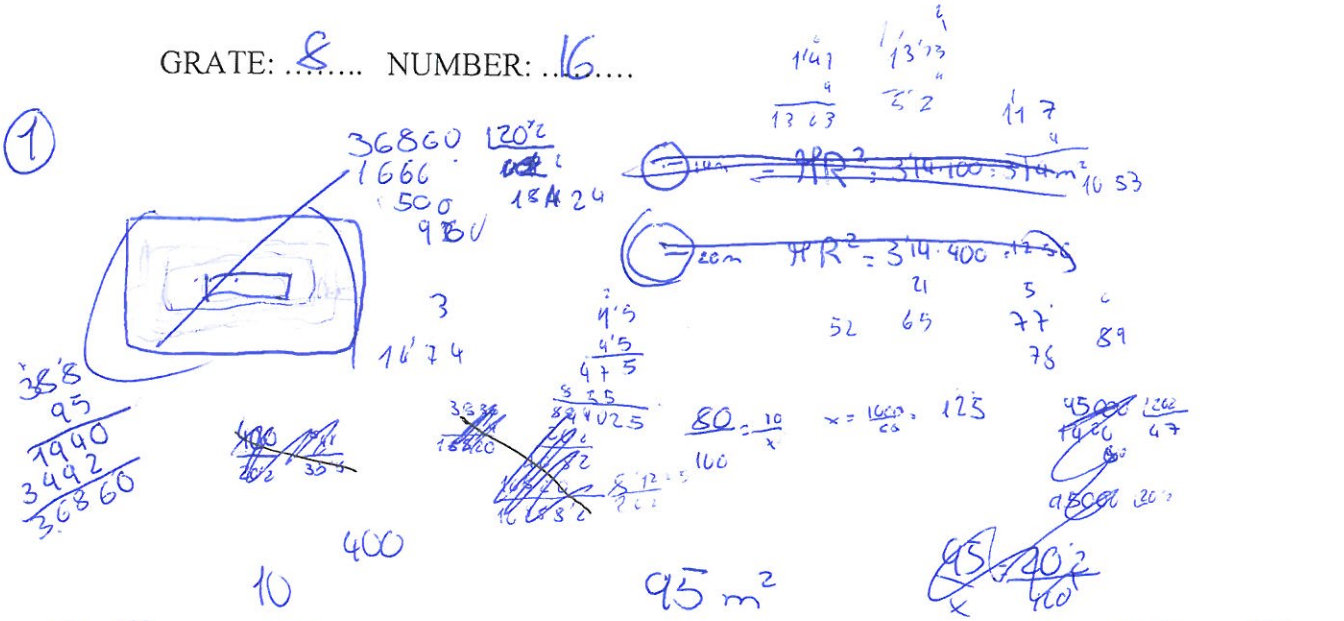
International mathematical Olympiad
"Formula of Unity" / "The Third Millennium"
2017/2018 year, final round

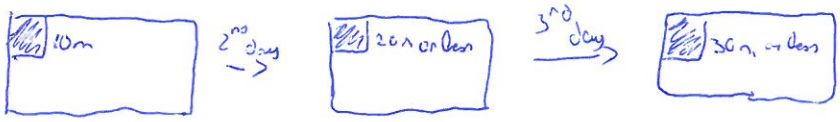
SOLUTIONS TO THE SECOND ROUND FOR PARTICIPANTS.

GRATE: 8 NUMBER: 16

(1)



