2016 年國際數學奧林匹克通訊 IMO 2016 NEWSLETTER

數聞 IMOment

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2016 年第五十七屆國際數學奧林匹克籌備委員會
Organising Committee of the 57th International Mathematical Olympiad 2016

2016 年第五十七屆
國際數學奧林匹克籌備委員會

香港將於 2016 年 7 月主辦第五十七屆國際數學奧林匹克（IMO），迎接來自超過 100 個國家和地區的中學生數學精英。希望《數聞》可在我們邁向 2016 年 IMO 期間帶動同學和公眾對數學的興趣，更希望這種氣氛歷久不衰。

歡迎讀者向《數聞》投稿。文章須為原著，以中文或英文寫成（或兩種文本兼備），長度為一至四頁（就一種語言而言），並以電郵附件方式傳送至 info@imohkc.org.hk，或郵寄至 九龍油麻地彌敦道 405 號九龍政府合署 4 樓 403 室 教育局數學教育組《數聞》編輯，標題為「Submission to IMOment」。

Hong Kong is proud to be hosting the brightest secondary school mathematics talents from over 100 countries and regions at the 57th International Mathematical Olympiad (IMO) in July 2016. We hope that IMOment will promote interest in mathematics among students and the public in this period leading up to IMO 2016, and beyond.

Readers are welcome to submit articles on mathematics and/or Mathematical Olympiad to IMOment. Submissions should be original, one to four pages in length in either Chinese or English (or both), and should be sent by attachment to an email to info@imohkc.org.hk, or be mailed to Mathematics Education Section, Rm. 403, Kowloon Government Offices, 405 Nathan Road, Yau Ma Tei, Kowloon, titled "Submission to IMOment."

Organising Committee of the 57th International Mathematical Olympiad 2016

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WWW.IMO2016.ORG

魔鬼細節
The Devil in the Detail

/羅家豪 LAW KA-HO

常言道「魔鬼在細節中」。學習數學時，我們固然知道必須著重細節，因為「不拘小節」往往會導致命題或證明不準確，甚至出現差之毫釐，謬之千里的情況。其實即使撇開數學課本，在日常生活中也有很多事例，讓我們體驗到「遊戲規則」的重要性。

As the saying goes, "the devil is in the detail". Attention to detail is as important in learning mathematics as in anything else, because negligence may lead to any consequences from imprecise statements to drastically wrong conclusions. In fact, even setting mathematics textbooks aside, there are plenty of examples in real life that show us the importance of the "rules of the game".

有看過足球比賽嗎？不少大型足球比賽（例如世界杯）都有「分組賽」階段，一般是由四隊同組以單循環方式對賽，每場勝方得 3 分，負方得 0 分，賽和則各得 1 分。例如，如果某組六場比賽結果如下：

Have you watched soccer? Many large soccer tournaments (such as the World Cup) involve a group stage, where (typically) a group of four teams play in a single round-robin schedule. The winner of each match gets 3 points and the loser gets 0 point. In the case of a tie, both teams get 1 point. For example, suppose the results of the six matches in a certain group are as follows:

例一 Example 1

紅隊 Red	0 : 1	黃隊 Yellow
藍隊 Blue	0 : 1	綠隊 Green
紅隊 Red	1 : 0	藍隊 Blue
黃隊 Yellow	1 : 0	綠隊 Green
紅隊 Red	2 : 0	綠隊 Green
黃隊 Yellow	0 : 2	藍隊 Blue

那麼，紅隊和黃隊各得 6 分，綠隊和藍隊則各得 3 分。同分時怎樣決定名次呢？一般有兩個做法：

Then both Red and Yellow have 6 points, while Green and Blue each has 3 points. How should the ranking be decided for teams with the same number of points? There are two common practices:

(1) 以得失球差決勝

在以上例子中，紅隊入 3 球失 1 球，得失球差為 +2，較黃隊的 0（入 2 球失 2 球）為佳，因此紅隊排第一而黃隊排第二。同理，藍隊壓過綠隊排第三。（註：如果得失球「差」相同，則得球較多者勝，例如入 3 球失 1 球較入 2 球失 0 球為佳。）

(1) By goal differences

In the above example, Red scored 3 goals and conceded 1, so their goal difference is +2, which is better than that of Yellow, namely 0 (since Yellow scored 2 goals and conceded 2). Hence Red rank 1st and Yellow rank 2nd. Similarly, we can find that Blue come in 3rd, ahead of Green. (Note: If two teams have the same goal difference, then the team with more goals is favoured. For example, scoring 3 goals and conceding 1 is better than scoring 2 and conceding 0 .)

