

Guess my number A game in binary arithmetic system

Complete the table below as in the examples and then the five cards on the right.
(From the table you choose those numbers that have a check mark below the initial number of the card, i.e. numbers 1, 2, 4, 8 and 16.)

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

1	3	5	7

2	3	6	7

4	5	6	7

8			

16			

The game

Once you have filled all the cards, present them to one of your friends and ask him to think of a number from 1 up to 31 (his day of birthday for example).

Then for each one of the cards we ask him if he sees his number there or not.

Once he has replied for the total number of the 5 cards, you will be in a position to announce him his number.

How? Just add the first number of those cards that his reply was positive (so, in any case, you will form sums that contain the numbers 1, 2, 4, 8 and 15).

For example, if his reply is that his number is contained in **just** the 1st, 2nd and 5th card, we then guess that this number is $1 + 2 + 16 = 19$.

Comment

This game is based on the **binary arithmetic system** for representing the numbers. Namely, each natural number can be represented as a sequence of **zeros 0** and **ones 1**. For example the number 11001 in the binary system is the number $16 + 8 + 1 = 25$ in the decimal system. It's worth noticing the correspondence between the ones 1 to the notation 11001 and the check marks \checkmark in the analysis of the number 25 on the table.

So, mathematically, we “translate” the reply of the player “YES” to 1 and “No” to 0, getting in this way the binary notation of the number, and thus the number as well.

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

4

5

6

7

12

13

14

15

20

21

22

23

28

29

30

31

8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31