95 m²



~~After 6 days~~

After 7 days

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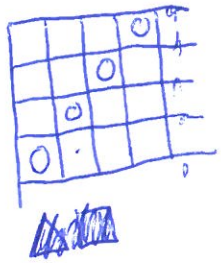
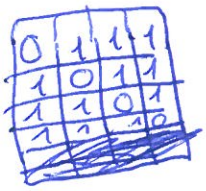
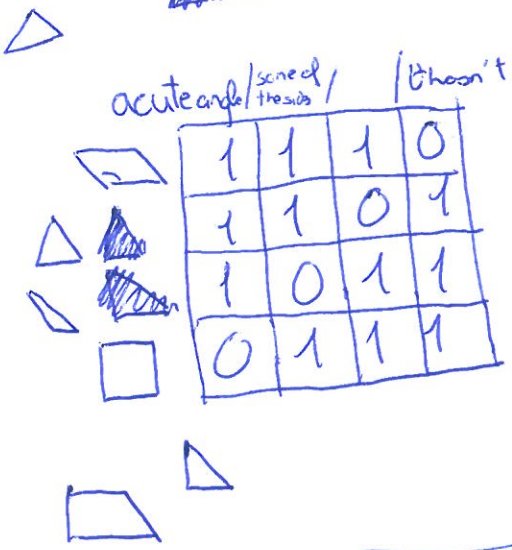
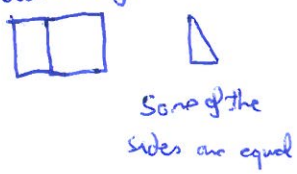
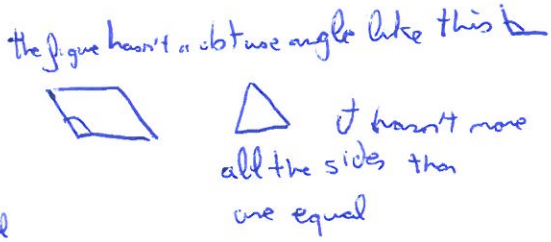
(2)

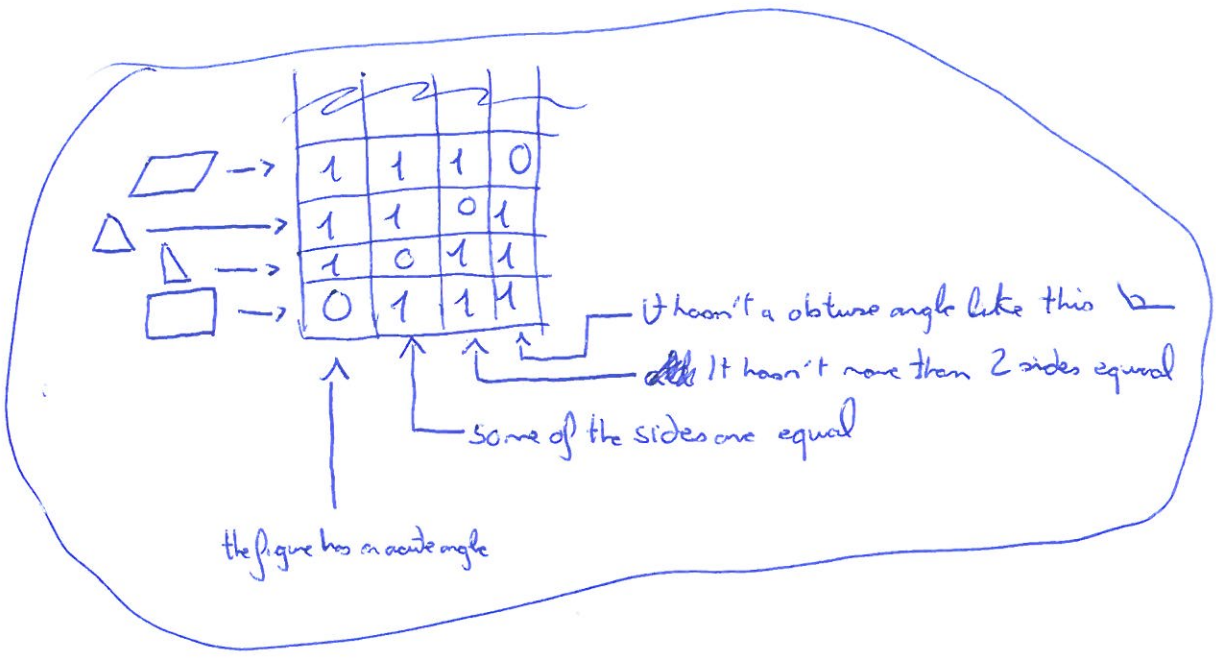












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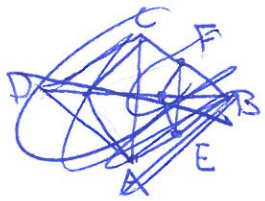
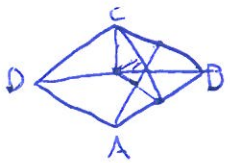
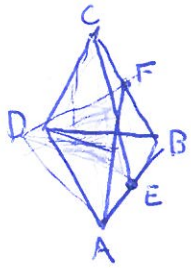
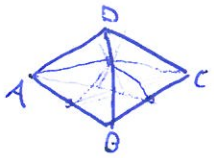
③