(2) 以對賽成績決勝

在以上例子中，紅隊和黃隊同分，但兩隊對賽時由黃隊勝出，因此黃隊排第一而紅隊排第二。同理，綠隊壓過藍隊排第三。

(2) By the results from the matches between the teams in question

In the above example, Red and Yellow have the same number of points, but the match between them was won by Yellow, so Yellow rank 1st and Red rank 2nd. By the same token, Green rank 3rd, ahead of Blue.

當然，得失球差或對賽成績也可以相同，因此一般做法是「先計得失球差再計對賽成績」或「先計對賽成績再計得失球差」，事實上兩種方法都有大型比賽採用（例如 2014 年世界杯採用前者，2012 年歐洲國家杯則採用後者）。兩者都相同的話還有其他方法（本文假設是抽籤）。

Of course, there may still be ties under these two criteria, so the usual practice is to "first consider goal differences, and then consider the results from the matches between the teams in question" or the other way round. Indeed, both practices have been adopted by major competitions (e.g. the 2014 World Cup uses the former, while the 2012 UEFA Euro uses the latter). If both criteria leave ties, there are still other ways to rank the teams (which we take to be drawing lots).

從例一可見，一個看來毫不起眼的小改動（先計得失球差還是先計對賽成績），會令結果截然不同。當然，有人會認為「先計哪一項也不重要，只要規則寫得清清楚楚便行了」。然而以上的規則是否足夠清楚呢？再看看以下例子，並假設先計對賽成績再計得失球差：

We can see from Example 1 that a seemingly unimportant change (about which of the two criteria to consider first) ends up producing starkly different results. Admittedly, some may contend that it does not matter which criterion we consider first as long as the rules are clearly stated. But are the above rules sufficiently clear? Let us look at another scenario, and assume that we first consider the results from the matches between the teams in question.

例二 Example 2

紅隊	Red	0 : 2	黃隊	Yellow
藍隊	Blue	1 : 0	綠隊	Green
紅隊	Red	1 : 0	藍隊	Blue
黃隊	Yellow	1 : 0	綠隊	Green
紅隊	Red	0 : 1	綠隊	Green
黃隊	Yellow	1 : 0	藍隊	Blue

這時，各隊的成績如下：

Now, the results of the teams are as follows:

隊伍 Team	得分 Points	入球 Goals scored	失球 Goals conceded	得失球差 Goal difference
黃隊 Yellow	9	4	0	+4
綠隊 Green	3	1	2	–1
藍隊 Blue	3	1	2	–1
紅隊 Red	3	1	3	–2

顯然，黃隊獲得第一名，另外三隊同分，要計算對賽成績。但三隊的對賽成績是相同的（紅隊勝藍隊 1 : 0、藍隊勝綠隊 1 : 0、綠隊勝紅隊 1 : 0），因此要再計算得失球差。因為紅隊的得失球差是 –2，比另外兩隊的 –1 差，故此敬陪末席。

Obviously, Yellow are 1st in the group. The other three teams have the same number of points, and we need to consider the results from the matches between them. Yet the three teams achieved identical results from these matches (as Red beat Blue by 1:0, Blue beat Green by 1 : 0 and Green beat Red by 1 : 0), so we have to proceed to goal difference considerations. Since Red have a goal difference of –2, which is worse than those of the other two teams (both –1), it follows that Red ranks at the bottom.

綠隊和藍隊呢？兩隊的領隊提出了截然不同的看法：

How about Green and Blue? Their managers propose squarely different views:

綠隊領隊：「我們和藍隊同樣是入 1 球失 2 球，根據賽例，當得失球也相同時需要抽籤決定二、三名。」

Green's manager: "Blue and us both scored 1 goal and conceded 2. According to the rules, we should draw lots."

