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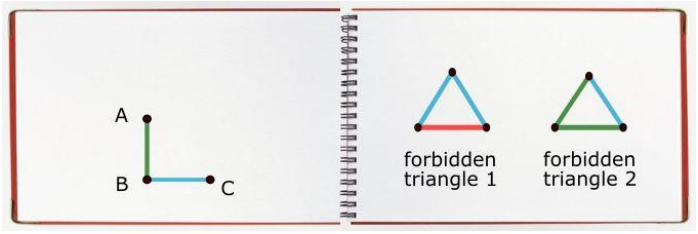
Three interesting fact about me: I am a part-time mixologist. My dream job is to be a pastry chef. My favourite author is Jane Austen.

Chapter 1

“Alice, Bob, let’s play a game!” Mum said while she took out a notebook and drew some dots and lines.

“I have pens of three colours: green, blue and red. I would like you to in turn add a dot and connect it with all other dots except one using different colours, but with some constraints. You cannot create these forbidden triangles.” Mum pointed at two triangles on the right page of the notebook.

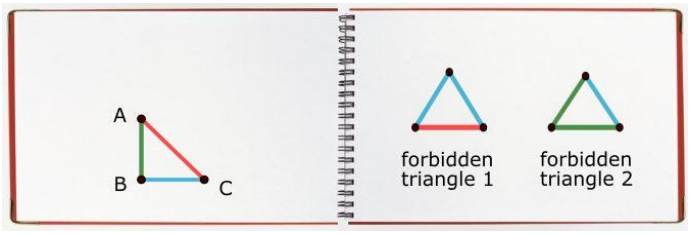
“You should try to create a scenario where the other cannot finish the missing line with any colour. Let’s try one game first. What colour can you choose for AC here?” Mum pointed at the left page.



“Red or blue!” I shouted before Bob, “because colouring it with green creates forbidden triangle 2.”

“Well done, Alice! You can pick one of them.”

I picked red.



“Now add a dot and connect it with two dots. Try to think how you can best block Bob!”

Hmmm… I started thinking.

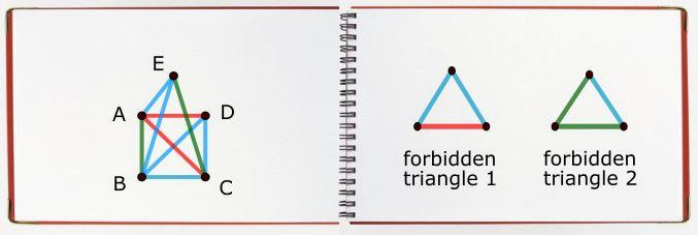
If I colour DC with blue, then Bob cannot colour DA with blue because of forbidden triangle 1. If I colour DB with blue, then Bob cannot colour DA with green because of forbidden triangle 2. So, I decided to do these.

“Well done, Alice!” said mum. “Now Bob, what colour can you choose?”

Bob thought for a minute and picked red.

“Great! You both got it! Bob, add a dot and try to block Alice.”

Two minutes later, Bob put down his answer.



After some thinking, I realised I was defeated. *(Can you see why?)*

“You both did great! Do you know these are called graphs in Maths? Anything consisting of dots and lines is a graph. Graphs appear a lot in our life, but probably without you realising it. Can you think of anything consisting of dots and lines?”

There was silence as we were both thinking but failed to find an answer.

“You’ve seen a tube map many times, right?” We nodded. Yes, it consists of dots and lines!

“Then a rail map is a graph too!” Bob, a train enthusiast, said.

“Very good, Bob! We indirectly use graphs almost everyday. For example, Google uses graphs to determine which page to show us first when we google something. Google maps uses graphs to find the best route between two locations. Facebook stores users’ connections as a graph by representing each person as a dot and friendships as lines.”

Mum seems satisfied to see two amazed faces, so she continued, “There are many more: brain neural networks in Biology, circuit connections in Engineering, language trees in Linguistic, molecule structures in Chemistry.”

“Remember my friend Yibei? She researches on graphs constrained by some forbidden triangles, like the ones you drew! She told me that there exists some set of forbidden triangles where no one can lose this game and the graph can grow to infinity.”

“Really! What are these?”

“You can ask her yourselves when she visits us next week!”

(To be continued…)