PMO 2017 REFLECTIONS

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1 INTRODUCTION

1.1 Summary

These are my reflections on the events of the 19th Philippine Mathematical Olympiad. This is a very personal document, intended for reflection and archival purposes. Thus, there will be a lot of rambling, and a lot of going around in circles. Expect long, uninterrupted, boring walls of text, interspersed with the occasional picture. It takes a certain kind of person (masochist?) to enjoy reading this.

The report I've written for the PMO last year is not a particularly shining example of my writing. The last year was a time of great optimism, of which has all drained out after previous events. Hopefully this article will sound much more mature and be less painful for me to read in the future.

Once again, I must warn the reader of the length of the document. This is a 58-page article, which largely documents events that occurred in three days. I also wrote each part of the article immediately after the event, which has the tendency to make my writing longer.

1.2 Format

For the benefit of those whom have never heard of the PMO before:

The Philippine Mathematical Olympiad (PMO) is the oldest and most prestigious mathematics competition in the Philippines. This year, 2017, marks the 19th year of its conduct since its beginning in 1984.

The PMO is open for entry to all Philippine high school students. There are three stages in the competition, the qualifying stage, the area stage and the national stage.

The qualifying stage is a two-hour written examination consisting of twenty-five multiple-choice questions followed by five short-answer problems. The top fifty scorers of each area (Luzon, Visayas, Mindanao and NCR) proceed to the area stage, a three-hour written examination consisting I still cringe when I read it. Available on my website, http: //dreamstudioph. com/cjq/

For comparison, last year's article was 23 pages long. This is about 17,000 words long.

For those wondering why this is only the 19th year of the PMO even though it started in 1984, the PMO was conducted every two years until quite recently. More on this in the appendix. On demographics: most of the finalists come from NCR, most of the finalists are male, and most of the finalists are from private schools. It is good that this is changing in recent years, see the appendix.

For comparison, last year 4622 students participated in the qualifying round, and the year before that 3216. of fifteen short-answer problems and three open-ended problems which require solutions. Finally, the top twenty scorers from the whole country in the area stage proceed to the national stage.

The national stage consists of a closed-door written phase and an oral phase which is open to the public. The written phase is a four-and-ahalf-hour examination consisting of five problems requiring a full written solution, worth eight points each. The oral phase consists of thirty questions being read to the participants, fifteen fifteen-second two-point easy questions, ten thirty-second three-point medium questions, and five sixtysecond six-point hard questions. Difficulty is of course relative and all the questions are very challenging.

The ranks from both written phase and oral phase are combined, 70% coming from the written phase and 30% coming from the oral phase, to form the final ranking. The top three contestants in the national stage are awarded trophies, medals, and prize money, as well as some prizes from sponsors. The top three contestants from each area also receive medals, and some prizes from sponsors.

The twenty contestants who qualified for the national stage are then trained over the summer in the Mathematical Olympiad Summer Camp (MOSC), a two-month intensive training program to select the six-member Philippine team for the International Mathematical Olympiad (IMO).

This year, 4533 high school students participated in the qualifying round, with 212 making it to the area stage. Of these 212 students, 22 made it to the national stage.

2 QUALIFYING STAGE

2.1 Preparation

For a month before qualifying stage, starting September 21, 2016, I led PRIME, a training program for the PMO participants. We had ten problem solving sessions, but to be honest we were constantly interrupted by school things.

The enthusiasm was way different this year. It seemed that everyone actually wanted to make it to nationals, which is good. I think that everyone has a shot of making it to the area stage, and it would be nice if three or more people make it.

Fast forward to October 21, 2016, the day before the qualifying stage and our last day of PRIME. Only Carabbay didn't show up because he had to go home early. I gave some quick reminders to the participants, told them to bring pencils, wear their uniforms, be at school by 7:00 AM, and so on.

The documents for PRIME are available on my website, http: // dreamstudioph. com/ cjq/

2.2 Morning

It was October 22, 2016, and the qualifying stage was to be held at the Ateneo (de Manila University), as it was for a few years now.

I came to school at 7:05 AM, making me five minutes late. Sir De Jesus was at the gate, telling me that we were only waiting for sir Miclat and for Allen. I come in the school. Even though it's a Saturday, there were clearly signs of people inside as the senior scouts were camping. I went in the coordinator's office, and there was ma'am Soriano and the rest of the group.

Everyone except Allen was there. Ma'am Soriano told us about the plans to go to Ateneo: me, DC and Jireh would go with sir De Jesus, while Allen and Carabbay would go with sir Miclat. Ma'am Soriano would follow shortly after she finishes her work. As ma'am Soriano gave her last reminders, sir Miclat walks in, along with Allen. With this, we are complete.

The Valenzuela City School of Mathematics and Science (VCSMS) sent five representatives for the PMO qualifying stage this year. They are, from most senior:

- Carl Joshua Quines (me), grade 11. This is my third time to join PMO. I qualified for the national round and won third in the area stage in the previous year.
- Jireh Emmanuel Gumaro (Jireh), grade 10. This is also his third time to join PMO, and last year he only made it to the qualifying stage.
- Allen Ross Mercado (Allen), grade 9. This is his first time to join the PMO.
- Mark Vincent Carabbay (Carabbay), grade 9. This is also his third time to join PMO, and last year he only made it to the qualifying stage.
- Vincent Dela Cruz (DC), grade 8. This is his second time to join PMO, and last year he only made it to the qualifying stage.

Allen was the only first-timer to the competition this year. We would've sent more representatives, but constraints of budget allowed the school to send only five. In the wish to maximize the probability that one of us reaches area, we sent this team. Exciting.

Of the mathematics department of VCSMS, the following were at Ateneo on the day of the qualifying stage. They are, in alphabetical order: "Don't only double check, but triple check your answers." "Yes ma'am."

a PhP 150 registration fee per student, plus transportation and food

• Mr. Edmundo De Jesus, grade 11 mathematics teacher.

- Mr. Kim Frondozo, grade 10 mathematics teacher.
- Mrs. Regina Gomas, grade 7 mathematics teacher.
- Ms. Irene Imperial, grade 9 mathematics teacher.
- Mr. Romeo Miclat, grade 9 mathematics teacher.
- Ms. Marilyn Soriano, mathematics coordinator.

It turns out that nearly all of the mathematics department of VCSMS would go to Ateneo today for a reason other than the PMO. Sir De Jesus, sir Frondozo, ma'am Gomas, ma'am Imperial and sir Miclat all had a seminar about senior high school STEM topics, which had a morning session from 9:30 AM to noon and an afternoon session from about 1:30 PM to 5:00 PM. Ma'am Soriano also had a seminar about something else, from morning to afternoon. That was a neat coincidence, and allowed everyone to be there for moral support and picture-taking, hooray.

We left the school at 7:15 AM. Me, DC and Jireh rode in sir De Jesus's car to SM North, and we took an e-jeep from there to Ateneo de Manila University, which had a very distasteful loop of BuzzFeed videos. We saw ate Arz (Herrera) at the e-jeep, a VCSMS alumnus, and we greeted each other. We would arrive at Ateneo at 8:30 AM. Sir De Jesus had to negotiate with the guard to let us in: "*may contest po sila ngayon*. IMO *po*." I said, "*sir*, PMO *po hindi* IMO!" Jireh replied, "*ayaw mo ba iyon*, IMO *na agad*?"

We realized that we haven't had any concrete discussion where we would meet once sir Miclat, Allen and Carabbay arrived at Ateneo. We had lots of places, from Gonzaga Hall (a canteen) to the room where the teachers would attend the seminar. While we were still discussing this, we made our way from the gate to the said room, at CTC 107. Sir De Jesus invited us inside the room, and we did to our reluctance. It was quite early, and there were only five educators in the room when we went in.

We were early. The registration would start at noon, and the exam proper at 1:30 PM. We were three hours early, and we didn't have anywhere to stay. Sir De Jesus told us that he would ask if we could sit in their morning session. We spent the time discussing math, particularly meta-solving, kuya Russelle (Guadalupe)'s handout and an MTAP NT handout which was surprisingly non-trivial.

Time passed. Eventually ma'am Gomas and ma'am Imperial came, along with ma'am (Rebecca) Biñas, to our pleasant surprise. Ma'am Biñas was a former teacher of mathematics at vcsms, and she was also at the seminar. The mathematics teachers of senior high school at PLV, whom we knew because they did their ojt at vcsms, also came, and we greeted them.

Well, nearly everyone. Sir Logronio and Sir Agustin weren't there.

"They have a contest today. The IMO." "Sir, РМО, not IMO!" "Don't you like that, straight to the IMO?"

Kuya Russelle is a VCSMS alumnus who made it to the national stage twice, in 2011 and 2012. He qualified to the IMO in 2011. If it wasn't obvious by now, he's really really good at math. MTAP is the Mathematics Teachers Association of the Philippines.



Figure 1: Goofing around at the session.

At about 9:10 AM the lecturer entered the room. She was Dr. (Flordeliza) Francisco, whose name I recognized because I know the names of a non-trivial number people at the Ateneo Mathematics Department. Sir De Jesus asked for permission for us to sit in and she accepted. She started by playing a short video, a humorous one pointing out math mistakes in movies. I haven't seen it before, but DC recognized it. It was Mathologer's "10 of the greatest math movie bloopers", and it was quite amusing.

Soon after, Dr. Francisco began the session. It was about antiderivatives. She was quite the interesting lecturer, and her pacing was slow enough for comprehension but fast enough not to be dragging. She was also very specific with details, how she would subtract a point for each forgotten +C and how the antiderivative of $\frac{1}{x}$ should be $\ln|x|$ not $\ln x$.

The session progressed and eventually sir Miclat, Allen and Carabbay came, at about 10:15 AM. We nudged Allen to enter the room, and he was reluctant but he eventually came in. We sort of participated in the session, listening and trying out the problems on our own. DC seemed familiar with the material, probably due to his exposure to Kumon. I, on the other hand, didn't do Kumon, and most of my calculus knowledge I picked up informally. Jireh was busy doing NT, and Allen was busy doing algebra.

available at https: //www.youtube. com/watch?v= zBuykQHFQ1Q

An instructor asked, what if my student forgot eight +Cs? "Then subtract eight points. One for each forgotten +C." This was met with laughter. In fact, DC was nudging me to recite on this one problem. I seriously didn't want to, and when I tried asking Dr. Francisco she laughed and said no. Well, it didn't hurt to ask, no?



Figure 2: Looking at the math research posters in front of SEC-A.

2.3 Noon

At about 11:10 AM we got hungry, and we quietly exited the room for lunch. To be honest, we weren't that quiet. I'd like to pretend that we were, however. Carabbay was outside, and when we asked him why he didn't go in, he said it was too cold. "Masama na nga pakiramdam ko," he said. "Pero yung kwarto mamayang PMO naka-aircon," I replied. "Okay lang, mamaya pa naman iyon eh."

Jireh and Allen kept telling me that we should find a way to inform the teachers we were going to eat lunch. Allen tried going to the door and making signs by the window, but he couldn't get any of the teachers to look. We decided not to do so and return before the session ended.

We made it back to Gonzaga to eat. We initially tried going to the second floor, but to our collective dismay, it was closed. We ate at the first floor instead. Carabbay disappeared while the other three ordered food. I waited for them to finish eating before I ate. While they were eating, I tried searching for Carabbay. He turned out to be in front of CTC, waiting for

"I don't feel well." "But the rooms later in the РМО are air conditioned." "That's okay, it's later and not now." the teachers' morning session to end to inform them we were at Gonzaga. I asked him if he already ate, and he said yes.

I went back to Gonzaga to eat some lunch. I picked up a copy of the Guidon along the way for some reading material. We ate lunch, and afterward we went back to CTC. The session ended at about 11:40 PM, and the teachers went out to meet us. We were supposed to register for the PMO: sir De Jesus had the forms and sir Frondozo had the registration fees. But as it was early, there weren't any registration tables outside yet, so we had to wait.



