



A CRYPTOGRAPHY COMPETITION FOR STUDENTS

Lyuba P. Petrova

Email: lyubap237@gmail.com

Abstract: *This article presents the processes of preparation and holding of a cryptography competition among fifth and sixth-graders. The objectives of the games are to introduce the science of cryptography to the students, to develop their logical thinking, creativity, competitive spirit and teamwork skills. By having fun, they were able to develop themselves.*

Key words: *cryptography, competition, students, school*

Objective

Two years ago, a cryptography competition was held among the students of 5th and 6th grade. The competition had several objectives:

- To introduce the students to the basics of cryptography through games;
- To develop the students' logical thinking;
- To develop the students' creativity;
- To develop the students' teamwork skills;
- To develop the students' competitive spirit.

Experiment

The competition was first held in 2021, when the students were in 5th grade. Several days before the competition, the students were introduced to the science of cryptography and the concepts of cyphering, deciphering and keys.

The competition was held in the school yard. It consisted in 6 games, the first of which was not of a competitive nature. Right at the beginning, the students were divided in three teams at random. Each of the three teams had a work station, where there were prepared sheets of white paper, pens, a printed keyboard layout (in Bulgarian and English), and a printed table, first row being the Bulgarian alphabet, and the second one – the Bulgarian alphabet but moved 15 steps to the right. There was a glued down piece of paper on each of the work stations, so the writing could stay hidden.

Besides the students who participated in the games, the ones from 6th and 7th grade were present as audience.

Before they began work on the tasks, the participants introduced what cryptography is to the rest of the students and teachers.

The first task was not part of the competition and it involved the audience. The participants had to think of a name for their team and cypher it with the help of the table with the Bulgarian alphabet. The audience, who also had such tables available, then had to decipher the teams' names, so they could be announced and written down on each of the work stations.

Each of the tasks would grant the teams points for speed and accuracy, with

А	Б	В	Г	Д	Е	Ж	З	И	Й	К	Л	М	Н	О	П	Р	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ь	Ю	Я
О	П	Р	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ь	Ю	Я	А	Б	В	Г	Д	Е	Ж	З	И	Й	К	Л	М	Н

Fig. 1 Table with alphabets

the fastest team getting 3 points, the second one two, and the third one getting 1 point. In addition, with the completion of each game, the teams would collect a word, which they would use in the end to form a sentence. The winner of the competition was the team that collected the most points and arranged the words correctly.

After the teams chose their names, the competitive games began.

Materials for some of the games were hidden in three different places in the schoolyard and they were labeled 1, 2, and 3 for each team respectively.

Game #1

The teams were told that they had to find a word at a certain place, which had to be deciphered with the help of the table with the two Bulgarian alphabets. If they deciphered it correctly, they would get a word for the final sentence.

Game #2

On the back of the piece of paper for the first game, the teams had directions for the second game. They each got a sheet of paper which had a word written on it with the Latin alphabet. With the help of the keyboard layout, they had to decipher it, writing it in Cyrillic, getting the answer and receiving the second word from the final sentence.

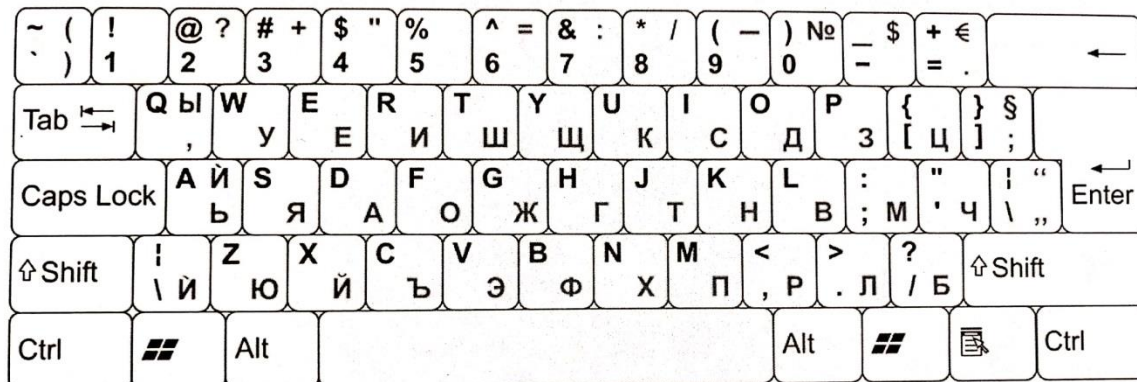


Fig. 2 Keyboard [1]

Game #3

For the third game, the students had to look for their materials in the schoolyard again. When they got to the right place, they received a code with digits and a table, with the first row being the Bulgarian alphabet, and the second one – numbers. The three teams had to decipher their words, using these tables.

