

IMO 2022

Unofficial Report

Introduction

After two years of online competition, this year's IMO was held in person in the refreshing city of Oslo, Norway, from the 9th to the 16th of July. Prior to this, the UK team also had a Pre-IMO Camp in Cambridge for further training. Overall we all thoroughly enjoyed the experience, and present a report on the events and mishaps that occurred in these two weeks. [Every problem is linked with its [AoPS](#) post where possible; reader discretion advised.]

Saturday 25th June

To decide an F3 exam for the Australians to sit, Freddie arranges a Zoom meeting. Apart from Alex, who's at Saturday school, and George, who asks on WhatsApp 'What call?', we meet up digitally and decide on TST/4 for problem 1 combi, Alex's geometry with too many points for problem 2, and Alex's monster functional equation (FE) for problem 3.

Sida's suggestion of [ELMO 2022/5](#) is dubbed too well-known, and Mohit found a way to overkill Ben's KöMaL number theory (NT) with cyclotomic polynomials. During the meeting Ben once again expresses his hate towards geo problem 2's.

Tuesday 5th July

Today is the day of arrival at the Pre-IMO Camp. We are greeted at the Porter's Lodge of Churchill College by Sam and Freddie, in the following order: Sida, Isaac, Alex, Mohit, Ben and George.

On the walk to our dorms (which is by no means a simple feat; there are numerous turns and many walls blocking our sight), we notice an employee party with giant chess, table tennis, etc. We eventually realise this is only temporary.

After checking into our rooms, everyone gathers in the Tizard Room and is enthralled by Ben's juggling skills (FORESHADOWING). Then we proceed to be entertained by just three juggling balls until Sam and Freddie come back to discuss F1 and F2, which we completed online.

1. Problem 1: Non-standard geometry, where Ben and Isaac had the idea of using vectors to shift, Alex and Sida did a purely synthetic solution, and Mohit complex bashed.
2. Problem 2: Difficult number theory involving quadratic residues.
3. Problem 3: [IMO Shortlist 2021/A7](#) (abbreviated 2021/A7), which is a dodgy inequality.
4. Problem 4: Number theoretic FE.
5. Problem 5: [2021/C4](#).
6. Problem 6: [2021/G5](#), which as always Alex solved, and Sida solved this morning.

Then Sam and Freddie ask us what we want for the exam, and George replies with bottles of peach Lipton iced tea (accepted), Sida asks for a calculator (rejected). Ben and Sida realise that they actually have the most in-person international experience, and team up as the ‘Balkan Boys’.

For dinner we are provided meal cards, and Sida meets a school friend who’s at Churchill for the Isaac Physics Camp. Then everyone but George (who returns to play League of Legends) goes on a walk. First we go around Churchill, but get bored of it quickly, and then around general Cambridge University. Freddie explains that he stayed in Norway above the Arctic Circle, and hence the sun was constantly out, which is very weird to get accustomed to. As expected the conversation also drifts to hopeful IMO problem topics, including Sida and Alex praying for a hard geo, Mohit a hard number theory, and Ben a hard combi. Then we discuss the motivation for F2/2 (or lack thereof), as well as printing issues for the Australian’s F3, since someone’s grand idea of converting LaTeX to Word has messed the formatting up.

Upon returning, Mohit and Sida gush over the Dual of Desargues’ Involution Theorem (DDIT) and its rare but overkill capability to demolish certain geometry problems. We play a game of Mao, which ended quickly before Sida could introduce a new rule. Then we try Cockroach, a bluffing game, and this gets quite aggressive towards the end.

Wednesday 6th July

We wake up at 6:30 to 7:00 for breakfast before F3, which the Australians set for us. George stayed up late playing League in the bathroom and hence gets into the exam room just 5 minutes before start; a massive bottle of Lipton iced tea sits on his desk. Sam writes on a board a correction on P1, then after the exam starts quickly writes a correction for the correction.

1. Problem 1: Weird NT sequence which looks related to AM-GM but actually not.
2. Problem 2: Functional inequality, which Sida skips because he is allured by geo P3 and gets teased afterwards for not solving it.
3. Problem 3: Projective geo monster where Alex’s only submitted material is a diagram. MODS POTD 1203.

Over lunch, it turns out that problems 1 and 2 were quite easy much to the disappointment of Sida, and both Mohit and Sida have cross-ratio chases for partial progress on the monster. Afterwards, everyone plays Piggy in the Middle in the yard outside dorms with Ben's juggling balls.



Figure 1: Piggy in the middle. Our first of many games.

Then mock coordination begins. Alex and Sida, who first solved Alex's problem 3 FE, are in charge of coordination for that problem, and finish very quickly due to lack of significant progress. The Australians present a lot of injectivity approaches, none of which worked, and one of them writes "I hate this problem, I spent three hours, who wrote this problem", and another tries to read the mind of the proposer in their rough. One even writes the same claim three times without proof.

Isaac and George finish next on the problem 2 geometry. One application of Pascal was removed from the problem, much to Alex's disappointment.

Ben and Mohit are left with the hardest problem to write up, with a variety of solutions and a greater variety of fakesolves. Apparently half the AUS team have seen it on a 2015 F-set, which is ironic considering one of them took 6 pages in neat with just 4 for one claim. Mohit is tempted at one point to write a full mark scheme, but decides against it.

Overall mock coordination goes as expected; all scores are within 1 of the proposed scores. Surprisingly the Australians haven't finished, so we proceed to dinner. After crossing a junction diagonally, we find Dominic at a Prezzo near the river, and order our pizzas and pastas.