Figure 3: Reading the Guidon before lunch.

I spent the time looking around the place. People were beginning to populate the area. During this period, I bumped into sir (Richard) Eden thrice and we exchanged brief greetings, and it was so totally definitely not not awkward at all. Matthew (Isidro) was quite early, and he was wearing long sleeves and a green necktie. I complimented his tie, and he said it was a part of their uniform. "How do you live with that uniform? It's so hot out!" "Yeah, there's supposed to be a blazer, but I didn't wear it."

While we were waiting for the registration, ma'am Imperial decided to get some drinks. She walked up to the vending machine, and she commented that it was the first time for her to use one. DC decided to take a video of the event. We watched as she placed a fifty peso bill in the I believe sir Eden needs no introduction: he is the current team leader of the Philippine team to the IMO. He himself competed in the IMO twice, in 1995 and 1996. machine and select a drink. The arm went past her selected drink, caught another one, and dropped it. Change fell.

We were shocked. She was dismayed. She blamed it on bad luck, and was pretty sour about it. We started coming up with explanations for what happened: the bottle was displayed originally, it malfunctioned, we should call someone's attention, what about ma'am Imperial's money... until ma'am Imperial decided to get her change and count it. It was fifty pesos. Crisis averted.

DC tried using the vending machine, and it was also apparently his first time. He bought a drink. He was ecstatic, jumping up and down, he was really happy. Jireh was like, *"hindi ko siya kilala, hindi ko yan kaschool!"*. Let people have joy at the little things, I guess. Allen and I bought drinks as well.

Eventually the registration tables were out at about 12:10 PM and we managed to register without much problem. My examinee number was 667, while Allen's was the number before that, which we made a huge fuss over. Sir Frondozo asked us if we already ate lunch, I said yes, all of us already ate. At this point Carabbay says he hasn't eaten lunch yet, and I am shocked. "Akala ko ba sinabi mo sa'kin kumain ka na?" "Kumain na nga ako...ng almusal. Hindi mo naman kasi tinanong kung ano kinain ko!"

The teachers wanted to take a picture of us, again. They went to the canteen to eat, while I stayed around the area to try and bump in some people I know. This was very successful. I bumped into a lot of people. In very roughly chronological order:



Figure 4: From left: Carabbay, Allen, Jireh, DC, me.

"I don't know him, he's not from my school!"

"I thought you told me that you already ate?" "Yeah, I did eat...breakfast. You didn't ask specifically what I ate!"

- Elijamin (Claveria). While I was walking to Gonzaga for lunch, I saw Elijamin on a laptop. I didn't recognize him at first. I said hi, he said hi back, and I asked him, "where's your hat?" He put it on. "Oh, there it is." It was hard to recognize Elijamin without his hat.
- Luke (Bernardo). Luke walked in, guns blazing with the entire DLSU-Is team, and he was in front of the pack, like an alpha leading the wolves. No, that analogy doesn't work, never mind. When Luke bumped into Matthew some time later, they hugged each other out of joy and went to J-SEC to eat lunch.
- Dion (Ong). Dion was there with his usual escorts. We exchanged pleasantries and talked about the nature of the qualifying stage. I asked him if his schoolmates were there and he said he hasn't found any; he asked me if my schoolmates were there and I said they were eating their guts out at the canteen.
- Jayson (Catindig). We said hi. Yes, totally not awkward.
- Kuya Reggie (Dela Cruz). He's also a former schoolmate at VCSMS. When we first bumped into him, he was pretty happy. Reggie was apparently going to be a proctor for today's qualifying exam. I told him to try and show some mercy to the students and try not to give whoever he's proctoring the flu or anything. He said he hoped to be our proctor, and I said if he was my proctor, I would straight go up and storm out the room and not take the qualifying exam. He said he was going to look my name up and see what room I was in and try to get assigned there.
- Tayan (Gelera). Tayan was there and we talked a little about the exam. I explained how it was scary to make it to nationals last year and have the chance of not making it in if you mess up the qualifying stage.
- Ate Arz, again. She asked me where everyone else was, and I said they were at Gonzaga eating. She asked me if I ate lunch, I said yes. I tried to treat her food as a favor for what she did last time, but she declined. She said she wasn't a proctor today because she had class.

Around this time I was walking around at SEC-B and Allen approached me, saying that sir Frondozo was calling me, and that he was at Gonzaga, eating lunch. So I went to Gonzaga. Sir Frondozo and the other teachers were there. I got my exam permit, and I was in room CTC 406. I said hi to ma'am Soriano, because it was my first time to see her since that morning, and I said I would be going to the venue. On the way, I bumped into more people! Kuya Reggie won first place in the MMC national team finals two years ago, marking the second time our school has won in MMC nationals.



Figure 5: Looking for the registration table.

- Kyle (Dulay). I stuck with Kyle for most of the time before the exam. We talked about plenty of things. One of the things I remember telling him was, "my schoolmates are all in Gonzaga. I'm not really sticking with them much, I mean, most of the time we're with each other in school anyway. When I'm at a contest, I use that time to meet with people I don't meet often." Kyle agreed to this, and said that his "schoolmates are all in a clump over there, and even at school I don't talk to my classmates much during break."
- Nikki (Dizon), Kelly (Guardiano) and Lhiana (Bañares). While I was on the way to Gonzaga, I saw Nikki, Kelly and Lhiana. These three people were my former schoolmates back in vCSMS, and it was nice to see them here. They introduced me to some of their schoolmates at Ateneo. Lhiana still wasn't talking to me, oh well. Nikki approached Kyle and told him that Lhiana was my girlfriend, Kyle responded with a quizzical look and asked me who Nikki was.
- Kuya Reggie, again. The second time I bumped into him was in Gonzaga. He told me that he was assigned at SEC-A 209. "Joke's on you," I said, "all of us are at CTC." "Wait, darn it!" He was amused at Allen's examinee number; "lucky you" he remarked. We walked

back to CTC together, and I told him I would try to meet some friends. He asked me whether they were actually Filipino, and I assured him that most of my math friends were of Filipino descent, unlike that horrible stereotype.

- Kyle, again. I asked him what his room number was, and he said it was CTC 406. "Wait, CTC 406? We're in the same room!" I showed him my testing permit, and he was like, "oh". We decided to walk around aimlessly trying to get people into our circle, but that wasn't very successful.
- Clyde (Ang). Me and Kyle saw him walking with his schoolmates. We greeted each other. Kyle asked me if we should approach him. We decided not to since he was talking to someone else.
- Kuya Reggie, for the third time. While I was talking to Kyle, I made the mistake of introducing Reggie to him. "This is Kyle," I said. "Wait, what's your last name?" he asked. I replied that it was Dulay, and Reggie was fanboying in front of him, going on about master Dulay or something, please give me some math skills. He apparently made quite some fuss over it. This made Kyle feel awkward and he slinked away while kuya Reggie and I were talking about something else.
- Luke and Elijamin, again. Kyle and I bumped into them talking with some other people. I asked them if they've seen Farrell (Wu), and they said they haven't. Suddenly the topic was about me and my personal life, and well, I was shocked at the allegations.

2.4 Exam

Eventually it became 1:10 PM and Kyle and I decided to go to our room. It was quite early and we spent a few minutes standing in front of the air conditioning to get acclimated, while talking loudly. There were only a few people in the room at the time. We looked at the names in front to see if any were familiar, other than ours. I pointed out Tsai, and said that might be Terence. He said it was possible, but he wasn't sure Terence was the unique Tsai in math competitions right now.

We eventually decided to go out for a last breath of fresh air before the exam, and for a last-ditch attempt to bump into more people. We ended up bumping into Clyde and Tayan, and I bumped into Allen and Jireh. Jireh does not have a pencil and he's worried, I told him that he should be because I already told him to bring pencils the day before.

This is a reference to the fact that, compared to the population, a significant proportion of people who are good at competition math are of some Chinese descent. This has lead to some wrong stereotypes.

Only goes to show how plenty of people know Kyle by name, but not by face I guess? He's that famous. We come back in the room and it fills. Tsai turned out, indeed, to be Terence. Kyle and I were still talking loudly when the room was nearly full, and everyone was looking at us because everyone else was quiet and withdrawn while we were talking. We made an estimate on the number of contestants at the venue: a lower bound was 667, my examinee number, and I estimated at about a thousand people. We decided to stop talking at about 1:25 PM.

Around 1:30 PM the proctor started checking the seats and exam permits. About 1:45 PM she read the introduction and said we had fifteen minutes to go to the washroom as the exam would start at 2:00 PM. I went to do so and Kyle shot me a menacing glance which I didn't even try to interpret; he was very cryptic. The proctor asked us to place our things on the front and I did so, carrying a chocolate bar and my paraphernalia with me to my desk.

The exam started and it was an uneventful two hours. I was shaking while I was taking the exam. It was cold, and it was freezing, and I was nervous that I would make a stupid mistake that would drop any chance I had to make it past the qualifying stage. A few minutes in and I needed to pee, which was frustrating since I peed before the exam. Hunger panged at about halfway through, so I ate some chocolate. The chocolate already melted when I started eating it.

On the matter of the exam itself, the difficulty was okay. I felt that it was easy, but perhaps this is impostor syndrome. It was hard to concentrate when I needed to pee and it was hard to write when I kept on shivering from the cold and from being nervous. The name Louie came up and I thought of sir (Louie) Vallejo. I noticed a set of measure zero coming up in a probability question. I finished twenty minutes early and spent the rest of the time memorizing the questions and my answers.

The exam finished at 4:00 PM and we passed our answer sheets, then our questionnaires, then our scratch paper. Welp, I wanted to keep the scratch paper, but I learned since last year that they don't allow that. Good that I still remember most of the questions and my answers.

2.5 Afternoon

The exam finished and me and Kyle talked about the exam. We compared answers and we had nearly the same answers...except for the last question. He said his answer was 401, and I said my answer was 499. I was puzzled, then worried, then I realized...I misunderstood the question! I was counting something different than what the question had asked. That was six points off already, and I was quite dismayed.

This was not entirely unlike the incident which happened during the qualifying round last PMO.

Sir Vallejo does not need introduction as well; he was the deputy leader of the IMO delegation for the last two years. I finally manage to pee what I've been holding in for an hour. Kyle explained that he didn't bother solving the question that was about counting triangles made by lines in a square. I said that I counted 20 and stopped counting because that was the biggest choice. He said he answered 16 and was shaking his head and saying, "this isn't math!"

We went down and managed to bump into some other people. I remember seeing Clyde, Dion, Tayan, Luke, Elijamin, some others. Of course we discussed the exam's contents. It turns out that several of us made a few slips here and there: Clyde skipping the word 'evenly', Dion, Luke and Tayan thinking that x in part III number 4 had to be integral, me counting the wrong thing in part III number 5, Kyle not counting the triangles at all in part II number 4...

Otherwise our answers agreed with each other well. I was kinda worried that one mistake in part III could be of consequence for the area stage, but Kyle reassured me that I still had a good chance of making it. I eventually said my farewell to him, and I met with my schoolmates and we discussed the exam.

It turns out that me and DC agreed with answers perfectly, except for part I number 7. He misunderstood the question, and apparently forgot the meaning of the word 'between'. A lot of people in our school messed up the probability question with the coin in part II. There doesn't seem to be much light for our school in part III, sans DC, but I crossed my fingers.

I met up with some other people along the way. Nikki seems to be dismayed, saying that she has made plenty of mistakes. Lhiana still didn't greet me. Nikki said that a girl who was their classmate wanted to take a picture with me, and I was reluctant and said no. Welp. I bumped into Luke and Elijamin again and we talked how part III number 2 was such a wonderful coincidence, the sum of the factorials just turned out to be exactly 2016. We noted that the fact that 2016 was a triangular number was also used to great effect.

