Matematica Senza Frontiere Junior

13-14 year old students

16th March 2012

- *Use a single answer sheet for each exercise. For each exercise, only one solution can be included, otherwise the answer will not be considered.*
- *Solve the exercise #1 in the foreign language that you prefer*
- *Partial solutions will still be considered*
- *During the assessment, it will be considered also the quality of the motivation provided in the answer (e.g., a scheme, a table, a drawing, an textual explanation)*
- *Particular attention will also be given to the care used in writing the solutions*

Exercise #1   (7 points)   Cheating

The solutions must be written in one of the proposed languages, using at least 15 words.

Graziella, que es una de las profesoras de matemáticas más rigurosas de la escuela, les ha dado a sus alumnos una tarea simple aunque repetitiva: tirar un dado 200 veces y grabar los resultados obtenidos en una tabla. Alessandro, que no quiere perder tiempo con los tiros y las grabaciones, apunta en su cuaderno la siguiente tabla y la entrega a la profesora:

Números	1	2	3	4	5	6
Frecuencia	21%	18%	17%	19%	16%	11%

Graziella lo manda a su sitio diciéndole que la ha engañado porque la tabla no presenta los datos reales.
De acuerdo con usted ¿cómo hizo la profesora para descubrir el truco de Alessandro?

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Graziella, qui est l'une des professeurs de mathématiques les plus rigoureuse de l'école, a donné à ses élèves un travail simple, bien qu'un peu répétitif : lancer un dé 200 fois et enregistrer les résultats dans un tableau.
Alessandro, qui ne veut pas perdre du temps à lancer le dé et à enregistrer les résultats, écrit directement sur son cahier le tableau suivant et le donne à son professeur:

Nombres	1	2	3	4	5	6
Fréquence	21%	18%	17%	19%	16%	11%

Graziella le renvoie immédiatement à sa place, en lui disant qu'il a triché car son tableau ne contient pas des données correctes.
A votre avis comment le professeur a-t-il décelé la tricherie d'Alessandro?

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Graziella, che è una delle insegnanti di matematica più rigorose della scuola, ha assegnato ai suoi alunni un compito semplice, anche se un po' noioso: devono lanciare un dado 200 volte e registrare i risultati ottenuti in una tabella.
Alessandro, che non vuole perdere tempo con i lanci e le registrazioni, scrive sul quaderno la seguente tabella e la consegna all'insegnante.

Numero	1	2	3	4	5	6
Frequenza	21%	18%	17%	19%	16%	11%

Graziella lo rimanda subito al posto dicendo che ha imbrogliato e che la tabella non riporta dati reali. Secondo voi come ha fatto l'insegnante a scoprire l'imbroglio di Alessandro?

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Graziella ist eine der strengsten Matematiklehrerinnen der Lehranstalt. Sie hat eine infache, wenn auch ein wenig repetitive, Hausafgabe seinen Schlülern aufgegeben.
Sie sollen 200 Male einen Würfel werfen und die erzielten Ausfälle in eine Tabelle eintragen.
Alessandro hat keine Lust, Zeit mit Würfen und Registrierungen zu verlieren; deshalb ausfüllt er folgende Tabelle in seinem Heft und übergibt dann das Heft an der Lehrerin.

| Nummer	1	2	3	4	5	6
Häufigkeit	21%	18%	17%	19%	16%	11%

Die Lehrerin schickt Alexander zu seinem Platz sofort zurück und sagt daß er betrügt hat, da die Tabelle keine reelle Daten aufführt.
Ihrer Meinung nach, wie konnte die Lehrerin den Schwindel von Alessandro entdecken?

Exercise #2 (10 points) Watching … is effortless

Carletto correctly computed the size of the area of the rectangle ABCD: 18 dm^2, but now he wants to know the area of the triangle EFG.