Meanwhile, Mohit and Alex play Euclidean, a Euclidean geometry game, and even though Mohit has amassed around 450 stars, Alex still one-ups him and says "it's easy". George keeps everyone informed about the tennis match between Fritz and Nadal, and Dominic notes the abundance of weirdly shaped decorations before chatting with Ben about STEP and A-levels. Sida and Mohit once again result in talking about projective geometry, but this time DIT and its uselessness (FORESHADOWING). In the back of our minds, we all wonder how many SMC papers this meal costs.

Upon returning to Churchill, we play Mao, where Isaac introduces a nice standing rule, and Ben a chaotic rule involving new piles. Freddie also brings out Perudo, another bluffing game, where Sida manages to remain on 4 dice for almost the whole game.

At our dorms, George goes about his usual routine, and Sida and Mohit collaborate to solve F3/3 first part. Turns out, they literally just need to combine their roughs, and then 20 minutes into sleeping, Mohit continues thinking from Sida's claims and says "Yay I've solved the second part, I can sleep now".

Thursday 7th July

We have breakfast as usual, and then proceed to the F4 exam.

1. Problem 1: Combi grid colouring problem, which Alex has seen before.
2. Problem 2: Another functional inequality.
3. Problem 3: [2021/N6](#) which Sida somehow uses primitive roots and generating functions to come up with a complete fakesolve.

Everyone finds 1 and 2 fine, then varied progress on problem 3. We meet Ava, our observer, Keith, our mascot, and get our free merch from UKMT. When George is asked to describe the shade of yellow of the shirt he brought, he says "Lipton Yellow" as the Lipton label is the only yellow thing he can find in the room.

On a walk, we visit Emmanuel College, where ducks are more respected than people with grass privileges, there's a pool, and oars are hung up on walls for bumping boats into each other sufficiently many times. By chance, we meet Thomas from the IMO Squad, currently touring for the Open Day, which is a very pleasant surprise. We get ice cream and, as is customary for ice cream conversations, discuss problem 3's. Mohit and Alex proceed to die inside at the mention of [IMO 2021/2](#), the infamous inequality. George returns with Ava early to Churchill.

We also visit Trinity again, recalling the fond memories at the Trinity Camp, and start discussing BMO1, Hungary Camps, and Mentoring Schemes. Ben is certain Alex would get invited to the Trinity Camp even if he failed BMO1 and BMO2; Sam and Freddie make no definitive comment. Mohit describes his cute graph theory solution for F4/2, and we go back to Churchill.

Before we jump into games, we receive our F4 scripts and find that our P3 scores are 0, 1, 2, 3, 4, 5. Mohit then ruins it by lifting his 3 to 4 marks, much to the annoyance of George. Then we play Betting Wist, where Mohit much like Thomas at the Balkans, gets close to winning by winning nothing. Finally, we finish the day with a game of Avalon. Every time Mohit and Isaac are an evil pair they lose; actually Isaac loses every game he plays. Sida is good every time, a statistical wonder, and George plays an intriguing strategy of rejecting every mission he's not on, and this somehow works?

Friday 8th July

The day of the Mathematical Ashes, which we agree is more important than the actual Ashes. Our goal is to win, not just because we can rub it in the Australians' faces when we meet them, but also because we then continue the tradition that the Ashes is only lost when Aron Thomas is on the team.

George decides to wake up slightly earlier this time; continuing linearly George would wake up on time in a week.

1. Problem 1: [2021/A2](#) grid problem which should have been NT, with a wide variety of approaches. (SPOILER) Mohit goes full on NT and calculates the sum explicitly using totients and properties of multiplicative functions. Ben and Isaac calculate by excluding residues. Alex does the most efficient reflection strategy. Sida's 'intriguing' solution is rotations of 90 degrees, and George's 'exciting' solution is looking at average residue size.
2. Problem 2: [2021/G4](#), nice synthetic geo.
3. Problem 3: [2021/C7](#), where almost everyone got the part (a) construction; Mohit's much more complicated construction was just off by m .

During lunch, Sida gets told off by lunch staff for having too many mains on the plate, but gets let off, and Ava kindly provides everyone with sweets. She also gives George three white shirts, two of which he offers to the rest of the team.

Apart from George (as usual playing League), we play more Piggy in the Middle, and eventually Alex and Sida retire as 'elderly men'. Ben, Isaac and Mohit attempt 2 people out, 1 person in, which results in Mohit (comically but pitifully) chasing between Ben and Isaac in vain. He realises his shoe is not built for this running (FORESHADOWING).

As we wait for the Ashes results, we watch the Djokovic vs. Norrie match on Sida's laptop, and also meet with Lingde from the IMO Squad, also touring for Open Day. Everyone gets roughly what they were expecting, except Sida who forgot to do half of the necessary geometry. It also turns out the DDIT he randomly wrote on his rough for F3/3 was seen by the Australians, who comment that it was their inspiration for the problem!

After meeting up with Ava at the Porter's Lodge, for dinner we go to a steak house, where George holds a knife with the intent to kill, whilst watching existential videos on YouTube. Alex plays another geometry game which Ben jokes that he can easily solve, and Sida and Ben discuss the joys and pressures of making the IMO team. Isaac and Mohit join in the discussion about selection tests. After food is served, Mohit, Sida and Alex discuss [2016/G2](#), which Alex found the trig bash for, but holds a devilish synthetic solution involving mixtilinear incircles. Freddie introduces us to [RMM 2012/3](#) which is Cauchy on the two-coloured naturals, and Ben continues the birth-month-guessing-game but his vibes fail him as he is correct only in the expected number of guesses.

Once back at Tizard room, we find that the official solution to [2021/A7](#) involves integration. Lovely.

We finish off the final day at Churchill with some Codenames, then Cockroach. Isaac accidentally causes his team to select the black square on his first hint, but the second round is much more intense with a constant back-and-forth of two answers; there is confusion around whether ‘troll’ fits the hint ‘green’ or ‘mythology’ better. Ben claims the third round is rigged as Alex somehow connects the hint ‘lane’ to ‘bay’, winning them the round.

