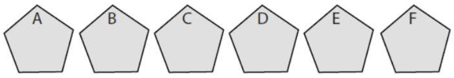
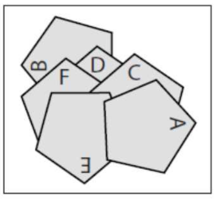
FFJM – Semi-Finals – March 21st, 2015

Information and rankings on *http://fsjm.ch/*

START ALL PARTICIPANTS

1 –Matilde's Collage (Coefficient 1)

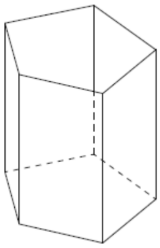




With the help of six pentagons identical to those of figures A, B, C, D, E and F, Matilde made a collage on a sheet of paper put on the table.

In which order has she stuck these pentagons?

2 – The Pencil Box (Coefficient 2)



Mathias has fabricated a prism shaped cardboard pencil box with 5 rectangles (the sides) and a pentagon (the bottom). He decided to paint the six sides (the sides and the bottom) so that two faces that have a common edge are never of the same colour.

How many colours will he have to use, at least ?

3 – The Medication (Coefficient 3)

Mathias is sick. He must take 36 drops of a drug mixed in a large glass of water.

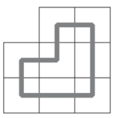
He drinks half of the glass, but refuses to drink the rest by saying that the taste is too bitter. His mother then tops up the glass with orange juice, stirs the both together and asks Mathias to drink the contents of the glass. Mathias drinks again half the glass, and then throws the rest down the sink. **How many drops of the drug did he absorb in total?**

4 – The Raffle (Coefficient 4)

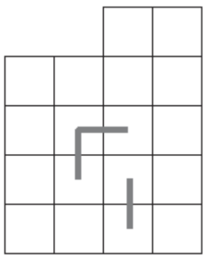
At the party of Mathilde and Mathias' School, a raffle is organized. One hundred tickets were printed: forty of them bear the inscription "voucher for a small prize", one ticket indicates "jackpot" and the others mention "lost".

How many tickets should one buy to be sure of winning at least one prize?

5 – The Circuit (Coefficient 5)



In the example on the left, one has drawn a closed circuit passing through the centre of each of the eight boxes of the grid exactly once.



Do the same with the 18 boxes in the figure to the right where 3 segments of the circuit are already drawn.

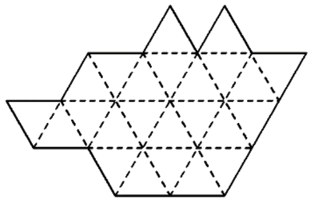
END FOR CE PARTICIPANTS

6 – Matilde's Bike (Coefficient 6)

On Matilde's bike, the front cog, on which is fixed the crank set, has 42 teeth and the pinion fixed to the rear wheel has 14 teeth. The pinion and the front cog are connected by a chain.

When Matilde has performed 15 turns with her pedals, how many turns has the rear wheel of her bike done?

7 – Cutting (Coefficient 7)



Cut the figure on the right in 4 stackable parts along the grid lines.

One can turn and reverse the parts.

8 – An Addition and a Multiplication (Coefficient 8)

Mathias writes the following serie of calculations :

1×(2+3) = 5

2×(3+4)=14

3×(4+5)=27, etc...

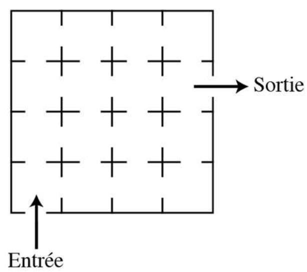
On each line, one multiplies the number corresponding to the number of the line by the sum of the two consecutive numbers.

How many calculation lines will Mathias have written when he reaches or exceeds 2015 ?

END FOR CM PARTICIPANTS

<u>Problems 9 to 18:</u> beware! For a problem to be completely solved, you must give the number of solutions, AND give the solution if there is only one, or two solutions if there is more than one. For all problems that may admit more than one solution, there is space for two answers on the answer sheet (but there may still be a unique solution).