More talking ensued. I bump into lots of people. To be honest, much of what happened that day was a blur. Math competitions are my method of escapism, and really, given that GMATIC happened a few days before that, it was all just a bunch of really exciting things. Math was the world that made me feel alive. I can't remember much of the specifics, but I remember that I had a really really fun time.

Me and Jireh decided to go and collect the receipt for registration and our certificates of participation. The room was in SEC-A 423, and I recognized it as the faculty room. That room has a special place in my heart for being the room where sir Eden told each person what their score was the week before MOSC ended, and I was one of the two or three people who did not ask for their score. In retrospect, SEC and CTC have a special place in my

I would eventually see this girl again in various other math contests. Hi, if you're reading this. heart: PMO qualifying stage and area stage last year were held there and MOSC was held there, so I had a lot of memories in that place.

The afternoon session for the teachers' seminar ended and I distributed the certificates. Now the teachers wanted yet another picture, this time with certificates, and we obliged. We were walking home and we discussed to the teachers the exam.



Figure 6: Certificates!

We made it pass the stadium at Ateneo, and ma'am Imperial was amazed at the blue eagle emblazoned on its front. Jireh remarked that it was dirty. We decided to take another picture in front of it, and really, the volume of pictures made it look like we were in a field trip and not a competition!

At about 5:20 PM, we walked to the LRT2 station in Katipunan and went to Cubao. DC seemed to be very unfamiliar with the place, asking questions about everything. I decided to be his guide, since even though it wasn't his first time, it felt like it.

After a short walk to Farmers Cubao, we ate dinner at KFC together at about 6:00 PM. There is not much to remark about it except for the fact that it was very lighthearted. DC was playing Geometry Dash a lot. I said, out of spite, that I didn't want to do math any more. Sir De Jesus asked me why, and I said I was only partly kidding. Partly. Some part of me really doesn't want to do math any more.

We finally separate ways. Sir De Jesus, sir Miclat, ma'am Gomas and ma'am Imperial all went to MRT again to transfer to SM North. Us students, sir Frondozo and ma'am Soriano went to take a bus all the way home. I managed to make it home by 8:00 PM.

I always say something like this after a competition. A notable exception is the national stage last year, which I really enjoyed.



Figure 7: Ignore us. The important part in this picture is clearly the eagle.



Figure 8: Dinner. At KFC. This isn't even a proper photo.

2.6 Aftermath

I make it home and talk to Sean (Ty) and Albert (Patupat), asking for what happened in their qualifying stage. Sean told me that he got all of them except for the counting triangles inside the square question. I comforted him by saying Kyle also didn't get it, and Sean complained that "it wasn't math!" just like Kyle! It was quaint.

Albert didn't seem to have any slips. I shared to him my tiny worry of not making it to area stage, and he told me that everyone makes mistakes. And really, people did have their share of slips:

- Clyde misread the first question in part II, skipping the word 'evenly' at first read.
- Dion, Luke and Tayan made the same mistake in part III number 4, thinking that x had to be integral.
- Kyle gave up counting triangles in part II number 4, and Sean miscounted. "This isn't math!"
- I messed up in part III number 5, counting the wrong thing.
- DC messed up in part I number 7 because he doesn't understand 'between'.
- Matthew made mistakes in part II and part III as well.

In the interim, I concerned myself with schoolwork. A contest also occurred, the Sipnayan, and lots of us saw each other there. In either case, the list of people who made it to the area stage was released without incident on November 8, 2016. The questions for the qualifying stage was released a day later, on November 9, 2016.

I made the list, which was happy. By extension, DC, who probably got a higher score than me in the qualifying stage, also made it to the area stage. That meant two people from our school made it to the area stage, a first in the history of VCSMS. It is interesting to note that there were seven public school students who qualified to the NCR area stage; last year, only three qualified. This is rightly so; there are more public school students than private school students in NCR.

A week passed by quickly. Congratulations were given to me, which was odd, in the sense that it didn't happen last year. I replied with stifled thanks. I worked with DC to improve his proofs, which were just as horrible as my proofs were when I was in grade 8. Evan Chen's English handout was excellent for this. Then came the area stage on November 19, 2016.

A report of Sipnayan is available once again at my website, http: // dreamstudioph. com/cjq/.

I'm going to stop myself from going into a full-scale digression on the public-private disparity. See the appendix for more on this.

3 AREA STAGE

3.1 Morning

It was November 19, 2016, a month after the qualifying stage. No announcement was released as to where the area stage will be held in NCR, which was quite troubling, in several levels. We assumed that it would be held in Ateneo.

As I was going to school, DC texted me. "*Nasaan ka na*?" I replied, "outside". A minute later I was stepping in the school. It was 6:45 AM, the time we said the night before we would meet up.

I see Yuan (Taguinod) by the gate as I enter. He seems surprised. He wonders why I'm at school on a Saturday, and I say that I have a contest. Which I mentioned to him just the day before. Well.

I saw DC walking towards me shortly afterward. The night before, DC asked me for the etymology of the word "integer". I replied that I didn't know. I looked it up afterward, and that morning I told DC: it comes from Latin "tangere" meaning to touch.



"Where are you?"

Ma'am Soriano is there, and she will accompany us that day, as she has a class at Ateneo in the morning. After a few minutes, we left for Ateneo. We took a bus to SM and took a jeep to UP. On the way, I introduce DC to OMO and NIMO. He liked the April rounds the most, followed by the summer rounds. I also showed him the legendary Mock AIME III 2010, which he also liked. He says he wants to join the next ones.

After getting down at UP, we were waiting for a jeep that goes along Katipunan. After no jeeps came to the usual waiting spots for several minutes, we decided to go to the highway and wait for a jeep there. And there were *still* no jeeps, no jeeps where we could fit in anyway.

So I told ma'am Soriano that we should try walking to Ateneo. She didn't like the idea at first. I try to persuade her, telling her that it was only a few minutes walk, and that it was only 8:15 AM, and that we would make it before her class at 9:00 AM. After a minute or two of talking, we finally started walking towards Ateneo.



Figure 10: Riding at the COMET. I will never take a selfie again.

And we did, and progress was slow. Dragging. The filled jeeps passed

by, almost mocking us for having to walk to Ateneo underneath the hot sun. Until suddenly, a COMET came! It was filled, but there was still just enough space for three people to fit! So we rode. *ple can* We alighted at the KEC across Ateneo. Ma'am Soriano got some take-out.

We alighted at the KFC across Ateneo. Ma'am Soriano got some take-out. We went to Ateneo, and went to Gonzaga to eat. Me and DC both ate a second breakfast. Ma'am Soriano left for her class at about 8:55 AM; her class was at SEC-A.

COMET is an e-jeep. Here's a bad joke: how many people can fit in a jeepney? One more.



Figure 11: Breakfast. At KFC. This isn't even a proper photo.

Me and DC spent the time doing other things. We started out talking about doing mathematics in Filipino. I tried to memorize some Filipino math terms, and I said that I wanted to try writing my solutions to part II in Filipino if I had the extra time. We tried translating some PMO problems and solutions to Filipino.

We briefly consider how amusing it would be if the area stage would not be held at Ateneo. Like, what if it was held at UST? Then we'd have to travel several kilometers to get there! DC tells me that if we're not at the right venue, then several other people won't be as well, so there's nothing to worry about. I suppose that Ateneo is a Schelling point of sorts, and 1:00 PM the Schelling time.

Sir (Kurt) Ang from Uno (High School) comes in the canteen. We give each other brief smiles. He approaches me afterward, asking if I had copies of the previous written national stages of the PMO. I replied that I didn't, except for the latest one. I ask sir Ang if he knew when the area stage would start, and where it would be held.

He replies that it would indeed be held at Ateneo, perhaps at 2:00 PM, saying that some people received a text message. I say that we didn't receive a text, and he says that neither did they, but certain people did. Josei (Tolentino) from Uno was also there, and I gave him a passive-aggressive smile.

Schelling point: see
https:
// en. wikipedia.
org/wiki/Focal_
point_(game_
theory)

Sipnayan is a math competition. I have a report about it at http: // dreamstudioph. com/ cjq/ files/ sipnayan2016. pdf "Are you a polygon?

Because I'm poly-n in love with you." At about 10:30 AM, me and DC went to Leong Hall. I got a Sipnayan shirt. The girl who was selling the shirts fell asleep, and underneath her head were some biology notes; she probably fell asleep while reviewing. The girl next to her kindly woke her up.

It got the polygon one, that one that had, "*Polygon ka ba? Kasi I'm poly-n in love with you.*" I originally wanted the black one, but they ran out. DC kindly pointed out that my size was medium and not small. But he was wrong, and the shirt was oversized. My size was small.

DC along with Allen and Carabbay joined Sipnayan JHS last week, and DC said he didn't get any chips. All the contestants who joined Sipnayan got a bag of chips because they were a sponsor for the competition, but apparently DC didn't, along with the rest of his teammates.

We were talking about this, when the guy at the counter decided to give DC a bag of chips as consolation for last week. He was really happy about this. We thanked him profusely.



Figure 12: Olympiad geometry with DC.

We went back to the hall, and the seat we were previously sitting in was taken, so we sat across Josei, in a totally passive-agressive manner. Scare the competition, yes, yes. I taught DC some basic olympiad geometry, in the off-chance a geometry question would appear in part II.

3.2 Noon

Eventually noon comes and ma'am Soriano's class was about to end. We said we would meet with her outside SEC-A. So we went to SEC-A, and we waited. I ate some pizza I packed for lunch. It was 12:15 PM when I needed to go to the comfort room, so I handed DC my phone and told him to call ma'am Soriano.

Walking back from the comfort room, I spot Kyle. We briefly greet each other, and walk toward where DC was. We talk about where the registration would be, and what time.

I reach DC and ma'am Soriano is talking to him. Ma'am Soriano informs me that she has a meeting and she'll go to Gonzaga shortly, and that I should take DC to lunch. DC handed me my share of the lunch money, and I went with him to Gonzaga. Kyle followed closely.

Kyle and DC made some light conversation with each other on the way. We ate lunch after struggling for several minutes to find seats. Once we do manage to seat ourselves, ma'am Soriano spots us and sits on a nearby table with, presumably, a friend of hers from her class.

Kyle is still solving, an AIME problem perhaps. Kyle always seems to be solving problems when he's at a contest. I talk about how scared I am about not making it to nationals. He concurs, to a certain extent. He shows me the text message that the PMO staff sent to some contestants.

We walk back to SEC-A, and by this time it's 12:30 PM, the time of registration. As we walk out of Gonzaga, DC was rambling about floors, and how the first floor was in fact two separate floors, and there was a floor lower than the first floor, and it should be named floor 0.5.

Kyle looks at me and wonders if he was ever like that in the past. I told him that he certainly wasn't like that now. He says something about his past self, and I say that my future self hates my past self for being so immature and for not being thrifty enough. Kyle abuses temporal adjectives and starts talking about his past future self and present past self or whatever.

We make it to SEC-A. The text message Kyle received said that the registration would be at SEC-A 116, but it was actually at SEC-A 117. Which made me wonder, if there was no class at 116, and the text said 116, why was the registration being held at 117?

Me, DC and Kyle were the first three people to register. The people at the registration tell us we should be in the testing room by 1:30 PM, and the exam starts at 2:00 PM. After signing on the registration sheet, we looked at the seating arrangements and made some comments. Two rooms were used, like last year, twenty-five people per room. Stray observations:

Er, I think this was the first time they talked to each other. I'm not sure they even know each others' names.

- Me and DC were in different rooms, probably because they're separating people from the same school. Me and Kyle are in the same room.
- If I remember correctly, in DC's room was Dion, Andres (Gonzales), Farrell, Elijamin, Tayan and Matthew. In our room was Kyle, Clyde and Luke.
- Luke and Terence were sitting behind each other. Kyle remarked that they would be quite noisy, and he would be right about this.
- I'm sitting next to Steven (Reyes). Kyle is sitting next to Jinger (Chong).
- Me and DC both have seats by the side: I'm by the window and DC is by the door.