Sam joins us for Cockroach, and as an early target, people blatantly attack Sida with cards, but he correctly guesses every card presented at him. Everyone (including himself) also abuses Sam’s inability to distinguish stinkbug and frog. Isaac gets 8 cards in front of him, but survives by guessing the stinkbug from Sam, making him the loser. Ben notes that the best strategy in this game is to sit on the far edges of the table so nobody is bothered to reach you.

Saturday 9th July

Today we depart to Norway. After breakfast, Ava takes a picture of us near the pond at Churchill College entrance, where the abundance of ducks satisfies George. On the minibus to the airport, Ben sits next to Alex and continues to joke around with him, and George and Isaac finish off the chess match that Ben and Isaac started, before moving onto Hex. Ava has purchased some special Percy Pigs, honouring Percy’s 30th birthday; they are enjoyed by everyone.



Figure 2: Final Churchill photo with Sam and Freddie.

The airport has abysmal queues for check-in and security. Furthermore, the check-in machines stop working so everyone joins Sida at manual check-in. We see the Slipstream sculpture, known as one of the most viewed attractions, and Freddie hypothesises that it’s because of how long people have to wait in line. In the meantime, Sida solves 2016/G2 using the beautiful butterfly theorem, and Mohit continues thinking about [IMO 2021/3](#).

At security, we're told to just dump our bags without taking anything out, and Freddie's Codenames box is ironically checked multiple times.

In the search for food, Mohit notes that the Perfectionists' Café has all the right grammar. We eat at Wondertree, where everyone is desperately trying to find a charging port; somehow George survives on sub-5% for an extended period of time. Ben teases Alex for his method of eating a burger one layer at a time, and dubs Sida's knife and fork method weird but acceptable. Luckily we never got the opportunity to visit the Chinese Restaurant in Hungary; George would not pass on the opportunity to order a £100 exotic soup.¹

Isaac gets a spicy Pad Thai and downs a lot of water. Ava asks if we would like to give Pret some business², and George takes her up on that offer. On the way to board, we observe the numbering on the doors, and as per the Balkans Sida asks for a flight picture. On the flight, Alex gives Isaac small hints/a complete guide for solving 2021/G5.



Figure 3: Aeroplane selfie!

Upon arrival, we note the abundance of y and j in words everywhere, and chat about the prospect of IMO 2023 in Japan; Ben is jealous. We also find the Polish and South Korean teams, and Mohit tells Sida we should say 'DDIT' loudly as we walk past to intimidate them; instead we are the intimidated ones. When we reach the designated area for the IMO 2022 contestants, it dawns upon us the scale of the competition, as Mohit tries to figure out the meaning behind the graph in the logo.

We take a coach to the hotel, and have dinner on wooden plates with wooden forks and spoons. There we meet our guide, Eirik, a student at the University of Oslo studying Japanese but having finished a maths degree. The USA team and their observer Gopal bombard us, and chat about the Ashes with Ben and Mohit.

¹Shoehorned reference to the IMO 2018 Report.

²Reference to the Balkan 2022 Report.

Before we head up, we collect our free merch, including, to the entire team's amazement, juggling balls. We get our lanyards, and plan for the days ahead, including a Wednesday excursion to the Technical Museum, and a Thursday excursion to the theme park. Ben, Mohit and Alex share a room; Sida, George and Isaac another (peculiarly if we let UK members be vertices of a graph and join an edge between members sharing a room at Churchill, this graph is bipartite between the two Oslo rooms and exhibits a perfect matching).

Ben begins his journey on becoming the 'Disoriented King', dubbed by Alex, by leading Alex and Mohit the wrong way into their room. Ben takes Alex's juggling balls captive because Alex threw them at him, but Alex eventually gets them back by messing Ben's suitcase.

Before we head to bed, we go downstairs, aiming to play some Mafia with other teams. We meet the Ukrainians, who have taken the German tiger mascot and hidden it in a toilet. Later we find out that the person who hid the tiger gets perfect score in IMO! (So we claim that hiding Keith can give us perfect scores next year) We end up chatting to the USA Team Deputy Leader Sasha about USA Uni Applications, and Mohit, Sida and Alex on the other end of the table chat for a bit to a Puerto Rico member. Alex eventually gets bored and starts playing Candy Crush.

Sunday 10th July

Everyone wakes up at around 6:00 to 7:00 to enjoy the hotel breakfast, except George who sleeps in. Ben and Sida meet the Greece team, which is basically the same as the Balkan one, and reunite with the charismatic George. Meanwhile Mohit chats with the India team, and Pranjal tells him that their mascot, a white tiger, was unnamed for two years until he named it Fluffy for its characteristic fluffiness.

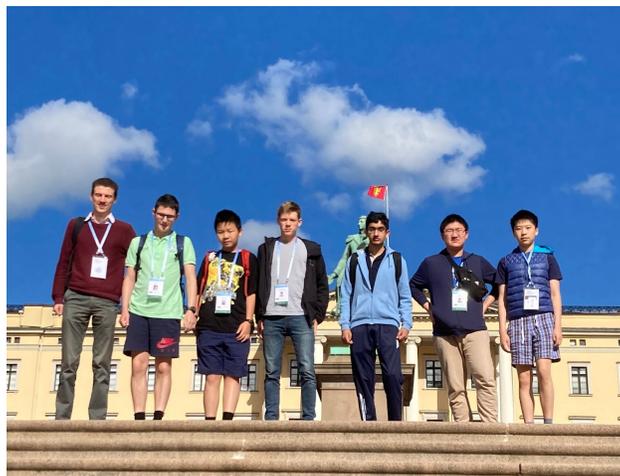


Figure 4: Some Norwegian king?

