Lesson 15 , December 15, 2009
Overview

1. The series of problems about boys and girls was adopted from the Mastermind game. Note that in our easy version there are only 8 arrangements, but it seems that this "baby version" was the right level for them – anything more sophisticated would be too confusing. Kids especially liked the game (Problem 3, I was the first player).
2. We played a race game as follows. Everyone in class have had a die, a racer (little person) and the handout with the racetrack. On each step two kids were called out by Lena and Laura to roll the dice. The numbers on the top of two dice were added and this sum was the number of the lane that moves one step forward. My impression was that most of kids in the 6 pm group chose lane 6, and many kids in the 7pm group chose 9 ( and the strange thing is that the lane number 9 won in that group. Or may be it is not strange - I asked kids not to cheat and not to change the lanes during the game, but I am sure that this request was sometimes ignored☺.) We got very excited, even too excited. We were very loud, even too loud. Here are the distributions from the class:

| Class\lane | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6pm | 0 | 1 | 0 | 2 | 3 | 7 | 9 | 3 | 3 | 2 | 1 | 0 |
| 7pm | 0 | | | | | | | | 9 | | | |

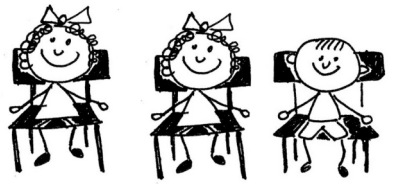
(the second distribution is lost)

In 6 pm group the curve of the distribution was very close to the classical shape, and even the lane 7 was the winner, so I took the advantage of that and connected the frequency of sums in the table (the last handout) with our experimental results. One of the participants even knew that this is called a bell curve!

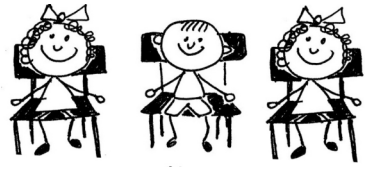
In 7 pm group the curve of the distribution was too bumpy, so I did not have a chance to make such good connection. Just for completeness, I suggested to think of the question, why the most frequent number in the table is 7 , but the winner was 9. I do not know how to explain it right on this level, so I basically left it without any answer.

This was our last class, and I would like to thank everyone for this great experience.
Many thanks to Zvezda Stankova, Lena Blanter, Laura Givental, Dave Auckley, Michael Pejic, Lena Sizikova, all the BMC Elementary parents and kids!

1. A class came to a movie theater. Each row in the theater has three seats, marked 1, 2 and 3. We say that the seats in different rows with the same numbers are occupied in the same way, if either both are occupied by boys, or both are occupied by girls.
For example, on the picture below only one seat (number 1) in the row 1 is occupied the same way as in the row 2.