DC writes a rectangle with Pikachu inside it beside his name on the whiteboard with the seating arrangements. It goes unnoticed. We walk outside in an effort to bump into people. We made it nearly outside SEC-A when I realized, if we wanted to bump into people, the best place to wait would be inside the registration room.

As we turn back, Kyle sees the rest of the Philippine Science HS (Pisay) team coming to register. He hides from them. Kyle makes the great suggestion of blocking the door to the registration room so that no one else can register, making us winners by default. I like this idea.

We make it back to the registration room, and stand in front of the door. The Pisay team comes, along with their coach, sir Petri (Espanol). Sir Petri briefly looks at Kyle, asking quizically if the registration was closed. He goes in the other door, and the Pisay team follows.

We go in the registration room again, and place our bags down. Elijamin sits next to us. People start coming in. Matthew and Terence come in, and of course this makes for conversation. Much conversation, in fact, we were pretty noisy.

Matthew asks me, "paano kaya kung si ma'am Amarra yung gumawa ng test? Tapos puro combi." Elijamin replies with two thumbs up. I liked this idea as well – I mean, if at least one question in part II was combinatorics I would be really happy.

More conversation ensues, of course. More people come in. Dion. Andres. Then comes Luke and... Albert? *Albert*? What was he doing here? Wasn't he supposed to be in the venue for the Luzon area, because he's in region IV-A? His school is in region IV-A...right?

This makes everyone confused. Apparently no one else heard of this, though Elijamin seems to have heard a few things about it. In either case,

"What if ma'am Ammara wrote the test? And it's all combi." For reference, ma'am Amarra was a trainer at MOSC and taught combinatorics, really hard combinatorics. this makes for good conversation and plenty of jokes. Albert having a twin brother, Albert being in two places at once, Albert having school superposition or location duality, whatever.

3.3 Exam

We go to the testing rooms at about 1:00 PM. I look at the board to find my name, and place my bag in my seat. Since there weren't that many people in our room yet, I go to the other room to strike some conversation.

I see Dion, and he's solving PMO 2009. We talk about this. Matthew approaches and says, "*nagsosolve ka pa hanggang ngayon*?" We talk about this, as well as previous PMO national stages.

Tayan was there, and we talk about last year's national stage. Kyle comes in, and bumps into us talking, along with Dion and Matthew. He remarks that he forgot what it was like to talk to MOSC people. I suppose I also forgot what it was like.

Farrell comes in. He notices us, but doesn't acknowledge our existence at first. After a few minutes, I approach him, and we talk about various things. I tell him how hyped I was about placing thirteenth in the omo the other day.

Andres was sitting near Farrell, and we exchange a few nods. I remind Andres of last year's area stage, where he was the only one I talked to before the contest. Things change, I guess. Now I'm talking to plenty of different people, and it's fun, and I like it.

I talk to DC, who is playing Geometry Dash. I remark that I sucked at Geometry Dash, because it's geometry, and I suck at geometry. He told me to go play Algebra Dash instead. Josiah (Balete) was watching DC, and we exchange greetings.

I go back to my room, and Steven (Wang) approaches me, telling me that my bag is in his seat. "Oh shoot, really?" I take my bag and place it in the seat in front of his. "That still isn't your seat," he says, and I finally moved my bag to the right seat. I suck at counting.

Around this time, it was 1:30 PM and so I took my seat. The proctors for our room were going around, checking the seating and asking the students to show their IDS. I was wearing my very dashing tie at the moment, so I had to grab my ID from my bag.

I take out my materials, a pencil, two pens, a protractor (for some reason, they were allowed), a ruler, a compass, a water bottle, an eraser, a pencil sharpener. Be prepared, right? The pen was important, as my other pen was running out of ink.

"You're solving until now?"

Top teams of OMO at http:// internetolympiad. org/archive/ OMOFall16/ top-teams.html It turns out that Albert was sitting near me, so we talk to each other about some things. Like, what he was doing here, for example. He will be scored as part of the Luzon area, but he will take the test here at NCR for convenience.

Steven attempts to formally introduce himself to me, saying something along the lines of, "hi, I'm Steven, I haven't introduced myself yet, haven't I?" It was extremely polite, and I commit a social faux pas by saying that such a formal introduction was out-of-place as we both knew each other's faces and names.

Several jokes were made particularly at the absence of a certain Ryan (Shao). Ryan was the person who was supposed to sit behind me, but apparently he didn't show up. This made for the recurring joke I made that Ryan's ghost would take the area stage, which is not funny.

It was 1:45 PM by then. At this point, the proctors started reading their script, welcoming us to the PMO, and telling us that the exam would start in fifteen minutes, and that we had time to go to the comfort room if we needed to, because once the exam starts we will not be allowed to go outside.

Clyde asks if we were allowed to keep the questionnaires after the exam. The proctors, after carefully going over their script, declare that yes, we were allowed to keep the questions and the scratch paper after the exam. This was good, for this made it easier to compare answers afterward.

I go to the comfort room, and so does Kyle and a lot of other people. At the comfort room, I make some conversation with Albert about the pigeonhole principle. If we have n pigeons and n + 1 holes, then at least one pigeon will have at least two holes. Of course, why else would it be called the pigeon*hole* principle?

I talk to Steven about several things. About how geometry isn't real math, and statistics isn't real math, and arithmetic isn't real math. About how awkward and frightening the few minutes before the contest starts, because everyone is quiet in anticipation.

The proctors started handing out the scratch paper and the answer sheets. There were five sheets of scratch paper, wonderfully generous for the PMO. Ghost Ryan got an answer sheet. Finally, they gave out the questionnaires.

The exam started at 2:00 PM. It was an uneventful three hours. I was coming down with a cold, and I was coughing and wheezing and had to deal with my horrible snot throughout the whole exam. It was also hot in the testing room, because there was no air conditioning.

I was horribly worried. I was so worried the night before, and the morning that day, and pretty much for the whole week, and it became a self-fulfilling prophecy of sorts: I made a whole host of arithmetic mistakes which I later corrected, and so on.

I am the self-appointed anti-geometry preacher since last year. Because I suck at geometry.

Hi Steven, if you're reading this, I would

like to apologize.

Sorry.

I solve the first fourteen problems, and by this point it was 3:00 PM. I give up halfway while solving the fifteenth, and try part II. I answer all three to some degree of correctness, and after writing up my solutions, it was about 4:00 PM.

I try the last few problems in part I. I solved all except the last one, and by this point it was 4:30 PM. I gave up on the last one, and decide it was better to use my time checking my answers to the problems. I managed to correct three or four answers in part I and make a few additions to my proofs in part II.

Five minutes were left when I went back to try the last problem of part I, but by then it was too late to make any real progress. The time was called at 5:05 PM and we pass our answer sheets.

3.4 Afternoon



Figure 13: Discussing the problems.

I was really frustrated. The moment I passed my answer sheets, I started grumbling loudly about how I hated math and I was never going to do math again. This was quite loud, and quite rude to others. I was really really angry, and really really sad afterward, but mostly sad.

We started comparing answers. This was a blur to me, because I felt really sad. For the sake of my mental health, I will not try to recall many details: I only showed my answers to Dion and Farrell. Kyle, Clyde and Albert made only a few mistakes. Farrell made several more mistakes, and he's worried about part II. Once again, I say something like this all the time. Also, it was quite rude for me to say that so loudly, sorry. Only Clyde and I claimed to solve part II problem 2, a geometry problem, synthetically. Everyone else did some sort of bash, with Cartesian bashing being the most popular it seems.

It was uninamous that this year's exam was harder than last year's. The difficulty of part II was comparable to previous national stages, perhaps even JMO 1/4, which was surprising. Some of my sources said that this was intended, so I partially expected it to be this hard.

DC comes in and he tells me he didn't perform well, and I comfort him. Luke made a sad face and said he made plenty of mistakes in part II. Patrick (Castro) approaches with Dion and they see my answers. At this point, it is 5:40 PM, and many people have already left the room.

Me and DC go out of the room, and see ma'am Soriano. As we were leaving, Farrell talks to me about part II problem 1, and I realize my mistake. DC talks to me about this as well. We walk away from SEC-A.

At this point, I've realized that I made two mistakes in part I, missed half of the problem in part II problem 1, and made a small error in part II problem 3. This made me really really sad with myself.

As if I wasn't sad enough, I became even sadder.



Figure 14: The only decent picture me and DC have that day, at Chowking.

We walk to the LRT2 station in Katipunan, alight at Araneta-Cubao, walk to Farmers and eat at Chowking, at about 6:20 PM. We briefly discuss the area stage, with possible guesses at the cutoffs, about who will be top three, things like that. This conversation made me sad as well.

We talked about etymologies again. I said that tangent, the trigonometric function, was named after the tangent that touches a circle in one point. This comes from the fact that if you draw a unit circle, the length of the tangent line corresponds to tangent. We talked about the etymologies and history behind other trigonometric functions, and I made a few mistakes in my retelling. This is an interesting topic I wanted to learn more about.

We took a bus the way home to Valenzuela. On the way, me and DC compare answers in the area stage. After an hour or so, at about 7:40 Рм, I alight at my stop. I take a tricycle home.

While at the tricycle, I was thinking about my solution to part 11 problem 2. It was at this point that I realized my solution had a hole – a large, irreparable hole. This made me really really frustrated, and sad. I had so many mistakes, and I didn't do my best. I make it home at 8:00 PM.

As I was walking home, I looked up. The skies were dark and cloudy, threatening rain. There were no stars outside – just darkness, and wisps of dark blue-gray clouds mixed upon the dark purple void of space. A bad omen, perhaps.

3.5 Evening

Dion has already messaged me by the time I went home, asking for the consensus answers to the area stage. I delay replying for a few minutes. Sean has also messaged me, and I tell him that I bombed the area stage.

I cry for twenty minutes straight, realizing how hard I messed up.

Part II is worth the same amount of points as half of part I. It therefore makes sense to solve the first half of part I, then part II, and then the other half of part I. The last thirty minutes or so are better spent reviewing solutions to the first half of part I and part II rather than solving.

I misused my time. I tried part I for too long. I did not spend enough time for part II and became complacent and overconfident with a wrong solution. I made a mistake, and an irreparable one, a costly one. I bombed the test, hard. *That* was what I felt.

I started running the numbers. Based on what happened after the area stage, and the claims I've heard. The cutoff will probably be around sixty or seventy. I have a chance of making it to nationals, a good chance, in fact. But my instict kept telling me that I won't.

I stopped crying. I was still sad. But right now, I had other things to do.

I tried part II problem 2 again, and this time, I was frustrated. To anyone who took the area stage and is reading this: (ADFOE) and (AHFB) solves the problem. Why did I not see that? It was so simple, but *why did I not see that*? I should've looked for cyclic quads in the first moment!

It made me even more frustrated. I told Kyle about it, and he said that once he saw (ADFOE), it took him ten seconds to prove it. Because yes, it really was that easy once you spot (ADFOE).

I did get some parts right though: trigonometry started not with the sine function but with the chord function, the word sine means something like chord and is a mistranslation from Arabic, the tangent trigonometric function is named after the tangent to a circle, and the same thing for secant.

As of now, I don't feel that frustrated – there were plenty of external factors affecting me negatively at the time. But I still should've seen that. Sean was surprised at (ADFOE) as well. He claims he made three mistakes in part I and got part II perfectly, though he complex bashed the second problem. I say that he's probably going to top his area, and I share how worried I am about my performance.

Luke talks to me about the area stage, and tells me that he's worried about not making it. I say that I'm worried too, and try to offer whatever consolation I can. It turns out we both performed horribly in part II.

Albert talks to me, saying that the test is over, and we can't do anything any more. It was actually really comforting and reassuring, and our conversation was really helpful for my mood. He was right – there was nothing I can do, not any more.

I decided to sleep that night.