In the quiet streets of a Norwegian Sunday, we visit the castle with a statue of some Norwegian king when Norway was owned by some other Scandinavian country (we have all the details mixed up). Eirik then points to a white building not dissimilar to Buckingham Palace

as the Concert Hall of our opening ceremony, and we're all in awe. Then he realises it isn't the Concert Hall and instead directs us to a less grand but equally large modern building.

Ben and Isaac are the only two to jump on the communal climbing bars, as Ben and Isaac both enjoy climbing. Mohit and Sida yearn for table tennis, and George yearns for League.

We go for a walk down to the fjord with a glistening view of the sea, and upon going in the wrong direction under the lead of the Disoriented King Ben, Eirik asks Mohit if he wants to see the islands or a construction site, to which he replies "I've never seen a Norwegian construction site before" and we burst into laughter.

Unsure how exactly to pay, we board a ferry going around 7 Norwegian islands, and sit back to enjoy the breeze. Some islands have little red and yellow houses, and we visit one which Eirik says is sung in a poem for its beauty.

We follow a path, and eventually it is obstructed by a tree branch just below knee level. George complains that it's too high, he has to return to play League, so Ben just pulls the branch down. Then we see a ship and Alex jokes that this is the final boss of League of Legends. Cementing his epithet, Ben goes in the wrong direction, and leads George with him.

After pulling Ben and George back, everyone goes in the wrong direction, and it seems we have lost George and Freddie. Ava leads us in the direction of the dock, and after some time the lost ones return; George had lost his phone whilst following Ben in the wrong direction.

After eating cakes and being introduced by Eirik to the famous Norwegian food 'brown cheese', a type of sweet cheese, Freddie goes through the exam procedure, as well as the daunting fact that we must wake up at 6:00. Ava stops Isaac from climbing the rocks, and then we ride the ferry back. Freddie and Sida note that the tune played at the end of every announcement is the beginning of the Apple Marimba ringtone.

After lunch at the hotel, we briefly chat to the Australians who mock Sida for skipping problem 2 on F3 and are in awe of Alex's supreme power. Meanwhile Alex misses the chat because he is following Ben to the wrong way. We get changed into our uniforms, which Ben expresses his discomfort towards. He then jokes that Alex is an 'idiot all the time', to which Alex responds 'at least not now as you are besides me'.

We walk to the Concert Hall, where we meet up with the Australians again (who stick koalas onto our backs), and Sida begins handing out IMO stickers. During the walk, Sida describes a geometry problem he's created as 'so you have these two circumcircles through these points, their second intersection is this point, here's this other point, find the ratio of these lengths', and Alex continues to ask him 'which point?', only getting the reply 'this point' or 'that point'. Alex then wonders, 'what's the point', and asks Sida 'how much?'.

Then begins the opening ceremony. We are treated to the IMO 2022 video, followed by some speeches, a classical tuba performance, and then stuff gets crazy. Geoff is preceded by a laser drum show by former royal drummers, and then he makes a lovely and concise speech in a mix of $(100 - \epsilon)\%$ English and $\epsilon\%$ in Norwegian.

After that is the presentation of the countries, with notable events being: flags the wrong way around for a lot of countries, although due to reflective symmetry they only matter for some; a massive round of applause for every single-person team and Ukraine while everyone forgets to clap for UK after the massive applause for Ukraine; a huge SIU from the crowd for the Portugal team; the Montenegro team taking a selfie on stage. Through careful calculation and discussion we get our flag the right way around.



Figure 5: Team UK!

Then we get a performance of ‘Don’t Kill My Vibe’ with the drummers, the tubist and the piano, which results in a laser show with inflatable balls thrown into the audience. As we try to lob them into the Leaders’ area, we spot Po Shen-Loh and Kasia, and catch up on the results of the tennis finals.

After returning to the hotel, we meet the GOAT Alex Song, Canadian Deputy Leader, and we have goat³ to take a selfie with him. In his quest to hand out more IMO stickers, Sida meets the Thailand team and continues his Discord discussions. Mohit and Sida also find Eric Shen from USA, give him a sticker, and tell him that they love his handouts as he stares at them, bewildered.

After dinner, Ava reminds us to observe the seating and we realise our neighbours are USA, with George having the pleasure of sitting next to Luke Robitaille. Later we play a game of Avalon next to the guides who are also playing Avalon, and are joined by Alex Song, bringing some insight into the game with an indecipherable expression. This game is interrupted twice: once by some Hungarians who congratulate Ben on his KöMaL performance, and another time by the Netherlands team on their quest to create a photo graph (different to a photograph) where teams are vertices and photos are edges. We contribute a 3-cycle.

³Although goats were depicted in the IMO Welcome Video, we unfortunately did not find them and so here is our reference. We hope it suffices.

Monday 11th July

Everybody wakes up in time for breakfast, including George who comes to the realisation that the hotel breakfast is actually very good.

We take a bus to the University of Oslo, where the contestants are split into four buildings. After a pep talk by Freddie, Keith is given to Isaac and we enter the hall and wait in suspense for 45 minutes. Sida later tells the team about how USA6 chatted with USA5 about properties of random three digit numbers and Stirling numbers to calm him down. At 8:30 exactly, the exam begins.

1. **Problem 1:** Standard combi problem although a weird bound.
2. **Problem 2:** Universally agreed to be quite easy, but nonetheless a nice problem. Alex is fuming after he exam because he solved it in 5 minutes so everyone will solve it.
3. **Problem 3:** Difficult number theory, but Mohit, a number theory wizard, claims a solution with complex motivations.

With everyone solving at least two problems, we are in high spirits as we head for lunch at the hotel. George gets all desserts and none of the mains, and we head to a park whilst Sida, Alex and Mohit continue the ‘point’ joke.

