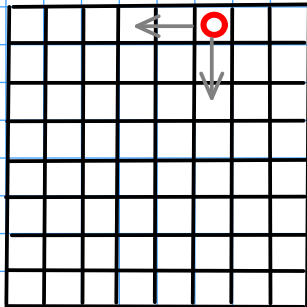# Mathematical Games

EACH GAME IS PLAYED BY TWO PLAYERS.

THE PLAYERS TAKE ROUNDS ONE AFTER THE OTHER.

① PLACE A COIN TO THE FIRST ROW AND SIXTH COLUMN OF YOUR CHESSBOARD.

IN EACH STEP A PLAYER CAN MOVE THE COIN (AS MANY SQUARES AS HE/SHE WANTS) EITHER DOWNWARDS OR TO THE LEFT.

THE ONE WHO GETS THE COIN TO THE LOWER LEFT CORNER WINS.

a) WHICH PLAYER HAS A WINNING STRATEGY? WHAT IS THE WINNING STRATEGY?

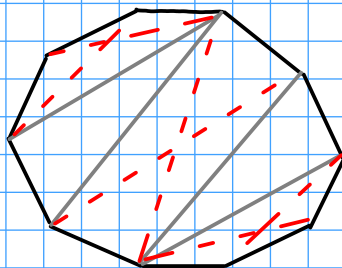b) WHICH PLAYER HAS A WINNING STRATEGY IF THE ONE WHO GETS THE COIN TO THE LOWER LEFT CORNER LOSES? WHAT IS THE WINNING STRATEGY?

c) CAN YOU GENERALISE THE GAME? CAN YOU GENERALISE THE STRATEGY?

② TAKE A CONVEX 10-GON.

AT EACH STEP A PLAYER DRAWS A DIAGONAL OF THE 10-GON THAT DOES NOT INTERSECT THE PREVIOUSLY DRAWN ONES.

IF A PLAYER CANNOT DRAW ANY DIAGONAL
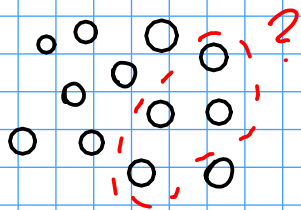
HE/SHE LOSES.

a) WHO HAS A WINNING STRATEGY?

b) WHO HAS A WINNING STRATEGY FOR AN 11-GON?

c) CAN YOU GENERALISE THE GAME?

③ THERE ARE 12 THINGS ON THE TABLE.

ONE PLAYER THINKS OF ONE OF THEM.

THE OTHER PLAYER ASKS QUESTIONS OF THE TYPE:

IS THE ONE YOU THOUGHT ABOUT IS AMONGST THESE?
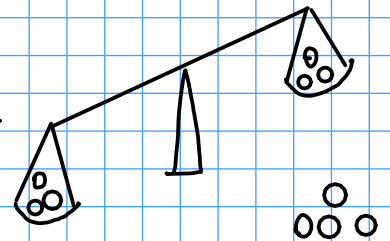
a) HOW MANY QUESTIONS ARE ALWAYS ENOUGH?

b) CAN YOU GENERALISE THE GAME?

④ THERE ARE 10 COINS, 9 OF WHICH ARE REGULAR AND ONE OF THEM MEASURES SLIGHTLY MORE THAN THE OTHERS.

HOW MANY MEASUREMENT IS ALWAYS ENOUGH ...

a) ... IF YOU CAN MEASURE THE WEIGHT OF ANY SUBSETS OF THEM?

b) ... IF YOU CAN COMPARE THE WEIGHT OF TWO SUBSETS OF THE COINS

⑤ THERE ARE TWO PILES OF COINS ON THE TABLE.

THERE ARE 9 COINS IN OF THE PILES AND 7 IN THE OTHER

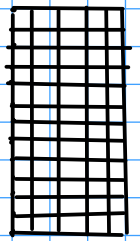AT EACH STEP A PLAYER IS ALLOWED TO TAKE SOME COINS FROM ONE OF THE PILES.

THE ONE WHO CANNOT TAKE ANY COINS LOSES.

a) WHICH PLAYER HAS A WINNING STRATEGY?

b) WHICH PLAYER HAS A WINNING STRATEGY IF THE ONE WHO CANNOT TAKE ANY COINS WINS?

⑥ YOU HAVE A 5 BY 12 CHOCOLATE.
AT EACH STEP A PLAYER TAKES ONE PIECE OF
THE CHOCOLATE AND BREAKS IT IN TWO.
THE PLAYER WHO CANNOT BREAK MORE LOSES.
WHICH PLAYER HAS A WINNING STRATEGY?

⑦ HOW MANY QUESTIONS IS ALWAYS ENOUGH IF YOU
HAVE TO WRITE DOWN THE QUESTIONS FOR GAME ③
IN ADVANCE?

⑧ HOW MANY QUESTIONS IS ALWAYS ENOUGH IN GAME ⑦
IF ONE OF YOUR QUESTIONS (YOU DON'T KNOW
WHICH ONE) GETS LOST?

⑨ WE CHANGE THE RULES OF GAME ③ : YOU HAVE 10
COINS, AND YOU HAVE TO PAY 2 COINS FOR EACH
"YES" ANSWER AND 1 COIN FOR EACH "NO" ANSWER.
FROM HOW MANY THINGS CAN YOU ALWAYS FIGURE
OUT WHICH THING THE OTHER PLAYER THOUGHT OF?

⑩ WE AGAIN CHANGE THE RULES OF GAME ③:
BEFORE GIVING THE ANSWER THE PLAYER FLIPS A
COIN. IF IT IS HEAD HE/SHE LIES IF IT IS TAIL
HE TELLS THE TRUTH.
HOW MANY QUESTIONS ARE ALWAYS ENOUGH IN
THIS GAME?

⑪ ON A 25 BY 1 BOARD
THE TWO PLAYERS FIRST PLACE 3 COINS IN TURNS
ONE AFTER THE OTHER.
THEN AT EACH STEP A PLAYER MOVES ONE OF THE
COINS TO THE RIGHT AS MUCH AS HE/SHE WANTS

BUT WITHOUT JUMPING OVER THE OTHER COINS.
THE PLAYER WHO CANNOT MOVE ANY OF THE COINS
LOSES.

a) WHICH PLAYER HAS A WINNING STRATEGY?

b) WHICH PLAYER HAS A WINNING STRATEGY IF THE
ONE WHO CANNOT MOVE ANY OF THE COINS WINS?