YOUR FAVORITE FOOD

MATERIAL

1 card (A4 size) with 30 different foods that are ordered by rows from 1 to 30

5 A4 size cards with 16 of these 30 foods. On each card, the plates have been placed following an established order according to their position on the A4 card:

1 3 5 7	2 3 6 7	4 5 6 7	8 9 10 11	16 17 18 19
9 11 13 15	10 11 14 15	12 13 14 15	12 13 14 15	20 21 22 23
17 19 21 23	18 19 22 23	20 21 22 23	24 25 26 27	24 25 26 27
25 27 29 31	26 27 30 31	28 29 30 31	28 29 30 31	28 29 30 31

GAME

Show the card with all the foods to the public.
Ask a person in the audience to choose their favourite food, and write it on a piece of paper.
Show small cards one by one, asking if the chosen food is on the card.
On each card, the upper left element is 1, 2, 4, 8 and 16, respectively. Due to this, we have to add the corresponding number of the cards that contain the food according to the volunteer. This number must be the plate that the volunteer chose.

MATHEMATICAL JUSTIFICATION

The game is based on the relationship that exists between the numbers in the decimal numbering system (base 10) and the binary system (base 2):

EXAMPLES:

The number that is 23 in the decimal numbering system, in the binary system is:

23: 2 gives quotient 11 and remainder **1**.
11: 2 gives quotient 5 and remainder **1**
5: 2 day of quotient 2 and remainder **1**
2: 2 day of quotient **1** and remainder **0**

Therefore, the number 23 in the binary system is **10111**

The number that is 10011 in the binary system, in the decimal system is:

$$\mathbf{1 \cdot 2^0 + 1 \cdot 2^1 + 0 \cdot 2^2 + 0 \cdot 2^3 + 1 \cdot 2^4 = 1 + 2 + 16 = 19}$$

APPLICATION TO THE GAME

The placement of the numbers on each card is based on the binary system.

• On the 1st card, we can find the numbers that, in the binary system, have the first digit, starting with the right, 1

• On the 2nd card, we can find the numbers that, in the binary system, have the second digit, starting with the right, 1

• On the 3rd card, we can find the numbers that, in the binary system, have the third digit starting from the right, 1

• On the 4th card, we can find the numbers that, in the binary system, have the fourth number, starting with the right, 1

• On the 5th card, we can find the numbers that, in the binary system, have the fifth digit, starting with the right, 1

BINARY SYSTEM NUMBERS 1 TO 31

	$2^4=16$	$2^3=8$	$2^2=4$	2	$2^0=1$
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	0
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1

GENERALIZATION OF THE GAME

If we want the game to seem more complicated, we can add more numbers and therefore more cards.
For example, the numbers from 1 to 63 need 6 letters and each letter will have 32 numbers. In the binary system the powers of 2 will go from 2^0 to 2^5