During the walk, Freddie wonders why the Portugal team was boo-ed, until Sida tells him that they were instead SIU-ed. He claims unfamiliarity with this slang, just like YEET a few years’ back with Aron. Ben and Mohit are determined to create a BMO1 combi problem involving George and League as an inside joke, and Alex keeps disturbing George’s League talk with cockroaches.

Mohit and Sida also discuss different programming languages, particularly why they’re bad: the verbosity of Java, the slowness of Python, the politeness of Intercal, etc. Eirik just solves all problems by saying ‘Don’t do programming’.

First we stop at a statue park, before going to a usual park. George watches League and the rest of the team play Piggy in the Middle with Eirik and Freddie; Eirik demonstrates very impressive speed. Then Ben proposes we play football, and after a hefty amount of persuasion, we have Sida and Ben Team 1, Mohit, Isaac, Alex Team 2. It starts off with a massive 3 - 0 lead on Team 1, but eventually Team 2 catches up and wins 4 - 3, at the cost of Mohit’s shoe falling off. With a jacket lying on the ground as a goal-post, there is ambiguity about which goals went through, especially between Alex and Isaac even though they are on the same team.

We get large Mr Whippy ice cream (which George doesn’t understand, why not just call it soft serve), and race against the atmosphere to finish it before it all melts and the pigeons eat it up. Mohit, Alex and Sida all comically go to the furthest bin despite there being one two metres away. Before leaving the park, Ava tries applying first aid to Mohit’s shoe, but after a few minutes decides to rip free again. Mohit walks back to the hotel, soleless and soulless.

Eirik introduces us to the Rebel, a hub for students to play games, including table tennis, pool, card games, coding, table football, and more. Ben and Alex play pool as a team and win because the opposite team hits the 8 ball in while also potting the white ball.

Because of overcrowding in the hotel for dinner, numerous floors are used which caused confusion, and Sida ends up grabbing food on floor 3, going down to floor -1, and then back up to floor 3. After dinner at the hotel, we return and Sida and Alex play some pinball games, before joining Isaac with the Netherlands in their game of Math Fluxx, a game where your goal is to create a number using the four operations and change the rules.

Tuesday 12th July

Same routine as yesterday; George gets Keith for the exam, and Ava makes sure he gets at least something in his stomach before the exam.



Figure 6: Is George dead or alive?

1. **Problem 4:** Nice and pure synthetic geometry; once again Alex killed in 5 minutes, this time without a diagram.
2. **Problem 5:** Generally considered a normal-difficulty but bad exercise in number theory.
3. **Problem 6:** Difficult combi.

Contrary to typical UK performance, we manage to have 6 solves on the geometry in this year's paper (which totally isn't because there was only one easy geometry on the paper).

Mohit, Isaac, Ben and Alex claim full solves to P5. Sida somehow manages to get stuck on the trivial case where a isn't a multiple of p , even though he showed $a \leq b < p$; Alex reminds him about this for the next three days. George proves $a = p$; the first part of the solution. There is also varied progress on P6, with some bounds and ideas on constructions.

At lunch we meet Dominic and Geoff, who claim the meals served at the Leaders' hotel has a much greater variety. Dominic also explains the origin of Keith's name.

Then we head to the Rebel. We get a juggling workshop from a previous Norway IMO contestant, whose invitation for us to clap anytime during the workshop leads to quite a lot of chaos. After the brilliant performances and mathematics, Mohit, Ben and Sida wonder

whether the maths behind juggling (or rather some theorem attributed to Hall concerning Abelian Groups) can be used to solve [IMO 2015/6](#), as Alex and Sida play a game where they take turns to guess colours of Smarties at random; Sida fails miserably. Then we meet with the Ghana team, who introduce themselves. Mohit meets with a member called Prince as they are both heading off to MIT next year; Alex receives a chocolate bar. They also inform us that Yuka, on the UK team in 2020 and 2021, trained the Ghana team.

Isaac joins the Netherlands team for a card game, and Mohit and Sida try to get a game of table tennis without success (the bats and balls were of questionable quality anyway).

For dinner, we head to Peppes Pizza, a rare occurrence due to the prices in Norway being very high. There are only small and large sizes (which helpfully are abbreviated L and S respectively in Norwegian), and Sida decides to leave Ben's pepperoni team to join Isaac with his large Heavy Heaven. Alex also decides to pay back Ben by teasing him about all of Arsenal's recent losses this season; his knowledge of football is on par with his knowledge of IMO shortlist problems.

We also catch up on the latest news regarding the UK government, as it has had its fair share of change within the past few days. Isaac is rooting for the Tonbridge MP, though Ben finds out Isaac doesn't actually know of his politics. Sida, Isaac and Ben play rock-paper-scissors to decide who gets a remaining garlic bread; Sida loses. Whilst he stands, a little girl on the other side of the window crawls towards him and jumpscars him.

On the journey back, Ben, Alex and Mohit discuss [C1](#) of the newly-released shortlist, and Sida realises he cannot be the first to post the IMO problems on AoPS as they've been 'leaked'. Ben also places verbal bets on where the problems have come from the shortlist; C8 for problem 6 is unexpected, although an abundance of combi problems explains it.

At the hotel, Mohit, Ben and Isaac join the Belgians in a game of Mao, which proceeds peacefully. On the other hand, Alex and Sida go up to the Australians' room, and after navigating the maze that is their floor, they engage in a chaotic version of Mao (which the Australians call 'Dinosaur' to avoid taking the name in vain) with music blasting out, wine glasses full of chocolate milk, Points of Orders called left, right and centre, and even more chaotic rules involving revealing cards. The day ends with confirmed 42/42 for P4.