Help Carletto to find it and explain your reasoning.
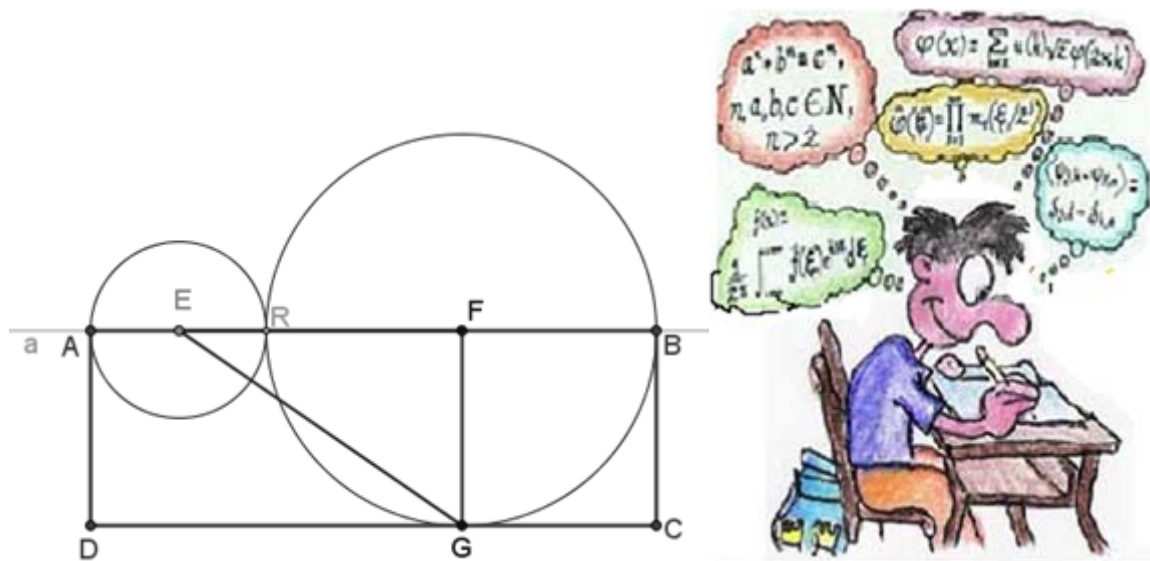
Exercise #3 (7 points) A nice table

Anna is moving to a new house and in the kitchen she would like to use an old table of her granny, which, however, is a bit bigger (1.30 x 1.50 m^2). Before bringing the table in, she looks at the floor plan and she decides to build a scaled model of the table and make some trials. Since she knows that the actual size of the fridge is 60 x 60 cm^2, she can derive the scale of the floor plan and build the correct scaled model of the table.

After working out the scale, draw with care on the floor plan (attachment #1) the scaled model of the table and stick it on the answer sheet.
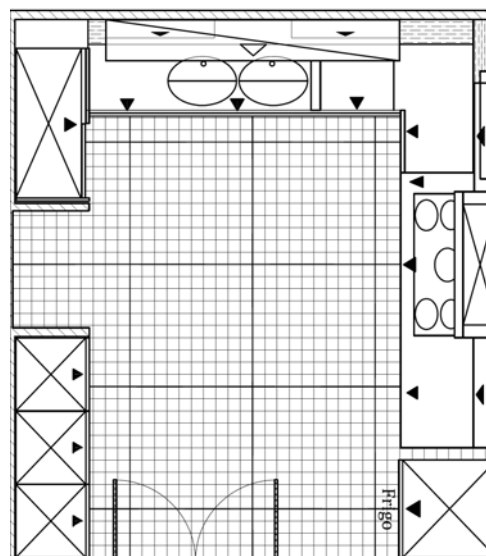
Exercise #4 (7 points) Fantastic collection

Alberto shows Mario his family collection of model cars: a real treasure. The first model car dates back to the 30s of the last century. Mario is fascinated and asks his friend: "How many do you have?"

Alberto, proud of it, answers: "I have got more than 500 and fewer than 600 and, if I partition them in group of 15, 9, or 12, I always get the same remainder: 7.

How many model cars does Alberto have? How did you get to this answer?

Exercise #5   (10 points)   Camping

In a scout camp, there are 9 tents. The scout masters sleep in the central one while the 28 kids sleep in the surrounding ones as indicated in the following figure:

2	5	2
5	●	5
2	5	2

At night, to make sure that all kids are in their tents, the scout masters, instead of individually counting them, to save time, they just check that there are always 9 kids on each side. One night, four kids decide to go for a walk furtively and the other kids rearrange themselves as follows:

| 4	3	2
3	●	3
2	3	4

such that the scout masters, since there are still 9 kids on each side, do not realize that some are missing.

