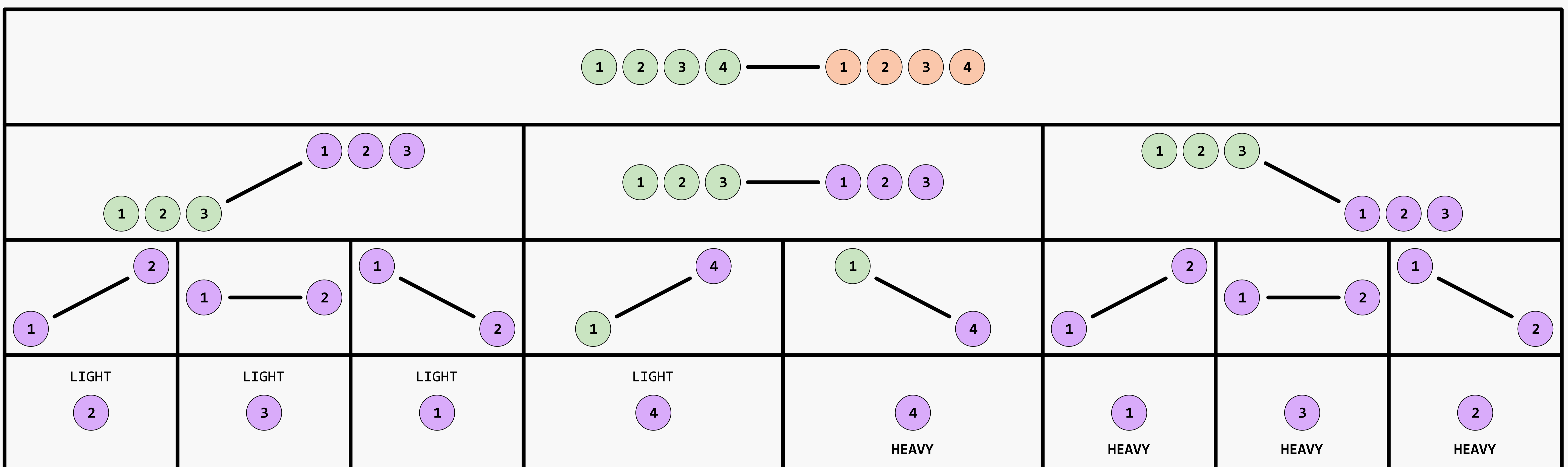
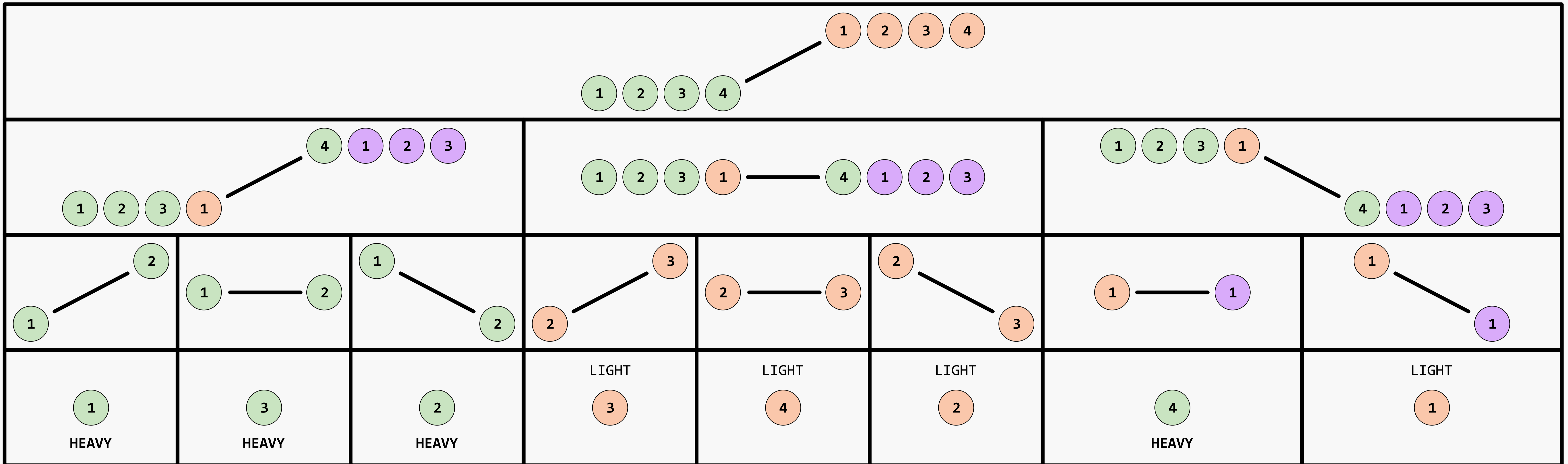
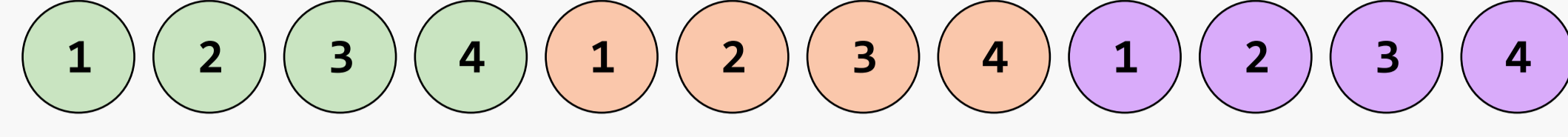


The Riddler Express

Aug 16, 2019

Zach Bogart

12 balls. 3 equal weighings.
Find the odd one out
AND if it's light or heavy.



Explanation

We start by weighing all of the green balls against all of the orange balls. There are three outcomes: the green balls are heavier, the orange balls are heavier, or the scale balances. Here we will describe when the green balls are heavier and when the scale balances. The outcome with heavier orange balls is symmetrical to the heavy green ball outcome, just with the green and orange colors reversed.

First, let's tackle the heavy green ball outcome where the scale tilts to the left. We know the odd ball is either a heavy green ball or a light orange ball. We also know that the four purple balls are normal so we will use them as controls in later weighings. For the second weighing, we swap the fourth green and first orange balls and replace the other orange balls on the scale with three normal purple balls. If the scale does not change state from above, we know the three green balls on the left must have the odd ball. If they are equal, that leaves the three orange balls not on the scale. Finally, if the scale tips the other way, it must be either the first orange or fourth green (the ones that swapped sides). Using the results from the previous weighing, we can weigh one ball on each side of the scale to determine the odd ball and whether it is light or heavy. For example, if the second weighing still tilts to the left, we know the odd ball is one of the three greens and we know the odd ball must be heavy. Similar deductions using previous weighings give us the other results.

The other option is the green and orange balls balance the scale. In this case, we know the eight balls on the scale are all normal and the odd one must be one of the four purple balls. For the second weighing, we weigh three normal balls (in the figure above, we used green ones) and three of the purple balls. If the scale tilts, we know the odd ball is one of the three on the scale and we know at that point whether it will be light or heavy. If the scale balances again, we know the odd ball must be the only purple not on the scale. We use our final weighing to rule out any remaining balls (if it tilted) or to determine whether it is light or heavy (if it was balanced). This process is similar to the outcome discussed above, using the previous weighings to deduce the odd ball and its relative weight.