Wednesday 13th July

After breakfast, which George joins us for, we convene but realise the bus to the Technical Museum only leaves at 11. Thus we go to the Rebel just as it opens and have first dibs on all the games. Isaac and Sida alternate in claiming victory in air hockey, curling, table football and reaction speed button-pressing. Alex and Ben play pool and while Ben wins the first game easily, Alex beats Ben by hitting in the 8-ball from an impossible angle in the next game. Before leaving the Rebel, the UK team plays King of the Table in table tennis with a guide named Brad and the Kyrgyzstan team.

On the bus, we get our confirmed marks for P3 and P6, including 1 more mark than expected for Isaac and Ben respectively. At the Technical Museum, we are served a batch of lovely food including prawns and beetroot, acting as a second breakfast, and play a word game called Donkey, in which Isaac claims ‘squeezination’ is a word.

Then Ben wonders off in the wrong direction again as the rest of the UK team watch a science show, filled with explosions, liquid nitrogen and fire. With his accidental experience with the museum, Ben leads the UK team in looking at the best attractions, including chucking balls at electrons in an atom (which we fail terribly at), racing clearly rigged race cars, and fitting the whole UK team except Alex into a $1m^3$ box. Alex also disproves the Pythagoras Theorem by hiding a block while merging a 3×3 square and a 4×4 square into a 5×5 square.

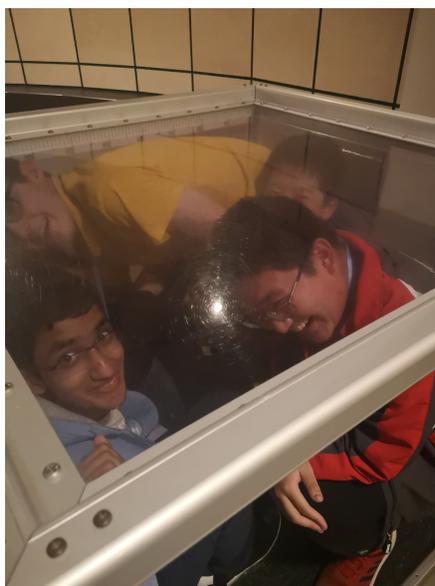


Figure 7: Apparently the record is 18 people!

Then it begins to rain, and on the bus we get our confirmations for P2; Ava has also bought superglue for Mohit’s shoe. Although everyone tries not to think about the medal boundaries, it is inevitable; everyone is hoping they’re on the right side, especially Sida, Ben and Alex, who wish for Silver, Gold and Gold respectively.

After receiving our official invitations, we visit the Oslo city hall, where we chat with the USA and Syria teams, and are greeted by Marianne, the mayor of Oslo (also the person moving chains in P1!). George and Sida accidentally spill their Fanta variant on the ground after too much shaking; they’re both not fans of fizzy drinks so claim it was to remove the carbon.

After describing the doors and paintings on the grand walls, we are presented with even more food (sliders, fish buns, and desserts) and begin chatting to the other teams. Participants are also invited to play the grand piano, and Mohit and Sida note a Chopin Etude as they leave.

Upon return, Sida and Mohit try coding the LEGO robots, and via a cheat solution Mohit opens the lock. Then he aides Sida in coding a shooting star animation, and proceeds to code single player pong. Ben and Sida, anxious for their P5 results, go to Dominic and Freddie, who present them with what they expected. Sida then returns to have a go at Mohit's game (extremely well made and faithful to the original btw) and discuss with one of the sponsors the structure of the IMO.

The UK team plays a game of Skull, which Sida manages to win by reading people's bluffs, and then join the Australians for a crazy game of Monopoly that leaves even the sanest Isaac discombobulated. We split into our UNK and AUS numbers. Unlike our early 12am night, the Australians slept at 4:30, with Christopher waking up after an hour and a half asking whether P was the centroid (it wasn't).



Figure 8: UK + AUS = chaos.

1. Team 1: The youngest William and Alex, who play fairly and tactically.
2. Team 2: Sizhe, who dips to play Geometry Dash, and Ben, who comes up with the shadiest deals and steals property because "where's the fun in Monopoly if you don't cheat?".
3. Team 3: Zian and Mohit, who repeatedly knocks the phone off the wall and blackmails those who cheat with even more preposterous deals.
4. Team 4: Christopher, who steals from everyone as they're taking from the bank, and Isaac, who is his aide.
5. Team 5: Tony with the most abysmal luck possible, with multiple rolls into jail and the highest value property, and Sida. Although they start off with by far the most money in the game, upon realising that only two utilities doesn't give much profit, their money becomes a strictly decreasing function.
6. Team 6: Grace and George. They just blatantly steal from the bank, both money and houses.

Following that we play Mao with combined Australian and UK rules; further chaos ensues. At 3:00 Christopher and Mohit somehow use DIT to solve 2021/3, a crazy turn of events; Ben falls half asleep.

Thursday 14th July

Theme park day! After getting on and off three consecutive buses, we finally step into one that embarks on its journey. Mohit and I discuss their IMO 2021/3 solutions, Mohit explains Sida his IMO 2021/3 DIT solution, and Sida shows [his solution](#), then Mohit finds that [Aron's solution](#) on AoPS is the exact same as his. Alex solves [G3](#) in his head on the journey.

We arrive at the massive theme park, Tusenfryd, and are greeted by the USA team who mocks us for not saying “cu’offs” instead of “boundaries”. Eirik actually used to work here at uni, so shows us around the best rides and tells stories of games employees used to play after hours.