At most how many kids can escape without anybody knowing it? Draw a possible placement of kids in the tents.

Exercise #6   (7 points)   Mother's day

For the Mother's day, Andrea wants to give his mummy as a present a wooden square table mat. He wants to use four equal wooden pieces with a shape of a right-angle triangle and one square piece, like the ones depicted on the right.
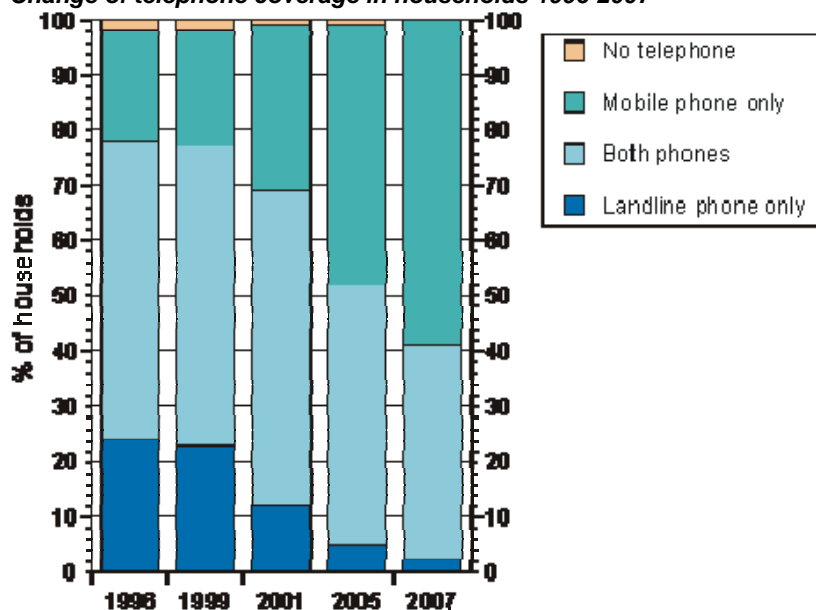
Following Andrea's idea, after having cut out the pieces in attachment #2, build a paper model of the table mat and stick it to the answer sheet.
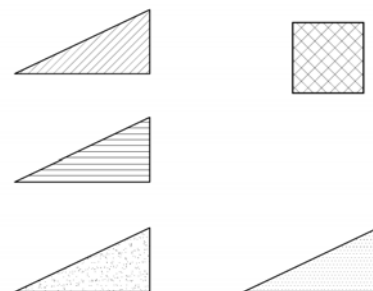
Exercise #7   (5 points)   Changing phone habits

From 1996 to 2007, Finnish citizens have significantly changed their phone habits, as illustrated in the chart:

Change of telephone coverage in households 1996-2007

Look at the chart and compare the percentage variants of the families using only mobile phones compared to the ones using only landline phones.

Figure it out in what year the use of the mobile phone has become 30 times higher than the use of the landline phone. Motivate your answer.

Exercise #8   (10 points)   Maria's garden

Maria's garden has the shape of a rectangle. Maria partitioned it in flowerbeds, also with a rectangular shape, albeit of different sizes. Now, she would like to build a fence around the innermost flowerbed to let hens scratch the ground. She goes to the shop to buy the chain-link fence but she forgot to measure the size of the flowerbed to fence in. She only remembers that the perimeter of the garden is 272 m and she remembers the perimeters of some of the flowerbeds. She draws a floor plan of the garden not in scale on which she annotates the perimeters of the flowerbeds she can remember:

	72 m	
112 m	**?**	56 m
	80 m	

Which is the perimeter of the flowerbed that Maria would like to fence in? How did you get to the answer?

Exercise # 9   (5 points)   Balls in the pyramid

Place four balls of equal size close to each other so that by adding a fifth ball on top, you get a small pyramid with a square base.

If you use nine balls as base, you can pile four on top, on top of which you can add one more, thus obtaining a three-level pyramid, and so on.