А	Б	В	Г	Д	Е	Ж	З	И	Й	К	Л	М	Н	О	П	Р	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ь	Ю	Я
0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58

Fig. 3 Table with alphabet and numbers

Game #4

In the fourth game, each of the teams got an envelope, which contained pictures of garbage cans with different numbers. The students' task was to add up these numbers, getting in the end a 5-digit code. To find out, whether they had the right code or not, they had to find the sheet of paper with the right answer at the last hiding place in the schoolyard.

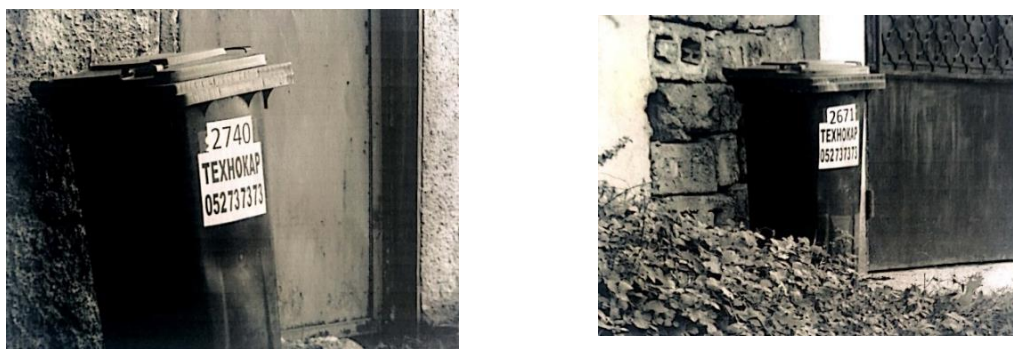


Fig. 4 Photos of garbage cans, used for the fourth game (personal archive)



Fig. 5 Photos of garbage cans, used for the fourth game (personal archive)

Game #5

In the last game, the students had to utilize the code from the previous game to find words in a book they had on the table. The first two digits showed the number of the page, the second two digits – the line, and the last digit indicated the number of a word in the corresponding line. That is how the teams got the penultimate words of their sentence.

The last word they each got as a bonus, after they had found the rest of the words.

The competition ended with the awarding of the first, second and third place teams respectively.



Fig. 6 Students in teams during the competition, 2021 (personal archive)



Fig. 7 Students in teams during the competition, 2021 (personal archive)

In 2022, the competition was held for a second time. Due to the great interest, shown by the students the previous year, this time the participants were not only 6th-graders, but also students from 7th grade. They were again divided in three teams and audience were the students from 5th grade and teachers. Due to poor weather conditions, this time the competition was held in the school gym, but that didn't stop either the words from being hidden or the students



Fig.8. Students in teams during the competition, 2022 (personal archive)

from having fun.

The games with the tables with the alphabets were the same as last year but with different words and the final sentence for each team was different.

This time, instead of pictures of garbage cans, the students got pictures of cars, and they had to find either the difference or sum of their license plates, and thus find a 4-digit code. They used this code again to find the words in their books. The first two digits indicated the page, the third one was the line and the last one indicated the word.

Except for the games that they played the previous year, they had a bonus game, which consisted in deciphering text written on a piece of paper by guessing how they had to place the paper in front of them to be able to make out the words.

Though for the second time in a row, the students had fun cracking codes and searching for words, while competing to be the fastest.

Conclusions

- The students learned what cryptography is in an interesting way;
- The students learned what a cypher consists in;
- The students learned what cyphering and deciphering information is;
- The students had fun and developed their teamwork skills;
- The students developed their logical thinking and their creativity.
- The students developed their competitive spirit.

References:

[1] Key combinations. A guide to working faster with your favorite programs (https://edbg.net/MC_KBDS.pdf)