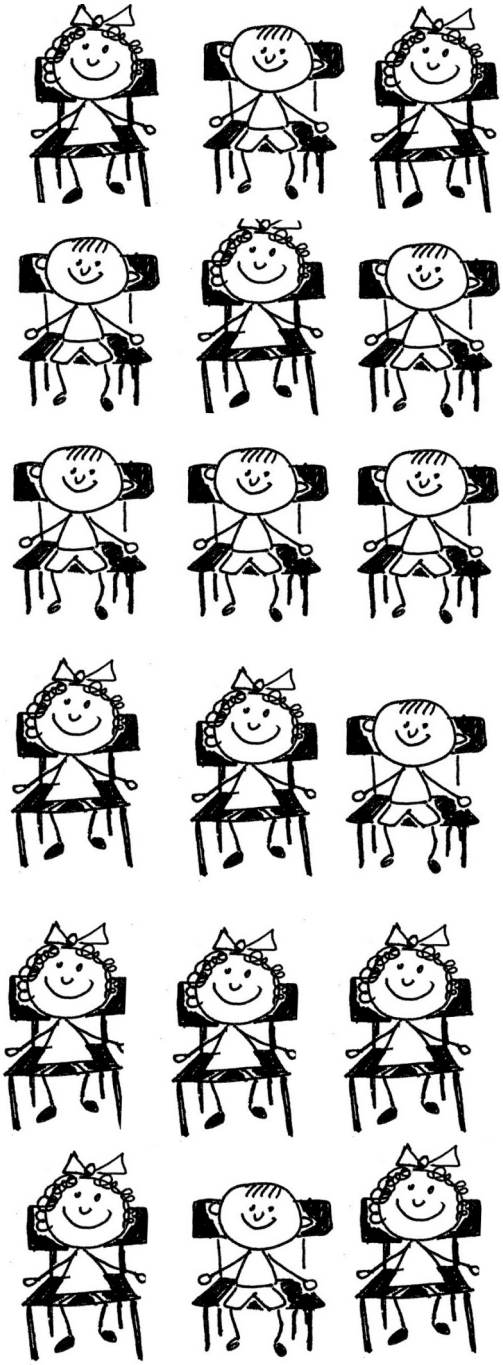
row 2 1



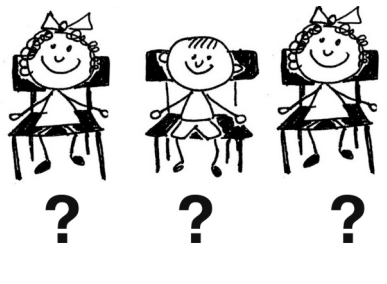
row 1

1 2 3

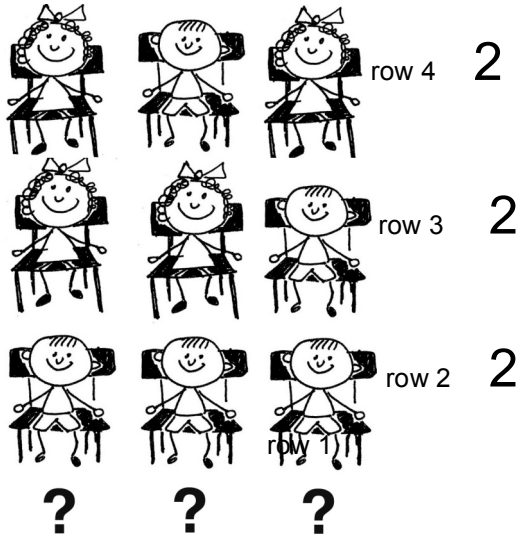
Problem 0.
Write for each row on the picture on the right how many seats are occupied the same way as in the first row.



Problem 1. If no seats in the second row are occupied the same way as the seats in the first row, how did kids occupy the first row?




Problem 2.
Two seats in the second row are occupied the same way as two seats in the first row.
Two seats in the third row are occupied the same way as two seats in the first row.
Two seats in the fourth row are occupied the same way as two seats in the first row.
How kids occupied the first row?




HINTS.

1. How many boys and girls are in the first row (use the information about row 2) ?
2. List all possible arrangements of this number of boys and girls.
3. Mark in the table for each seating where it coincides with rows 3 and 4.