9 – The Museum (Coefficient 9)



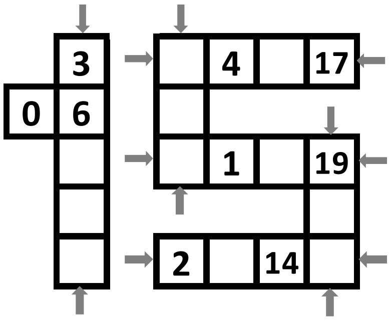
Mathilde and Mathias visit a museum. It is made of 16 rooms arranged in a square as shown on the figure on the right. **How many different routes allow going from the Entrance (Entrée) to the Exit (Sortie) by passing through each room exactly once?**

10 – Division (Coefficient 10)

One divides a two-digit number by the sum of its digits.

What is the largest residue that can be obtained?

11 – The Magical 15 (Coefficient 11)

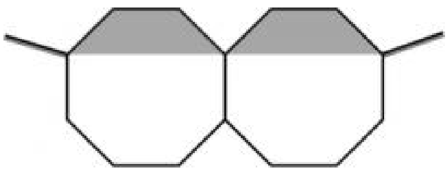


Mathilde has written the numbers from 0 to 19 in the twenty cells that make up this magical 15.

If one adds the numbers entered in each of the six rows of at least three consecutive cells, one always obtains a sum equal to 43.
Moreover, the numbers in the vertical bar of the 1 are ordered in an ascending order from top to bottom.
Fill the cells where the numbers have been erased.

END FOR C1 PARTICIPANTS

12 – The Glasses (Coefficient 12)



The two attached regular octagons represent the lenses of a pair of glasses. The tinted part of the lenses is in grey in the drawing. The total area of both glasses is 24 cm^2.
Which is that of the tinted part, in cm^2?

13 – The Digital Dial (Coefficient 13)

Mathilde invented a game. She has a digital dial on which a number is written. When she subtracts the number of lit bars from this number, she gets a second one. By repeating the operation on this second number, she obtains the number 2015.
Which was Mathilde's first number?
Example: By starting with 11 which displays with 4 bars, 11 – 4 = 7. 7 displays with 3 bars, 7 – 3 = 4.

14 – Mathias' Division (Coefficient 14)

By dividing 100'000 by an integer having 3 different digits, Mathias obtains a quotient and an integer residue.
The quotient is written with the same digits as the divisor, but they are written in the reverse order.
Which is the divisor?

END FOR C2 PARTICIPANTS

15 – The Factorial (Coefficient 15)

The factorial of a positive non null number *n* is written *n*! and means the product of all positive non null numbers less or equal to *n*.
So 1! = 1 ; 2! = 1x2 = 2 ; 3! = 1x2x3 = 6 ; 4! = 1x2x3x4 = 24, etc... One admits that 0! = 1.
A positive non null number with three digits is equal to the sum of the factorials of its digits. **Which is this number?**

16 – Pawns on The Chessboard (Coefficient 16)

What is the least number of pawns that one must place on a chessboard (8 squares by 8) so that every line getting through the centre of any square and parallel to either one side or one of the two diagonals of the board meets at least one pawn?

END FOR L1 AND GP PARTICIPANTS

17 – The Parallelepiped (Coefficient 17)

One has a certain number of small identical cubes.
By sticking all these cubes together, one creates a solid rectangle parallelepiped. One paints 3 faces of the parallelepiped having a common vertex. Exactly half of the cubes have at least one painted face.
How many small cubes are there?

18 – The Two Chessboards (Coefficient 18)

Two identical chessboards (8 squares by 8) have black squares and transparent squares arranged as a usual checkerboard. The squares of both chessboards are squares with edges of 5 cm.
One places both chessboards exactly one on the other and one turns one of the chessboards by 45 degrees around the centre.
What will be the total apparent black area in cm^2?
If necessary, you can use 1,414 for √2.

END FOR L2 AND HC PARTICIPANTS