3.6 *Aftermath*

The days in between the area stage and the announcement of results were filled with increasing tension. In the previous year I did not expect to make it to national stage, but I did, which was a pleasant suprise. This year, I *did* expect to make it, and other people did expect me to make it as well because I made it last year, and knowing my relative performance on the area stage made me scared.

I have received wind that the announcement of scores would be on December 20, 2016. On the said day, we did not have class, so I spent the whole day checking the PMO website and Facebook page every thirty minutes or so. Night approached, it became 6:00 PM then 7:00 PM then 8:00 PM and I was checking the website every ten minutes or so.

On 9:00 PM, the results for the national stage were posted. I immediately opened the article, and I was ecstatic. Not only did I make it, but so did DC! Such a remarkable occurence was totally unexpected for both of us. My predictions for the top three in NCR's area stage were on point. I then made a post about this, hooray.

I shared the news to Sean, who was ecstatic about making it, and to Albert, who was excited as well, and to Kyle, who replied an hour later saying he was busy playing a video game and did not show any excitement. The list of area stage winners follows. From Luzon,

- Albert John Patupat from De La Salle University Integrated School stc.
- 2. Vince Jan Torres from Santa Rosa Science and Technology High School.
- 3. Emmanuel Osbert Cajayon from Emilio Aguinaldo College.

The PMO team has a penchant for posting results in the mid-evenings. In retrospect, this makes sense; they have day jobs. From Visayas,

- Cris Jericho Cruz from Philippine Science High School Western Visayas Campus.
- 2. Makarios Joash Wee from Philippine Christian Gospel School.
- 3. Jonathan Conrad Yu from Philippine Christian Gospel School.

From Mindanao,

- 1. Sean Anderson Ty from Zamboanga Chong Hua High School.
- 2. Xavier Jefferson Ray Go from Zamboanga Chong Hua High School.
- 3. Fedrick Lance Lim from Zamboanga Chong Hua High School.

From NCR,

- 1. Kyle Patrick Dulay from Philippine Science High School Main Campus.
- 2. Farrell Eldrian Wu from MGC New Life Christian Academy.
- 3. Clyde Wesley Ang from Chiang Kai Shek College.

The surprising fact about the national finalists this year is that there are twenty-two, rather than the usual twenty. This meant that there was at least a three-way tie for the last spot, which has never happened before.

A few words about these twenty-two are in order. Jinger is the only girl this year, compared to three girls last year, an all-time low. Josiah and DC are the most junior students, both in eighth grade, Clyde and Farrell are the most senior, both in twelfth grade.

We have two all-time highs this year: the number of public high school students, four: me, DC, Kirk (Bamba) and Vince (Torres); and the number of non-NCR students, five: Albert, Vince, Manuel (Kahayon), Sean and Xavier (Go). They are tied with the previous records of four in 2011 and five in 2008, respectively.

Kirk is the first non-science public school student to ever make it to modern PMO nationals. This is an excellent achievement, and I hope that he will not be the last.

Finally, fourteen finalists from last year also made it to the nationals this year. This is another all-time high, with the previous record of eleven students being retained from 2014 to 2015. It is indeed sad that Shaq (Que), Matthew and Errol (Suarez) did not make it.

The list of national finalists follows.

The only other time in modern PMO that there weren't twenty finalists was in 2008, when there were sixteen.

I am happy that more public school students got in, and that more non-NCR students got in. See appendix for more on this.

Andrea (Jaba) and Isabel (Villanueva) graduated, Tiffany (Ong) did not join.

- 1. Clyde Wesley Ang from Chiang Kai Shek College.
- 2. Immanuel Josiah Balete from St. Stephen's High School.
- 3. Kirk Bamba from Mataas na Paaralang Neptali A. Gonzales.
- 4. Luke Matthews Bernardo from De La Salle University Integrated School Manila.
- 5. Emmanuel Osbert Cajayon from Emilio Aguinaldo College.
- 6. Jinger Chong from St. Jude Catholic School.
- 7. Elijamin Wolfgang Claveria from Philippine Science High School Main Campus.
- 8. Vincent Dela Cruz from Valenzuela City School of Mathematics and Science.
- 9. Kyle Patrick Dulay from Philippine Science High School Main Campus.
- Christian Philip Gelera from Philippine Science High School Main Campus.
- 11. Xavier Jefferson Ray Go from Zamboanga Chong Hua High School.
- 12. Andres Rico Gonzales III from Colegio de San Juan de Letran.
- 13. Sedrick Scott Keh from Xavier School.
- 14. Dion Stephan Ong from Ateneo de Manila University High School.
- 15. Stefan Marcus Ong from St. Jude Catholic School.
- Albert John Patupat from De La Salle University Integrated School stc.
- 17. Carl Joshua Quines from Valenzuela City School of Mathematics and Science.
- Rafael Jose Santiago from Philippine Science High School Main Campus.
- 19. Vince Jan Torres from Santa Rosa Science and Technology High School.
- 20. Sean Anderson Ty from Zamboanga Chong Hua High School.
- 21. Steven John Wang from Uno High School.

22. Farrell Eldrian Wu from MGC New Life Christian Academy.

I began giving DC even more olympiad problems. We worked on several practice olympiads and I would go over and regularly improve his solutions. To be honest, his skill frightens me – he is better than I was a year ago, and he is three years younger than me. But in another sense, it is inspiring for me to guide such talent to reach heights I never could have.

The Sunday before PMO, January 15, 2017, I sent Facebook messages to the national finalists, asking for consent from them to participate in my research, a project for Practical Research 1.

The goal of the research is to create a model for how people solve olympiad problems. It is at this point that Rafael (Santiago) told me that he wouldn't be able to go to the national stage, which was quite sad. A number of people also declined for several reasons, which I respect.

The week leading up to the PMO was our midterms. On Friday, January 20, 2017, the day before the nationals, I told DC to come at 6 AM the next day, to wear his uniform, bring formal wear, whatever. The plan was for me and DC to ride with sir De Jesus in his car, while DC's companions would ride with ma'am Soriano and commute.

4 NATIONAL STAGE

4.1 Morning

It was Saturday, January 21, 2016, one month after the release of the finalists, two months after the area stage. The national stage would be held at UP (University of the Philippines), in NISMED (National Institute of Science and Mathematics Educational Development) for the morning and afternoon and at SOLAIR (School of Labor and Industrial Relations) for the evening.

I woke up early and packed my things. I went to school at around 5:45 AM. Sir De Jesus was there, and he was talking to another teacher from our school. The science department had a simultaneous contest, this time all the way in Laguna, which is why they were there early.

Ma'am Soriano arrives shortly after I arrive. At around 6:05 AM, DC and his companions arrive. He is accompanied by his mom and his younger brother. I tell him he's five minutes late, and he shows me his phone, which has the time 5:55 AM, claiming he's five minutes early.

It turns out that all of us fit in sir De Jesus's car anyway, so they didn't need to commute. We went to UP during this time. During the trip, I ask DC to sign the consent form for my research. We also talk about various things, like MOSC and the PMO.

I'm planning to release the conclusions some time soon. The most interesting result is that very few people know where their motivation comes from.

Incidentally, Solair is also the name of a resort here. So it caused a bit of confusion at first. I tell him to have fun and try to socialize with other people, and not worry about things much. I also scare him with the gossip that some of the problems were the Philippine's proposals to the IMO, which was just gossip.

We arrive at NISMED rather early, at 6:30 AM. We were the first to arrive. Punctuality, as always, hooray for Valenzuela. DC is rather taken aback by the place, and I gently remind him that we went to NISMED before for Mathira. We take a few pictures in front of the tarpaulin in the lobby, much to my distaste as the lighting was not ideal.

At the lobby was ma'am (Jasmin-Mae) Santos, a familiar face. In MOSC last year, ma'am Santos was the very diligent person who distributed our allowance each day. She was in the lobby preparing the registration table.

At around 6:35 AM, Clyde arrived. He's alone, listening to something through earphones. We greet each other, as I walk past him outside NISMED to take a walk. DC follows behind me, and I let him tag along. Sir De Jesus catches up with some snacks for our walk.

We walk around UP, making a counter-clockwise turn around the block in front of NISMED. It went through the Oval, and I pointed to DC some of the buildings I know. Nikki was texting me incessantly, telling me about her dream last night which somehow involved me and DC.

As we were approaching NISMED, sir De Jesus called me. He told me that the registration table was set up. It was on-time, at 7:00 AM, an improvement from last year. A few minutes later we reach the building and greet lots of other people on the way in.

Me and DC register, and I had to correct the email which was in the database. That explained why I didn't receive sir Eden's email to the finalists, which Kyle forwarded to me. Tayan and Dion registered at about the same time.

Our lunch allowance was given out, and so were the program booklets. I didn't bother looking that hard at the program booklets this year. Ma'am Santos handed a copy to sir De Jesus as well. She also remarked about how the format of the written round was changed.

At this point, I run into Luke and Clyde. Luke makes several remarks about the program booklet, which prompted me to actually pay attention to it, so I did. We discuss the written round, which has a new format, and I say it has four problems. Luke is taken back by this, and says the problems have to be ACGN.

Clyde is there as well, absorbed in reading the booklet. I ask Luke to sign the consent form for my research. He reluctantly agrees, telling me that he's probably going to withdraw from the study later on, just so I fail my research class. Clyde also signs the form, and makes a similar remark. I missed that kind of teasing.

I'm ashamed for not being sure that this is her name. Apologies.

Something along the lines of "apat na problems na lang, kaya talagang mas mahirap na." "With only four problems, it will be harder." At this point Vince arrives and I make him sign the form as well. We were catching up with each other, discussing curriculum math. Luke says that grade 11 math is boring, except for the precalculus subject which was "slightly harder" than normal. Clyde says that the grade 11 math was the only math that was in STEM.

Sean arrives and we're all taken aback by his arrival. He wants to talk about Sharygin with me, but to be honest, I didn't really want to talk about Sharygin. He is really good at geometry and solved a lot of problems in Sharygin, which makes me kind of insecure. I get Sean to sign my form. I also get Tayan to sign.

I break off from their group to talk to others who were there. I manage to talk to Manuel and ask him to sign. He's quite anxious about the written stage, and I reassure him. Kirk was there too, and I greeted him as well and exchanged a few remarks about the written stage. I also talked to Xavier and asked him to sign.

At about 7:30 AM, we were asked to enter the examination room. At this point, there were still some of us who weren't there yet, like Kyle or Farrell. In either case, the exam continued.

4.2 Written



Figure 15: Taking the exam. Note the barely visible HIWAGA 2017 at the whiteboard on the back.

We entered the exam room. The seats were labeled with sheets of paper with our names on it. We seat ourselves. Meanwhile, Vince is at the whiteboard drawing the logo of HIWAGA 2017, which is something that no one has figured out the meaning of. Ma'am Santos explains the rules.

For the interested, http://fb.com/ randompage514

They had to prove Bernoulli's. Why didn't we get to prove Bernoulli's? The envelopes were distributed and the exam started at 7:35 AM. Most of the late contestants managed to arrive within a few minutes of the start of the competition. However, Kyle arrived at 8:00 AM, and Farrell arrived at 8:30 AM. Nevertheless, the exam ended at 12:05 PM for everyone.

Various things happened in between. The most notable, however, was Manuel shouting "yes!" with his arms stretched out, overjoyed, perhaps, at solving a problem. This was met with laughter and quizzical looks.

As the problems are still confidential as of publication, I will not speak as to any of the details. I will speak in vague generalities, however: problem 1 is not that hard, problems 2, 3 and 4 are easy-medium IMO. I will also say that I performed sub-optimally during the written round, which made me sad but not that sad.

The written round ended at 12:05 PM. Ma'am Santos explained how the sheets of paper will be placed in the envelope: the questions, followed by the solution sheets, followed by the scratch paper, "back side up". It is at this point I am confused, as most scratch paper does not have a back side. Eventually we just place all unused sheets of paper at the back of the envelope.