How many balls in total can be placed on a five-level pyramid? Motivate the answer

Exercise # 10   (10 points)   Non only flour sacks...

One day, during summer, Anna, Benedetta, Carlo, Donata, and Enrico go with their grandfather in the countryside to visit a mill. When they see a weighing machine, they would like to use it all together but the miller said that it is not possible since the machine cannot support such a load.

Given their disappointment, the grandfather, a retired Math teacher that always seeks to challenge his grandchildren with some exercises, proposes a game: use the machine in groups of four, note down the weight and then compute the total weight.
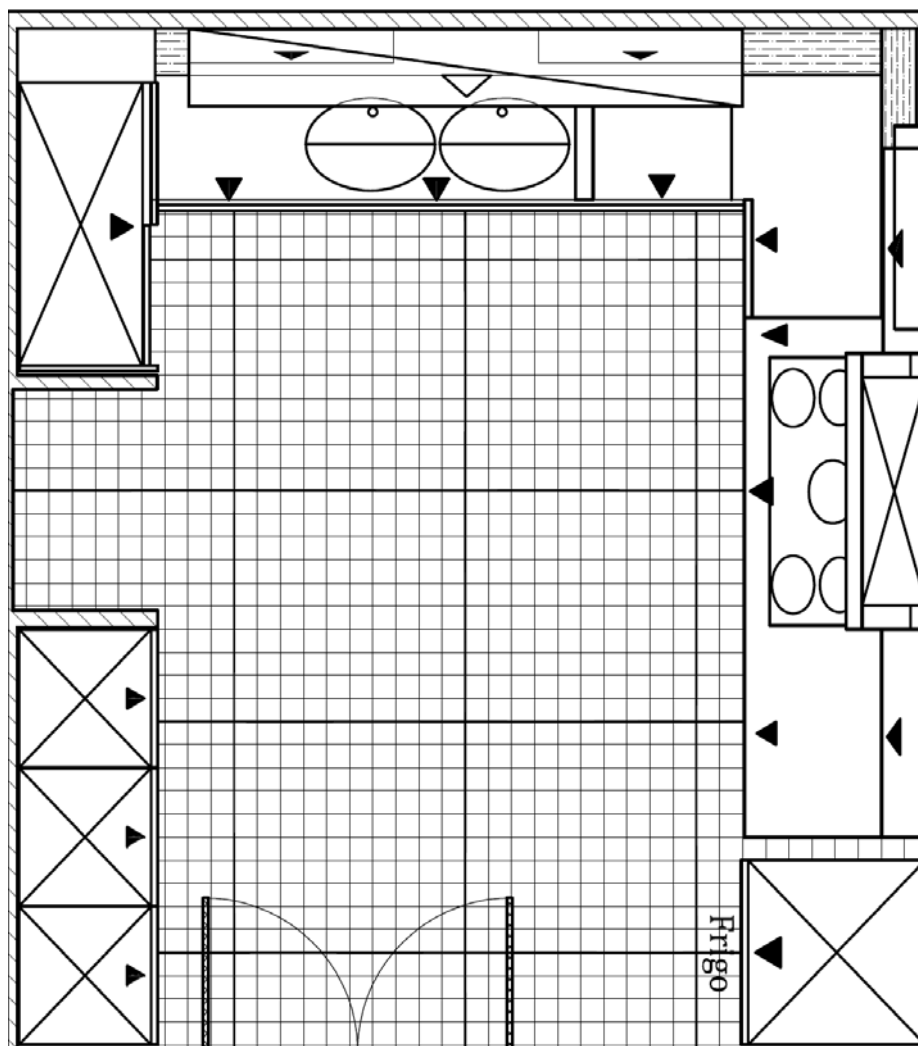They proceed as follows:

- Anna, Benedetta, Carlo, and Donata start using the machine and they get a weight of 208 kg
- Then Donata gets off and Enrico gets on and the measured weight becomes 200 kg
- Anna leaves and Donata gets back on and the weight is now 216 kg
- Carlo gets off and Anna is back and the weight is 204 kg
- Finally, the last group of four people gets on with the result of 212 kg

How much does the "sack" of grandchildren weight? Motivate your answer.