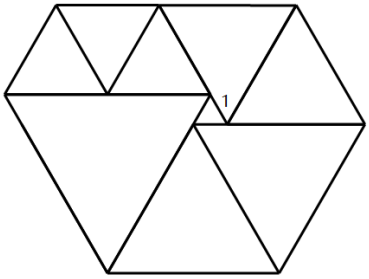
2023 RIPMWC Round 2

1. As shown in the figure below, a hexagon is cut into some equilateral triangles. Given that the side of the center triangle has length 1, find the perimeter of the following hexagon.



2. How many ways are there to put 8 identical balls into 4 boxes of different colors such that each box contains at least 1 ball?

3. Given that there are 2023 layers (2022 fraction bars) in the following fraction, evaluate this fraction:

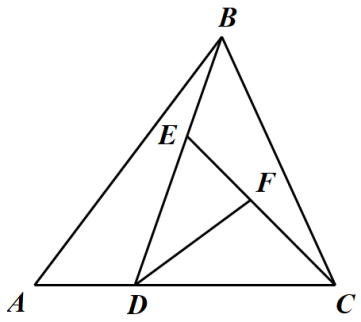
$$1-\cfrac{1}{1-\cfrac{1}{1-\cfrac{1}{1-\cfrac{1}{\vdots\\ 1-\cfrac{1}{1-\cfrac{111}{347}}}}}}$$

4. In a 10-digit code consisting only “0” and “1”, how many codes are there without two consecutive “1”s?

5. Tom and Jerry share a plot of land, and they each planted some corn and potatoes. Given that the ratio of: (i) Tom's land area to Jerry's land area is 3:5; (ii) Tom's potatoes to Tom's corn is 2:1; (iii) Tom and Jerry's total number of potatoes to their total number of corns is 4:3. Find the ratio of Jerry's potatoes to Jerry's corn.

6. How many ways are there to arrange 7 students A, B, C, D, E, F, G such that B is next to C, A and G are not next to each other?

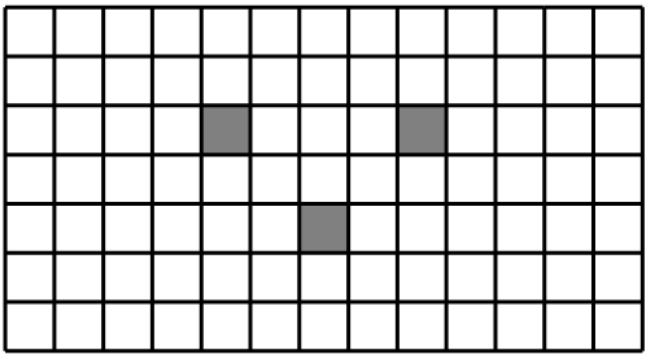
7. As shown in the figure below, given that $AD:DC=1:2$, $DE:EB=3:2$, $EF:FC=3:4$. Find the ratio of the area of $\triangle DEF$ to $\triangle ABC$.



8. Find a pair of 4-digit numbers that are divisible by the sum of their digits and have a difference of 26. Find another such pair that have difference 31.

9. Given that p and q are prime numbers, if $p+7q=260$, find the sum of all the possible values of p.

10. How many rectangles (including squares) are there without any shaded areas?



11. As shown in the figure below, a 2×3 square grid has a triangle removed and placed at another comer, is it possible to cut the figure into 2 equal portions? If yes, show how, if not, explain why?