4.3 Lunch

The questions were met with much discussion. It was much more difficult this year compared to last. I think that it was comparable to a national olympiad now, perhaps JMO.

Kyle and Farrell are on the whiteboard discussing problem 2, which both of them claimed to have solved. Consensus was that no one was claiming to solve more than two problems. Sean talks to me about problem 4. I've heard no claims for full solves in problem 3.

After that we all go out of the testing room to eat lunch. I talk to DC about the exam and he shares that he only solved the first problem. I sympathize with him, saying that I also only solved the first problem. We eat our lunch, some take-out that the school paid for.

Sir De Jesus and ma'am Soriano have a conversation about various things. It is revealed that while sir De Jesus has classes that day, he skipped them to attend the PMO, which is very touching. Ma'am Soriano did have classes, but they were called off, as sir (Christian) Chan Shio was teaching them. I tell DC that I heard from someone that sir Chan Shio lived in Valenzuela, but I wasn't that sure of that fact.

I finish lunch quite early. I scare DC at about 12:30 PM, telling him that the oral round would start at 1:00 PM and that he only had thirty minutes to rest. He shrugs it off. He finishes eating and we go out to socialize.

Incidentally, our lunch was KFC. Like areas. And last year. And all the time.

Sir Chan Shio taught at MOSC last year as well. He's also one of the members of the problem-setting committee at the PMO.

In retrospect, when was I ever satisfied with my performance? I go up to the entrance of the NISMED auditorium, where the oral rounds would be held. Sean and Vince were eating lunch over there. Sean shows me that one of the problems in the exam is equivalent to a problem in literature, though to protect confidentiality I will not reveal anything more about this. He finishes eating and we talk about the problems.

He was going to the restroom to brush his teeth. I followed him, and we were talking about problem 4. I began to explain my solution and how I managed to find what was required, but not prove it. Sean attempts to reply while brushing his teeth, and the result is an incomprehensible mess of words. "Brush your teeth first", I tell him. His dad laughs at this.

He explains his solution, which managed to prove its existence but not constructively find it. I try to follow the solution in my head but after a while I couldn't keep it in. At this point we encounter sir Chan Shio, and we talk to him about the written phase.

We say that it was much harder this year, and talk about the relative difficulties of some of the problems. Sir Chan Shio is happy about this, remarking that the problems are finally becoming on par with other national olympiads. I ask sir Chan Shio whether the rumor that some of the problems were the Philippines' submission to the IMO. He declines to answer due to confidentiality, so the rumor is still up.

It is at this point me, Sean and Vince decide to go down and talk to the other contestants. The rest of the group was there, and the topic of discussion was indeed the written stage. Kuya Nathanael (Balete) was there with his brother, and we talk about various stuff. For example, he observes that it's been a while since the national round was held at UP.

I bump into ma'am Imperial. Ma'am Soriano said earlier that morning that ma'am Imperial would be there to take the place of sir De Jesus when he leaves. I didn't know what time sir De Jesus would leave however. She asked me where the others were and I told her they were upstairs.

Roughly this time, I talk to Manuel about the written round. I ask him if I can record our conversation for research purposes. He agrees, and we talk about the problems. He claims problems 1 and 4, and his solution to problem 4 was simple. I did not manage to check its veracity however, since the study I am conducting is more about the motivation behind problem-solving.

Kyle and the others were there, and I talk to Kyle about research. He will also conduct something for his research during that day, and he plans to interview the participants of MOSC 2016. He tells me that if the interviews are recorded he gets a higher grade, so he prefers to do it face-to-face. On the other hand, I tell him that we could always do the itnerview online if I do not manage to interview him. But really, sir Chan Shio is almost always smiling. He's pretty cool. I break off from everyone else and go to Kirk, whom I noticed was sitting away from everyone else with his coach. I approached him and initiated conversation about the written round, and he claims problems 1 and 2. I ask him about his solution to problem 2, and he tells me about it. It becomes difficult to describe without paper though, so he brings out a small notebook to write down the details.

At about 1:30 PM, we were called to go to the auditorium for the oral phase. Kirk was still explaining his solution to me while we were going up. We went in the NISMED auditorium and find seats. I was still standing while Kirk was explaining.

Shortly after Kirk explained his solution, I tried to initiate a conversation with Stefan (Ong). Although I had darker motives, like setting up rapport as I plan to interview him later on, one of my goals that day was to manage to get to know each contestant. We talk a little bit about his progress on the written round.

4.4 Oral

I take my seat as the awarding was about to begin. The awarding of certificates is done before the oral phase. After each person was called up to the front with their coach, they took their seat for the oral phase.

Once everyone was seated, the quizmasters (Dennis) Leyton and (Diane) Pelejo began the program. If I recall correctly, sir (Emmanuel) Cabral gave opening remarks. The judges were introduced, but I do not believe they need much introduction: sir (Job) Nable, sir (Jose Ernie) Lope and sir (Manuel) Loquias.

Once everyone confirmed their contestant numbers, the oral phase began. The mechanics was to write the contestant number at the upper-right corner of the question slip, which also contained a space for writing in the answer. The first easy question was read, the slips were collected, and the judges read the contestant numbers who got the correct answer. However, two people neglected to write contestant numbers, so they gently reminded people to do so.

The next easy question, a few people forgot once again to write their contestant numbers. One of them got the correct answer, so the judges asked who it was, and it was Sean. Once again, the judges reminded the contestants to write their contestant numbers.

A few questions afterward, everyone wrote their contestant numbers. The problem was that two people wrote contestant number 7, and one of them had an incorrect answer. One was Elijamin, but I forgot the other one.

Interestingly, they were the same judges as last year, except sir Chan Shio judged instead of sir Nable.



Figure 16: Background: Quizmasters Leyson and Pelejo. Foreground, from left: sir Nable, sir Lope, sir Loquias.



Figure 17: Sean forgot to write his contestant number.

And then the next easy question, there were two people who wrote contestant number 17. I stood up because one of them was me, and the other one, apparently, was Sean, whose 9 looked like a 7 because the loop was small. Finally, the judges reminded the contestants to write their *correct* contestant numbers *legibly*.

There were various other fiascos involving contestant numbers during the easy round and to document them all would make the report un-funny. Needless to say the contestant numbers were quite the issue, because it was easy to forget writing the contestant number during the heat of solving.

The last question for the easy round was the history question, which is PMO custom. The history question this year was the name of the division sign \div , which comes from the Greek word meaning sharp pillar. The answer is obelus, and I got it correct. Luke remarked that I got the history question correct twice in a row now.

While it looked like the quizmasters were ready to proceed to the average round, I tried to signal to the judges for a break. I really needed to go to the washroom. The board of judges declared a five-minute break before the average round at that point, and a lot of us went out of the auditorium.

Outside the auditorium, Sean was talking to me about how much he failed the oral round. I tell him his performance wasn't that bad. I go back to the auditorium and talk to Luke and Albert about the problems. We also talked about the contestant number thing.

Albert got the idea to write the contestant numbers at the back instead, which would allow the contestants to write the numbers before the question starts, making it easier to remember. I agree with him, and he suggests the idea to the board of judges, who in turn suggests it to the quizmasters.

The average round started and went by smoothly, since writing the contestant number on the back made things easier for everyone. There is not much to remark about this round, and it ended with Clyde at top score. Another five-minute break was called after the average round.

The difficult round is much of remark, however. There were only five questions, and true to its name, they were indeed very difficult. Andres was beast in the difficult round, solving three or four questions, making him the top scorer for the oral round. Quite amazing indeed.

4.5 Afternoon

The oral round officially ended at about 3:45 PM. One of the sponsors, C&E Publishing, had things to give away. So the quizmasters prepared a few

It's from this word we get the word obelisk. The mark ÷ was in fact used historically to mark dubious or suspected passages, but its use as a division sign is only relatively recent.

> A sampler: given that $100^2 + 1^2 =$ $65^2 + 76^2 = pq$, where p and q are primes, find p + q.

numbers.

questions for everyone to answer, and the person who'd answer it correctly would get the prize. Here goes:

- 1. At what point do the Celsius and Fahrenheit scales...
- 2. What is the old name of the city of Kaliningrad?
- 3. In the song 12 Days of Christmas...
- 4. A right triangle with integer side lengths has hypotenuse 2017. What is the length of the shorter leg?
- 5. In his book the Liber Abaci...
- 6. What is the smallest number equal to the sum of the cubes of its digits?
- This year, January 21 is a Saturday. When is the next year that January 21 will be a Saturday?
- 8. One percent of a certain population has a certain disease. For a person who has the disease, a certain screening procedure gives a positive result 99% of the time. For a person who does not have the disease, the same procedure gives a negative result 99% of the time. What is the probability a person has the disease, if the screening procedure gave a positive result?
- 9. Is it possible to represent 2017 using the digits 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, exactly once, in order, and adding any operations between the digits?
- 10. Who is the only female Fields medalist?
- 11. Explain the following sentence: may I have a large...

You might notice that the questions are cut-off. This is indeed the case, as the questions were answered before the rest of the question was read.

When the 2017 question was posed, Clyde immediately raised his hand. His answer was "yes". This was met to much amusement, as indeed, the question only asked if it was possible. The quizmasters asked for a construction, but no one could provide any, so they had to scrap the question. The rest of the questions were easily answered, however.

The quizmasters ran out of questions and there were still gifts to be given away. Vince started shouting "spare questions! Spare questions!" The quizmasters listened, and decided to use the spare questions for the giveaways.

1. How many real roots does $\frac{1}{3}x^4 + 5|x| = 7$ have?

The challenge of finding a construction is left to the reader as it is clear there exists one.

The answers: -40° , Konigsberg, 364, 792, Fibonacci, 153, 2023, 50%, yes, Maryam Mirzakhani, it's a mnemonic for pi.



Figure 18: "Yes."



Figure 19: Listening to the questions.

 Segments AP and AQ are tangent to a circle with center O at points P and Q, respectively. If E is on the circle such that QE is perpendicular to the diameter PD, which has length 4, and PE = 3.6, find the length of QE.

The first question was easily answered by Clyde. The second question stumped us for quite a while. I was working on the question in the back with Clyde, who used my hastily-drawn diagram for reference.

Lots of groups of people were working on the question. No one was really working alone. To this, the quizmasters remarked that they can "really see the spirit of collaboration". It made me miss the days of MOSC, when we would spend the whole day working on problems alone and then together, sharing ideas and stuff.

Eventually someone, I forgot who, managed to get the answer. The reason probably wasn't because they solved it, but because the quizmaster said whether each guess was higher or lower than the actual answer. It was a simple matter of binary searching and trial and error.

With that done, several people started to take pictures at the tarpaulin on-stage. I, however, had to do research. I approached Steven and started talking to him about the written round, and he shared with me how he solved the first problem and what he did for the second problem.

During this, Albert and Luke were showing to me their computations for determining the relative weights of the oral and written rounds. Apparently seven points in the written round is equivalent to 52.5 points in the oral round. Since I was doing the interview, I did not have time to analyze that statement at the moment, but now that I look back I think much can be said about this computation.

Also during the interview, my companions signalled to me to take a picture on-stage. However, it would be very rude indeed to leave Steven hanging. So I gestured to them that I would do so later.

The interview took a little bit longer than I originally anticipated however, and soon enough the auditorium was deserted. Steven didn't seem to mind, as if I recall correctly, his coach sir Ang was also there. In either case, we finished the interview.

My companions were still inside, and so was, apparently, kuya Russelle. We started talking about the oral questions, because some of them were definitely non-trivial. We also talked about some of the written round questions, which he apparently knows.

Ma'am Soriano wanted to take a picture, but sir De Jesus already left us, so I couldn't take it with my coach. Ma'am Imperial then became the official photographer because she had a real camera, and took a few pictures of us in front.

The answer, by the way, was 1.2.



Figure 20: Math people have a tendency to talk about math a lot.



Figure 21: Talking to kuya Russelle about math.