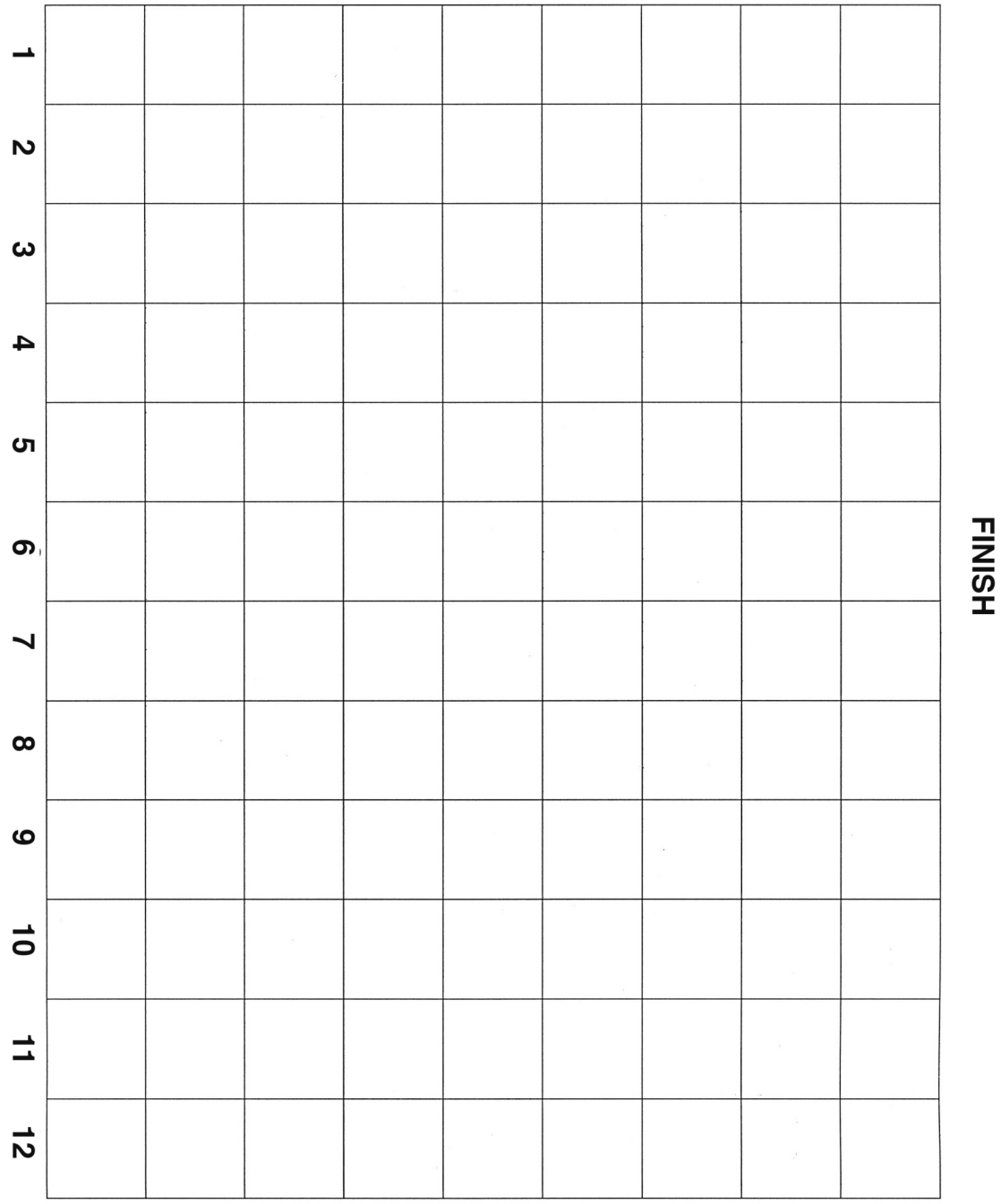
| Possible seatings for row 1 | row 3: G G B | row 4: G B G |
|---|---|---|
| | | |
| | | |
| | | |

Problem 3. (The game) The first player put the boys and girls on three seats in the row. The second player has to guess the arrangement: he makes guesses. For each guess the first

player tells, how many seats in his row are occupied the same way as in the row suggested by the second player.

Problem 4. How many different arrangements are there for a row with 3 seats?

Answers :
Problem 0: starting from the second row: 2,1,1,0,3
Problem 1: B, G, B
Problem 2: G, B, B
Problem 4: 2X2X2=8




THE RACE

There are 12 lanes marked 1 through 12. Choose a lane for your racer. On each trial we will throw two dice and look at the sum of the numbers on the top. If the sum is the same as the number of your lane, your racer moves one step forward. The one who comes the first to the finish line is the winner.

Questions:

1. Which lane never wins?
2. Which lanes are more likely to win than others?
3. Put the possible sums of numbers on the top of two dice in the table. Which sums appear in the table most often? Can you explain now, why some lanes are more likely to win than others?

| |  1 |  2 |  3 |  4 |  5 |  6 |
|---|---|---|---|---|---|---|
|  1 | | | | | | |
|  2 | | | | | | |
|  3 | | | | | | |
|  4 | | | | | | |
|  5 | | | | | | |
|  6 | | | | | | |