First we board Loopen, literally translating to Loops, and during the 20 minute wait we play Contact, a word game introduced to Ben and Sida at the Balkans. George takes this opportunity to give very inappropriate hints for words which cannot be mentioned here. Alex decides to opt out, and so the rest of the team plus Eirik feel the G-force as they are sent upside down and through barrel rolls. Isaac enjoys his first upside down rollercoaster, and Ben and Sida decide to sit together for the rides as the Balkan Boys.

We sign up digitally for queue for the largest available ride: Speed Monster. Whilst waiting for Dodgems, we discuss the weirdness of [N1](#) and [A1](#).



Figure 9: Bumper cars.

After teaming up on Alex and Isaac in the bumper cars, we grab lunch consisting of four mains and a drink; Alex gets a tiny portion of Lasagne, and hence a large portion of meatballs to maintain equilibrium.

Then we join the queue for a wooden ride called Thundercoaster. Gosling, animosity, uniform and for(e)swear are words that come up in Contact, and we realise we have a weakness for FORE words. The ride itself is long, shaking, and very loud; everything just seems unstable, causing everyone to agree this ride is the scariest.

As Alex boards the flying chairs, the rest board Speed Monster, with consecutive falls and barrel turns matching the excitement of Thundercoaster. Throughout this, Mohit's face remains unimpressed, and Alex teases Ben for screaming "F***" as soon as the ride started.

We use our free ice-cream cards, and then board the water log ride, but not before everyone is equally disappointed and impressed at Isaac for coming up with another FORE word in Contact (FORESHADOWING, literally). Once again, Mohit remains stern. We grab our free large popcorns, and head back to the bus where Ben jokes that G3 isn't even BMO1 level, to Alex's fierce disagreement. Mohit then adds his popcorn to the building stack of popcorns by an Austrian team member. Alex gives his popcorn to George; while George is asleep on the bus, Alex repeatedly wakes him up by stealing his own popcorn from George.



Figure 10: It starts to rain! Good thing we EACH HAVE A LARGE POPCORN to protect us.

Back at Rebel, the Romanians go around every team asking for their number of 32's and above; Ben's worries seem minute in comparison. Due to hidden scores on the live scoreboard, Mohit appears to have gotten a perfect score as his only non-7 mark is sneakily hidden.

After dinner, with upcoming medal boundaries and the large screen with scores looming over, Sida, Ben and Mohit decide to go on a walk to relax the nerves of the former two. Sida and Mohit decide to trust Ben's sense of direction, but this proved to be a terrible decision and they eventually resort to Google Maps.

At 22:00, the medal cutoffs are released... everyone is in awe; the highest medal cutoffs in recent years in 2022, and the lowest in recent years in 2021. Quickly we accept reality. The UK has a full medal haul with 1 G, 3 S and 2 B, and has come 13th. China sweeps the IMO, and Romania does exceptionally well. USA loses to Korea only by one point.



Figure 11: UK, AUS and USA united by the live scoreboard.

Then to mimic the crazy atmosphere, we play ‘Unhinged Avalon’, where Mohit randomly calls Sida evil, Ben perfectly reads Mohit’s lies, Isaac approves from the outside and rejects from the inside, then Alex scolds Mohit for going completely against rational thought in guessing Merlin.

Friday 15th July

After a slightly late and crazy night, everyone gets breakfast and gets ready for another ferry ride. Geoff asks Mohit for a quote, claiming that “UK beats foreigners” isn’t allowed since we came 13th. Eirik proposes “One small step for Mohit, one giant leap for Mohit-kind”; this brings out a laugh but is ultimately rejected.



Figure 12: Looks like the cover to a music album.

We visit a beautiful island with a breathtaking ocean view, where Ben and Isaac once again utilise their climbing skills. This time, Ben doesn't go in the wrong direction, but after running to catch the ferry, we realise it's the wrong one, so do another loop of the islands.

As Isaac and Ben offer Percy Pigs to the Luxembourg team, Sida and Alex wish for a geo problem 3/6 next year, which Dominic expected, and Isaac plans to get better at difficult problems. Apparently there was a nice P4 NT, P5 geo option, but the famed 'G1 brigade' selected the easy geo, to Alex and Sida's disappointment. George proposes that the UK team next year shares Keith for good luck during next year's IMO, which would involve either cutting into 3 or 6 pieces. Hence begins the saga of Mohit protecting Keith from dissection, and through the medium of Mohit, we get to know more about Keith (see [Appendix 2](#)).



Figure 13: Mohit, protector of Keith, from the attackers George and Alex.

Then we get pizza and pasta near the dock, with Mohit protecting Keith with a knife, and Alex and George taking the opportunity to tease Keith with suggestive jokes. Mohit claims his cheese pizza is the third best he's eaten in Oslo, even though it's apparently top in the world, and Alex asserts that [2020/G8](#) is 'trivial after inversion', dampening Sida's pride.

Back at the hotel we agree that Mohit is the one keeping Keith hostage, and then proceed to play catch with Keith. Mohit gets his Gold prize, a Huawei watch, and Isaac, Sida, George are slightly late for departure to the closing ceremony due to listening to a cello concerto. Although on the flight sheets George is scheduled for a separate flight to the rest of the UK team, Ava assures him she has dealt with the issue. After chatting to the Syria team, we head to the city hall one last time.

The closing ceremony begins with a lovely cello and piano performance, followed by speeches, the medal presentation, and a welcome to IMO 2023 in Japan, which gets Sida hyped. There is also a secret IMO-wide bingo in play, but unfortunately nobody completes a row, column or diagonal. Sida and George talk to the Saudi Arabians who were sitting next to them; George rubs into Sida's face the fact that there are others who play League. As per tradition, one UNK member has to get their flag the wrong way around; Alex falls for this. We also spot a mythical creature⁴.

⁴Technically the truth, the Mexican mascot is a mythical creature. Take that, EGMO 2022 Report.



Figure 14: UK medal haul!