We then decided to go to SOLAIR, where the dinner would be held. It was quite a walk from NISMED, and it was good that kuya Russelle was there to accompany us, as we didn't know the directions.

He and I talked about various things. For starters, he shared how his favorite subjects were algebra and geometry, and that he liked combinatorics the least. I said that I noticed this, because he has never put a combinatorics problem in any of his handouts.

We also talk about campus life in UP. He apparently teaches three classes, and he doesn't have class on Saturday. He makes a remark about grading papers, and I ask him if there were a lot of students who forgot the binomial theorem. He is amused by this, which probably means there were.

He asks me where I would study for college. I tell him I'm still unsure, but UP was one of my choices. We talk about research interests, and it turns out that his adviser picked the topic of elliptic curves for his thesis. I tell him that I at least understood *some* of the words in his thesis. I tell him I'm more interested in combinatorics, and he refers me to sir Loquias.

Kuya Russelle urged me to study at UP. I tell him that if I do, I'll try my best to avoid the classes he teaches. He laughs at this, and says that I can probably just skip the units by taking an exam or something.

We arrive at SOLAIR at about 4:20 PM. I knew I had to do interviews for my research. Lots of people were there already, pretty much chilling before the dinner. Kyle was there, and he had to do interviews for his research too.

I approached Jinger and asked her if she was okay to do an interview. She consented, and we talked about the written stage. At first she was a bit reticient, but she started to share her thoughts during the written round to me after a few minutes.

I talked to Stefan afterward to interview him. He managed to solve problem one, and I listened to him describe how he did so. Establishing rapport with him earlier paid off.

The next person I talked to was Elijamin. I remember getting into a conversation with Elijamin about programming languages. We were talking about Python and the NOI. The NOI started accepting Python as the IOI started accepting Python, so he was kinda excited about that.

After that I interviewed Elijamin for my research. He had a lot to say. It was especially enlightening to listen to him talk about his thought process for the combinatorics problem, because Elijamin is renowned for being strong in combinatorics.

The rest of the people in the lobby were those I already interviewed, so I spent a few minutes just walking around. I managed to strike a conversation with Kirk and Manuel, who were sitting together. We talked about AOPS, and we talked about olympiad handouts.

This reminded me of sir (Gari) Chua, who also made a similar remark.

NOI is the National Olympiad in Informatics, the Philippine qualifier to the 101. We also talked about MOSC, and both of them were joining. Manuel said something about not having that many people to talk to, and I tell him that he'll find plenty of opportunities to talk to others during training. I remember saying, at this point, something along the lines of "if your goal is to have fun, you won't lose."

I managed to intercept Dion as he arrived. He was very dashing with his suit. I interviewed him for my research, and he said he also managed to solve problem one. He was self-effacing about it, not knowing how to describe how he solved the problem, so I didn't force him to.

During this time I also managed to talk to the older people, kuya Russelle, sir Chua, and kuya Nathanael. It was always fun to talk about math with them, because they would talk about stuff like the PMO's history and what college feels like. These were different topics compared to what I talk about with my contemporaries.

Kyle ambushed me and asked to interview me for his research. I agreed. The questions were about my study habits when it comes to math and about last year's MOSC. It was a short interview and it only took about seven minutes. Kyle asked me afterward if I would interview him, and I said I'd just do it online.

At this point Vince arrives and I ask if I can interview him. Since it was already about 5:40 PM, the dinner was about to start. So I told Vince that I'd get dressed first, then we'd do the interview.

Vince went in the washroom to get dressed too. Apparently there was only one open stall, and Vince went in that one, so I dressed up outside. I got my dress shirt out and folded my uniform.

As I was about to tie my necktie, Sean entered. He was going to get dressed as well. Sean talks to me about my research and I tell him that the results I've gathered so far are quite interesting. I tie my necktie and exit the washroom.

After this, I interview Vince about the problems. He was well-spoken about his ideas, though he had a bit of trouble articulating the motivation behind some of them. We were cut short by the fact that the program was about to start, so we both entered the SOLAIR auditorium.

4.6 Dinner

After registering, getting a copy of the program, and asking for my table number, I seat myself. There were two tables, but it looked like the other one didn't have any open seats. There was only one open seat in the other table, and it was between Farrell and Vince.

I later found out that the other stalls were in fact open, but the locks were broken so they looked like they were closed.



Figure 22: Josiah and DC stuck to each other for a large part of the program.

The program started shortly afterward with the usual invocation and national anthem. The usual speeches were also delivered, and I tried to listen to them. However, my seat was facing the back, which made it exceedingly difficult for me to pay attention to the speeches being given.

The first speech was delivered by sir (Jose Maria) Balmaceda, dean of UP's college of science. It referenced that the awarding ceremonies being held at SOLAIR was only appropriate, as it was the school of *labor*, and we could not have made it this far if it wasn't because of the labor of each person involved.

Another speech was supposed to be delivered by ma'am (Josette) Biyo. However, she was unable to attend the ceremonies because of a schedule conflict, like last year. Ma'am (Jumela) Sarmiento briefly introduced her, listing her several remarkable accomplishments, like winning ISEF and having a planet named after her. Her speech was delivered by her representative.

One of the most memorable remarks of the evening was delivered by her before she read the speech of ma'am Bijo. "I do not have the privelege of having a planet named after me." This was funny at the moment, however it is not funny when written down, and once again my attempt at humor is foiled by the medium of my presentation.

Then the dinner proper started. People stormed the buffet table. I remarked that I recall last year was more orderly, when people were called

It is not written in my previous report anyway, so I don't have proof.



Figure 23: Eating dinner, our table.



Figure 24: Eating dinner, their table.

to the buffet by table number. Xavier does not seem to remember this, and I doubt my memory.

Accompaniment was delivered by a gamelan group. They were named Kontra-GaPi, short for *Kontemporaryong Gamelan Pilipino*. I remark to Farrell that their genre does not seem to be folk, but folk crossover. I was right – they performed folk crossover music.

They had a truly remarkable performance. Two pieces were accompanied by dancing, and the movement was remarkably fluid, a blending of traditional and modern steps. The quality of the percussion was remarkable, and the melodies were progressive and elaborate. In other words, they were good. Really good.



Contemporary Philippine Gamelan. Gamelan is kinda like an orchestra.

Figure 25: Kontra-GaPi performing.

During the dinner, Vince was going around asking people to take his Chinese Proficiency Test, which is apparently part of Steven's research. Farrell took it and was very amused because he found it quite challenging. Clyde also took it. I'm willing to bet they speak Filipino better than they do Chinese, in either case.

Vince seemed to be taken with Dion and Andres, who were doing something on their phones. I see Andres smile a lot, which is relatively rare for him, so I take a picture. Although Andres does not have a total void of pictures of him smiling he doesn't smile a lot for pictures.

After the dinner and the wonderful intermission, certificates were awarded to the regional coordinators. The area stage winners were awarded and so were the medals to the national finalists. And certificates were awarded to the sponsors. After that, sir Eden gave a small report on the Philippine participation to last year's IMO. The most memorable thing he said was that after the awarding ceremonies, the Singapore(?) team went to the Philippine team and asked for a picture with them.

There are several pictures of him smiling, unlike certain people, coughs Kyle coughs And then the winners were announced. They were the reverse permutation of last year's winners, third was Farrell, second was Kyle, and first was Albert. This was only expected since Albert claimed a full solve in all the problems. Before he went up the stage, Albert even pretended that he wasn't expecting first place, which was cute.

Then lots and lots of pictures were taken, and closing remarks were given by ma'am (Marian) Roque, the director of the MSP. After that we took even more pictures, and then I went home, after having lots and lots of fun.

5 CLOSING

5.1 Comments



Figure 26: The only decent picture.

The PMO has started to shift in a new direction with this year, which is clearly evidenced by the much more difficult problems. This is something I like, something that most of us have talked about for several years now.

It is good that the problems have become harder. I no longer look at other national olympiads with a sense of shame for our country's olympiad, for indeed, the written phase of the national stage is on par with several olympiads of remark. This is an excellent direction for the PMO to pursue, and I hope there is more of this in the future.

It would still be interesting to see some changes, however. The qualifying round can fulfill its purpose of being accessible to the motivated, talented high school student without being straightforward for the more experienced competitors by including a variety of problem difficulties.

Indeed, the difficulty of the qualifying stage looks like a step function,

I try writing problems myself. It's tough.



Figure 27: Top: Farrell, Tayan, Stephan, Xavier, Elijamin, Albert, Steven, DC, Clyde, Manuel. Bottom: Vince, Andres, Dion, me, Jinger, Sedrick, Kyle, Sean, Josiah, Luke, Kirk.



Figure 28: The reverse permutation. Of course.

with a low standard deviation. I know that writing problems is a difficult process, but perhaps the difficulty distribution can be more spread out. A good example of this would be the AMC, either Australian or American, which are multiple choice questions from a variety of difficulties.

The area stage, however, can be made much more different. This year's area stage was found to be too difficult by most contestants. The difficulty distribution, especially for the first part, had a low standard deviation, making it more of a test of endurance rather than a test of ingenuity.

In the end, the process is intended to select for students who could perform well in the IMO, and while endurance is indeed an important problem-solving trait, in my opinion ingenuity is far more valued. For this reason, I would recommend reducing the number of problems for the area stage.

This is a controversial recommendation, but I would suggest reducing the number of short-answer problems to ten. This allows the problem-setters more time to come up with better problems, allows an easier balancing of problem difficulties, and places more emphasis on the open-response questions.

Once again, I would also suggest making the short-answer problems a variety of difficulties, and making the questions more olympiad-oriented. A good example of this would be the Canada Repêchage, if it was shortanswer. This would make the area stage questions feel less of a chore and more like problem solving.

I also think it would be nicer if the number of open-response questions was increased to four. I acknolwedge that this makes the difficult task of checking two hundred papers even more difficult. But I think adding an additional problem can help make the open-response more balanced, providing an opportunity to make them ACGN.

Once again, there should be a variety of difficulties: the easiest openresponse question should be about as difficult as a middle short-answer question, while the hardest can be as difficult as, say, a USAJMO problem one or two. Whatever the case, there should be overlap with the difficulty of the short-answer portion.

Both of these suggestions for the area stage in conjunction would make it ten questions short-answer, four questions open-response. I would also suggest making the short-answer questions four points each, which would make the total score for either portion forty points, reducing the emphasis on short-answer questions.

For the written phase I do not have much comments, except praise for being far better this year. Last year's exam was too easy, but this year's exam is challenging enough to be on par with other renowned olympiads. As with the other suggestions, however, I'd say that it would be better if

The idea of having a repêchage is also interesting, but that's another topic. the problems were more balanced in difficulty. However, better to err on the side of too difficult than too easy.

I will not make comments on the oral phase. I still think that the oral phase best serves its purpose when it is used to break ties for the written phase and when it is used to make the competition more engaging to spectate. I'll only say that the contestant numbers should definitely be sorted out.

I commend the test development committee this year for balancing problems from ACGN as evenly as possible. It is good that they are reversing the PMO's old trend of being focused more on algebra. It is also nice that the problems are far nicer and more varied than before.

Ah, and a personal reflection? I don't know. I've already reflected upon the PMO this year from a personal perspective and I am not inclined to place my thoughts here. All I hope is that things go well. I don't think the test development committee gets appreciated enough. They're doing good work.

5.2 Acknowledgements



Figure 29: These guys are neat.

To the PMO team – the problem-setters, the coordinators, the administrators, the proctors, the staff, everyone really – thank you so much. Logistically and mathematically the PMO went smoothly, as always, and such a huge effort is impossible without your work. Thank you for making the PMO better each year. You guys are awesome.

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Finally, I'm grateful to my contemporaries in the math community, for their company. You guys showed me that mathematics is anything but lonely. I've already mentioned you guys in the body of my report, but Navi, Michael, Brian and Ethan, if you're reading this by some off-chance, thanks too.