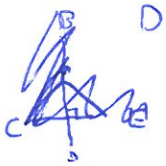
PA = PF
PE = PC

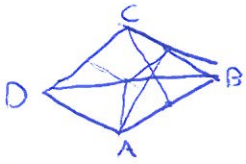






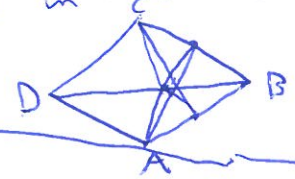


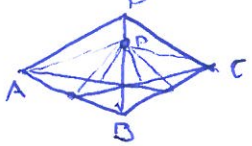


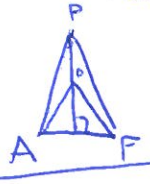


~~P can't be on the line DB because if PA = PF and PC = PE it form a triangle and the line BD will pass in the center of it and form a red angle with the line AF or CE but if we draw the line in the rhombus it don't form a red angle.~~

P is on the line BD because if we draw the line AF and CE, and we draw a red angle line in the midle of it we can see that the lines cross in the line BD. It's because if we put a point X in the red angle line always AX = AF and if the two lines cross in the line BD it's because P is in BD if it cross in other place it isn't in BD line







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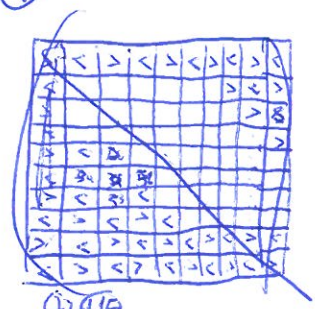
4



7 115
110 8
1 112 9
3 2 113 10
4 6 5 104 11

1
2 3
4

1
3 2 7
4 5 6 8

4
5 6

1
3 2
5 6 4 8
100
1 111
3 2 112
4 6 5 104

The smallest possible sum of these two numbers is 3+4=7 because if we want to put just two numbers in the table we put it in the corners and 1 and 2/3 and 2 can't because it will be 3 on more numbers not colored. And 3 and 4 can be not colored only 2

Example

smaller
bigger ~~biggest~~
smaller
not colored
bigger

11
114 12
7 115 13
110 8 116 14
1 111 9 117 15
3 2 112 10 118 16
4 6 3 113 11

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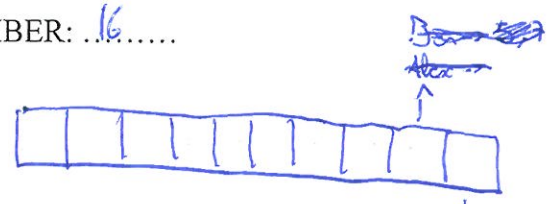
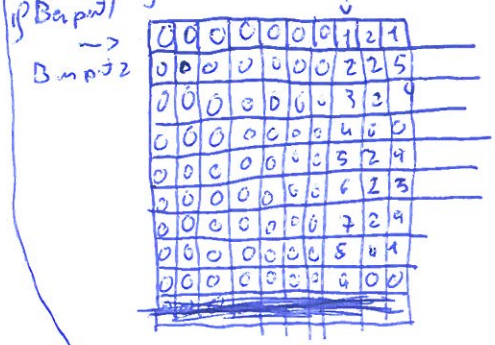


Alex ~ 1~9 moves
Ben 1 move
Alex the remaining moves

Alex - 4, 5, 6, 9
Ben - 1, 2, 3, 7, 8

- All the perfects squares ends in 4, 5, 6 and 9
- If Alex want to win he will ~~not~~ do less than 9 moves because if he put the first 9 moves and Ben do the last move, Ben will put 1 2 3 and last y the final number
- Alex shouldn't put 8 zeroes in the first move because Ben put numbers like 3 or 7 and he can't have a perfect square

Alex is the player with the winning strategy, he need to put 7 zeros in the first move and then, if Ben put 1 put 21, if Ben put 2 put 25, if Ben put 3 put 24, if Ben put 4 put 06, if Ben put 5 put 29...