We return to the hotel, saying goodbye to the Australians and getting Koala'd one last time. The banquet begins, consisting of a buffet of small boxes with international food, including a sushi bowl, pizza, sliders, fajitas, etc. Sida writes DDIT on a whiteboard and joins a Thailand member with copying out a MODS L + ratio copypasta; George helps him take a picture of an infamous Discord message. TWN3 also proposes a geo problem on the board and as always Alex solves it. To top it all off someone writes the statement 'IMO 2021 P2 is good' - very controversial statement.

As the adults talk with Joseph Myers, we place stickers on Ben's chair and when he sits down, the stickers comically stick on his trousers. Then we start chatting with the USA team about MOP, admissions, etc., when the disco begins. Ben joins the centre of the crowd, and both Sida and Isaac (who calls it "vigorously jumping up and down") dance for a while but leave early. Notably, the song Shallow is played, which is slightly out of place. Sida greets Fidan, Eleanor's roommate at the Balkans, and then finds Mohit who begins his salesman phase. He goes up to people in an aggressive fashion demanding they take stickers, regardless of whether they've gotten one before; this continues until only three stickers are left after multiple sheets of them were burnt through.

Isaac talks to a Hong Kong trainer who now lives in the UK, and then receives a gift from the Saudi and Syria teams. Ben chats with the USA team as Sida tries his best at mimicking the American accent, and Alex KO's Gopal by talking about [IMO 2004/3](#) which even Gopal doesn't know.

Finally, the UK team plays Perudo, where Alex and Mohit remain on 4 dice and Mohit gets statistically lucky. Next a game of Betting Wist, and finally a game of Mao with the Belgians, where Sports Direct and changes in regime must be respected.

Saturday 16th July

We pack our things, and Isaac ends up with a sore throat so wears a face mask for our safety. Ava also provides him with medication and he feels better in no time. We say goodbye and thank you to Eirik with a card and a present, then depart on a coach to the airport.

This time, only George's bag is checked at security; we joke it's because of League of Legends. At the airport we solve some more IMO shortlist problems, including G1, N1, C2, and Alex, Ben, Mohit make some progress on N7. Ben presents his G1 solution "hey it works on my diagram" to Alex and asks for a 7; Alex gives him a 0 because there are infinitely many diagrams and $7/\infty = 0$.

Whilst waiting to board, Sida, Ben, Mohit discuss next year's selection, and how it will be difficult for our returning 4 members. We enquire about the significance of Keith being a jaguar to Freddie (see Appendix 2 for result), and Freddie informs us that the Scottish national animal is actually a unicorn. Mohit and Freddie then give examples of linearity of Power of a Point, including in IMO 2019/6. Upon reflection Ben describes how he has solved problem 3's of everything but geo (though he claims without consistency), and Sida can only somewhat consistently solve problem 3's of geo.

We board the airplane and Ben discusses graph theory; upon touchdown Sida realises the proposer for P4 this year is the creator of GeoGen, the geometry-proposing AI, so there's a chance we had an AI-generated problem (Ben also uses this chance to belittle geo, Mohit uses it to ponder the eternal nature of geo).

We pass through the airport smoothly, and are greeted by Sida's parents with roses. One by one, we say goodbye to Freddie and Ava, and go back home.

As if to welcome us back in the most British way possible, British weather decided to crank its unpredictability to the max and give us the hottest heatwave in recorded history just a day later. How lovely.

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Figure 15: Thank you!

Appendix 1 - Score Analysis

Code	Name	Q1	Q2	Q3	Q4	Q5	Q6	Total	Result
UNK1	Alex Chui	7	7	2	7	7	1	31	Silver Medal
UNK2	Benjamin Gillot	7	7	2	7	7	2	32	Silver Medal
UNK3	Mohit Hulse	7	7	7	7	7	1	36	Gold Medal
UNK4	Isaac King	7	7	2	7	7	0	30	Silver Medal
UNK5	Sida Li	7	7	0	7	5	0	26	Bronze Medal
UNK6	George Zhou	7	5	1	7	2	2	24	Bronze Medal
-	Total	42	40	14	42	35	6	179	-
UNK7	Geoff Smith	-	-	-	-	-	-	-25	-
UNK8	Freddie Illingworth	-	-	-	-	-	-	-256	-
UNK9	Ava Yeo	-	-	-	-	-	-	-927	-
UNK10	Dominic Yeo	-	-	-	-	-	-	-2456	-
UNK0	Keith	-	-	-	-	-	-	108	Gold Medal
-	Min	7	5	0	7	2	0	21	Honourable Mention
-	Max	7	7	7	7	7	2	37	Gold Medal

We came 13th out of 104 teams.

Our fifth-degree polynomial:

$$108 - \frac{1639x}{10} + \frac{361x^2}{3} - \frac{931x^3}{24} + \frac{17x^4}{3} - \frac{37x^5}{120}$$

This year 3 is quite a special number:

1. 3 of our individual scores are multiples of 3.
2. 3 of our problem scores are multiples of 3.
- 3.
4. $3 \times$ Mohit's score is Keith's score.
5. $30 - 3$ contestants got 7 points on problem 3.

Appendix 2 - Keith

Keith can tell you the answers to Problem 3's.

Keith acts as a telepathy medium between the holder and Alex.

Keith is friends with the Australian koala.

Keith was told not to go on stage, but everybody loves Keith so we brought him up anyway.

Keith can swim, but was against being thrown off the ferry.

Keith loves DDIT.

Keith hates League of Legends.

Keith hates trig bashing.

Keith hates being held captive by Mohit.

Keith hates being dissected, especially into 6 pieces for each of the UK team to bring into the exam.

Keith is a jaguar, and jaguars are in no way related to the UK.



Figure 16: Keith wins big at IMO 2022.