A A HISTORY OF THE PMO

[There seems to be only one documented account for the history of the PMO, which is circulated in the booklet given out every year. Finding this account unsatsifactory, I have chosen to do a little research into the history myself.]

The PMO began on 1984. The primary person who established the olympiad was Dr. Jose Marasigan, a professor at the Ateneo de Manila University. Four years later, in 1988, he lead the first Philippine team to the IMO. The team had five members: Guido David, Joseph Del Callar, Jerome Khohayting, Dennis Lee and Victor Luchangco. Luchangco won an honorable mention with a perfect score on problem five.

Under the Science Education Institute of the Department of Science and Technology, Dr. Marasigan established the Program of Excellence in Mathematics (PEM) a year later in 1989, the primary purpose being to train mathematically gifted high school students, but secondarily, to identify and prepare future IMO participants.

Since 2005, this program has been the sole project of the Ateneo Mathematics Department. As of today, PEM still goes on, albeit without the stated objective of preparing IMO participants.

Dr. Marasigan then lead the Philippine team to the IMO each year from 1988 to 2005. Khohayting won the country's first silver medal in 1989, and Wyant Chan won the first bronze medal in the next year. All-in-all, in this period, the Philippines won ten honorable mentions, six bronze medals and one silver medal.

[A note: I do not know much about the selection process during this period. I will look into this.]

In the year 2006, the PMO underwent a change to the olympiad as we know it today. As part of the change, no team was sent to the IMO for that year. The PMO restarted in 2007, under the leadership of Dr. Ian June Garces, the deputy leader at the time being Dr. Timothy Teng.

Since then the modern PMO has been held yearly, with a qualifying round, an area stage and a national stage. The leadership of the IMO team changed more regularly, about once every three years. In 2016, Kyle Dulay and Farrell Wu won the Philippines' first two gold medals. The year is also remarkable as the Philippines placed fourteenth out of all the countries, the first time the country has placed in the top twenty.

B THE PRIVATE-PUBLIC DISPARITY

[The following essay presents some hypotheses to explain the private–public disparity. It does not focus on providing evidence to show that this phenomenon exists. It is far from being one of my better essays. In fact, it is one of my worst. However, this is a reflective document after all. Not like anyone's going to read this.]

Introduction

A private–public disparity exists in competition mathematics. It is odd that, at aggregate levels, the average skill in public and private schools are the same; take the results for the National Achievement Tests. Yet when it comes to the extremes, the top private school students outperform the top public school students when it comes to math.

In results for intercollegiate competitions, in results for Metrobank-MTAP-DepEd-Competition, for international math competitions, and so on, private schools clearly dominate. Why does this happen?

The Philippine Mathematical Olympiad (PMO) is an example of this. Of the 57 unique national finalists from the past five years, 2013 to 2017, 43 are from private schools. Here's a breakdown:

- 43 from private schools. The distribution itself is interesting. Only five schools have at least three students in the list: Ateneo De Manila High School (4), Grace Christian College (6), Jubilee Christian Academy (3), Saint Jude Catholic School (9), St. Stephen's High School (3). This makes a total of 25 students coming from seven schools, with the other 18 students coming from 15 schools.
- 6 from public schools, all being science high schools except one. These were Makati Science High School (2), Mataas na Paaralang Neptali

A. Gonzales (1), Santa Rosa Science and Technology High School (1) and Valenzuela City School of Mathematics and Science (2).

• 8 from Philippine Science High School (Pisay), which defies all classification: it's de jure private, de facto public. Of these, six were from the main campus, one from the Region 1 campus and one from the Southern Mindanao campus.

If we are lenient and include Pisay as a public high school, only 14 out of the 57 are from public schools, a mere 25%. Yet, public school students are 80% of the high school students in the Philippines. What possible explanations can one offer for the missing expected 55%?

Now, such a phenomenon requires a good explanation. I will discuss the characteristics of a good hypothesis for this phenomenon. I will then present several hypotheses and discuss each of them briefly.

Such a hypothesis must explain why this effect only applies to highperforming students in mathematics, and not to the general population. Such a hypothesis must also be convincing enough to evade the strategystealing technique: it must be something that private school students uniquely have compared to public school students.

We first present two hypotheses relating to socio-economic status (SES). Although it is not true that everyone studying in private schools are upper class and everyone studying in public schools are lower class, it is arguable that, on average, high-performing private school students are of higher SES than high-performing public school students.

Access to resources

First: private school students have access to resources that public school students do not. It is arguable that since private school students are of a higher SES, they are able to buy books, pay people to help them study, pay for training and programs and so on. These are resources that students of a lower SES do not easily have.

An admitted weakness of this hypothesis is that it fails to explain why publicly available resources are not enough. Indeed, there are plenty of free resources available on the internet, and given the wide-ranging internet access that Filipinos enjoy, it cannot be said that public school students do not have access to good resources.

The only possible rebuttal is to say that the publicly available resources are worse in some aspect compared to other resources, but I find this doubtful based on ancedotal experience: most of the high-performing students I know get their resources online, through their own diligence.

Opportunities to join contests

Second: private school students have the opportunity to join more contests than public school students can. Consider the simple fact that joining most contests requires a registration fee, on top of expenses for transportation and food. This may be a trivial cost for someone from a higher SES, but not so for a student from a lower SES.

To give an anecdotal example, our school only sent one team to Sipnayan this year, compared to sending two teams last year, because of registration fees. Compare this to a student from a private school, who by virtue of being higher SES, would be able to join more competitions and thus gain more experience.

A more extreme example of this is are the contests through the Mathematics Trainers Guild (MTG). The MTG is a non-profit organization that trains students mathematically, often in preparation for an international contest. Such training requires money, which would again fall into the first hypothesis.

More than this, however, the MTG is arguably the primary way of entering an international mathematics competition. Again, while it is again debtable whether or not participation in international contests makes much of a difference, it is clear that these are opportunities that are unavailable to students from a lower SES.

A counterargument would be that contest experience only correlates with, and does not cause, competition mathematical skill. A similar counterargument would be that contest experience can be replaced by other kinds of experience.

I find these counterarguments doubtful: contest experience can help with skill in competition mathematics. Contest experience provides things that non-contest experience does not: the social aspect, the pressure to perform well, and so on. These are things which are not replicable in non-contest situations.

Higher family standards

Third: private school students have families with relatively higher standards compared to public school students. This is hard to quantify and back up, but I suppose that is a weakness of this hypothesis. Though there are several reasons why it can be said this is so.

There is a sense of the parents sending the message to their children to study hard because they are paying for the child's schooling. Sending a child to a private school already represents an investment into the child's education, which may indeed apply to other areas. Some anecdotal evidence I have collected supports this. Two colleagues of mine, both studying in private schools, relate that their parents constantly push them to perform well in mathematics competitions, citing reasons similar to the ones cited above. One of them also shared that other highperforming students in their school have the same kind of parents.

However, this falls prey to strategy-stealing: public school parents too can put pressure on their children to study hard precisely because they don't pay for their child's schooling. It works both ways. It works especially when we talk about public science high schools, which give the impression to students that they are getting quality education without paying directly for it.

Finally, I find this hypothesis untenable because the anecdotal evidence I have against it seems to be more than the evidence I have for it. While it is true that several of my friends have parents who push for them to perform well, I believe there are just as many whose parents take a more passive role. Family standards do indeed play a role in explaining competition performance, but I find it hard to think that it plays a big role in the larger scale of things.

Higher school standards

Fourth: private school students have a higher culture of excellence than public school students. This is debatable, and I will present several arguments as to why this hypothesis can hold water.

Private schools, firstly, are self-selecting. Most public schools do not discriminate between students in their admissions. Public science high schools are the exception rather than the rule; however this should also be a matter of concern given that most high-performing public school students in mathematics come from science high schools.

Private schools also have a bigger incentive to perform well in mathematics contests than public schools. While public schools do indeed have performance-based bonuses and like to place tarpaulins boasting of their students' achievements; I argue that private schools have even more incentive to do so.

When students from a private school enjoy success, the private school also enjoys the success. It is, in a sense, advertising. If we take an extremely simplistic view of the business model of a private school, in essence, the private school has more incentive to make their students perform better because this will lead to more admission, which will in turn lead to bigger profits. Public school students do not have the same business model.

Another reason why private schools tend to have a culture of excellence, perhaps, is due to having a system that encourages tradition. This would

also explain why only a number of schools account for three-fifth the PMO private school qualifiers: schools which have a long track record are further encouraged to make it longer. (This also works on the individual level, and can explain why some students have long track records.)

Public schools cannot easily do this because of the large amount of turnover. Often this is turnover due to promotion, from a temporary teacher to a permanent teacher, from a school coordinator to a division coordinator. As ancedotal evidence, during the past four years around half of the staff in my school have moved elsewhere.

Because of this large turnover, it is difficult to establish tradition, compared to private schools. Teachers in private schools tend to teach longer, giving them the bigger tendency to uphold tradition, especially so if it is a tradition of excellence.

There are possible counterarguments for this. I will present one from my own experience. Our school has had only one national qualifier before, Russelle Guadalupe, who is practically a legend in the school. His story is passed on, and despite the fact that only three teachers of the current math department have taught him directly, all of them know his story.

In the same sense, this story is passed on by the students, in the sense of an oral tradition being passed between generations. This has created the same expectation of excellence from our school's mathematics competitors. A possible rebuttal to this would be to argue that it is not as strong as that of private schools, which is indeed possible.

More school liberty

Fifth: private schools can take more liberties in training their students than public schools. This is a weaker hypothesis, I think. But it can perhaps play a role. Private schools can choose to be more lenient when it comes to schoolwork and curriculum design, compared to public schools which have to follow the standards set by the Department.

I will present some anecdotal evidence. In the old days of our school, at least half a decade ago, one section once had three mathematics courses in a single year. This section thus had many students who were *par excellence* in mathematics competitions, and it was a silver age in our school's achievements in mathematics.

A new curriculum came, however, and the school was reduced to having two courses a year, until another curriculum came and it eventually became one course. The more senior mathematics teachers still have qualms about this, and greatly missed the days when there were more math courses. (The students, however, have different reactions.) In contrast, I have heard many stories of students in private schools who had different curricula to accommodate their mathematical aptitude. It can be said that this is thus a factor, since private schools can adjust to the students' skills while public schools do not usually enjoy that capability.

Another factor related to this hypothesis, which might be of some controversy, is that private schools are more lenient when it comes to excusing students from schoolwork. I do not have much evidence for this, not even anecdotal ones. Having been a private school student during elementary and a public school student for high school has given me this impression, however.

Related to this, a colleague of mine has suggested that high-performing public school students tend to study in science high schools, which occupy the students with more requirements, therefore lessening the amount of time available for mathematics training. In another sense, he seems to suggest that public science schools tend to give more schoolwork that private schools, which is also a possibility.

Being a public science school student with friends from other science high schools and from private schools alike, I have done a few informal surveys into this matter. The consensus seems to be that science high schools seem to have more work than private schools, but only slightly more. This is skewed of course by the fact that the private schools my friends attend are high-performing ones, with a track record in mathematics competitions, and are thus more likely to give more work.

Conclusions

To wit, this essay has focused on providing possible explanations for the private–public disparity. Two ses-related hypotheses were given: private school students have more access to resources, and more opportunities to join contests. Three other hypotheses were also considered: higher family standards, higher school standards, and more school liberty.

It is indeed completely possible that a different factor is involved here. A colleague, for example, has pointed out that three-fourth of the private school students at the PMO are from Chinese schools, which is an interesting avenue to pursue. Other things can be discussed, such as gender and location. This is for a different essay in a different time.

Perhaps it is possible to encourage more high-performing students from public high schools if the above reasons are partially reversed. Contests can partially waive registration fees for public schools, the Department can be more lenient in the curriculum for science high schools, among others.

What is known, however, is that there is a private–public disparity, and steps can be taken to ameliorate this.