

# Mathematical Enrichment Class

Professor Gary McGuire

*Head of  
UCD School of Mathematical Sciences*



- There are three initial enrichment classes on Saturday 24 January, 31 January and 7 February 2015.
- On Saturday 14 February there will be a selection test, at the end of which the best 40-50 students will be invited for more intense training in view of participation to the Irish Math Olympiad.
- This event will take place at a national level on Saturday 25 April 2015. The best six pupils at the Irish Math Olympiad will represent the country at the International Math Olympiad which will take place in Thailand between 4-16 July 2015.



- Suppose a hacker can try 1000 passwords in one second.
- Suppose there are 60 possibilities for each character in a password.
- How long will it take a hacker to check all passwords with two characters?
- With three characters?
- How about with eight characters?



A password with two characters \*\* has 60 choices for each \*

So there are  $60 \times 60 = 3600$  possible passwords.

3.6 seconds to try them all.

With three characters there are  $60^3 = 216,000$

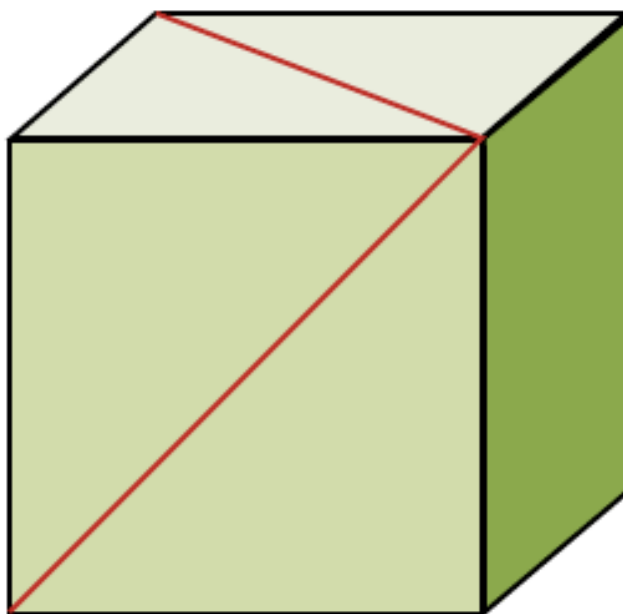
It would take 216 seconds = less than 4 minutes.

With eight characters there are  $60^8$  passwords.

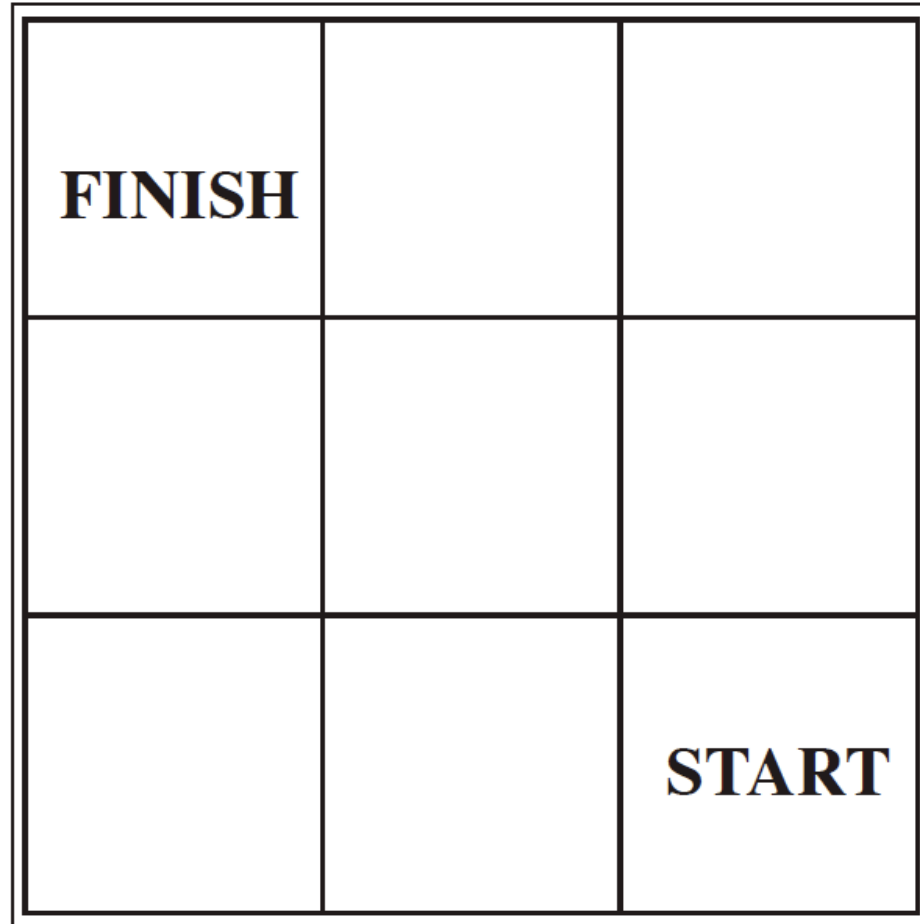
This is 167961600000000 which would take over 5,000 years!



What is the angle between the two red lines?



Heads go up, Tails go left. If you go off, you lose. What are the chances of winning?



# List Possibilities

WIN

LOSE

HHTT

HHHH

HTHT

HHHT

...

...



# A Hat Game

A group of  $N$  people are in a room. Each person is randomly given either a red hat or a blue hat.

Each person cannot see their own hat, but can see all other hats. Each person must guess the colour of their own hat. They all must guess at the same time. If they all guess correctly then they win a billion euro each. If anyone guesses incorrectly they win nothing. Before the hats are given out, the group may decide on a strategy. Once the hats are given out, no communication is allowed.

What would be the best strategy? What are the chances of that strategy working?





- 3 people in a room. Same deal with the hats, except this time they may also pass. They win as long as nobody guesses incorrectly, and at least one person guesses correctly.
- What is the best strategy? What are its chances of working?



I colour edges red, you colour green.  
We take turns. If you make a triangle in  
your own colour, you lose.  
Can it end in a draw?

Hexagon