藍隊領隊：「現在綠隊和藍隊角逐二、三名，而我們曾經以 1 : 0 擊敗綠隊，因此我們的對賽成績佔優，故此應該是我們排第二，綠隊排第三。」

Blue's manager: "Now Green and us are contending for the 2nd place. Since we beat Green by 1 : 0 we have a superior result from the match between the two teams, so we should rank 2nd and Green should rank 3rd."

你認為誰是誰非呢？為甚麼會出現兩種不同的看法？規則不是已經很清楚嗎？

Who do you think is right? Why are there two different views? Aren't the rules already very clear?

如果「先計得失球差再計對賽成績」，也會出現類似問題，例如可以考慮以下情況：

In the case that we first consider goal differences, we may also run into similar problems. Take the following situation as an example:

例三 Example 3

紅隊	Red	1 : 2	黃隊	Yellow
藍隊	Blue	2 : 0	綠隊	Green
紅隊	Red	2 : 1	藍隊	Blue
黃隊	Yellow	4 : 0	綠隊	Green
紅隊	Red	0 : 3	綠隊	Green
黃隊	Yellow	4 : 0	藍隊	Blue

大家不妨計算一下各隊的得分和得失球差，然後嘗試從不同領隊的角度，看看會否得出像例二般的不同結論！（詳見本期「挑戰園地」。）

Readers may wish to compute the points obtained by the teams, as well as their goal differences, and then try to see if different conclusions can be obtained from different managers' perspectives (as in Example 2)! (See the Challenge Corner in this issue for more.)

從以上各例子可見，清晰而無歧義的規則非常重要，而規則經常主宰遊戲的結果。除了足球比賽，日常生活中也有很多其他相關的例子，這裡再舉出兩個：

The above examples demonstrate the importance of clear and unambiguous rules, and how rules often determine the outcomes of games. Apart from soccer, there are many related examples in real life, two of which being:

- 在數學比賽中，如何處理同分的參賽者？各個比賽有不同的做法。國際數學奧林匹克（IMO）的金、銀、銅牌是採用「同分者同獎」的原則的，好處是不必區分得分相同的參賽者，但壞處是得獎者的數目無法控制，可能出現太多或太少的情況。至於亞太區數學奧林匹克（APMO）的獎項則設有限額（例如每個國家或地區最多只有一個金獎），同分時必須按特定規則判定相對優劣（一般而言，來自一道完整題解的分數比來自多道題目的部份分數為佳）。

- In mathematical competitions, how do we handle contestants with the same total scores? The practice differs from competition to competition. The International Mathematical Olympiad (IMO) adopts the "same score, same medal" principle, with the advantage of not having to differentiate contestants who have the same score. The disadvantage, however, is the difficulty in managing the number of medalists, possibly resulting in too many or too few. On the other hand, the Asian Pacific Mathematics Olympiad (APMO) imposes a quota for each prize (e.g. every country or region can have at most one gold awardee), and in the case of equal scores, the tie is broken using specific rules (e.g. a contestant who solves a problem completely are generally preferred over a contestant who gathers partial credits from different problems).

• 在某個音樂頒獎典禮中，賽會讓現場觀眾一人一票選出最受歡迎歌手。兩大熱門分別是一對二人組合和另一位歌手，以前者支持度較高。正當大家以為二人組合將會勝出時，觀眾發現選票上二人組合被分成兩項，每位成員各佔一項。在每人只有一票的情況下，二人組合支持者的選票在兩位成員之間平分了，結果另一位歌手爆冷勝出。

大家還有更多例子嗎？

在學習數學時，大家都學會著重細節。儘管覺得課本中的定義和定理寫得非常冗長，但我們知道正是這樣才能確保數學理論的嚴謹性，才能趕走細節中的「魔鬼」！原來我們從數學課本帶到日常生活中的，還不只數學知識呢！

• In the prize presentation ceremony of a certain music contest, the organisers let the studio audience select the "Favourite Singer" in a "one person, one vote" fashion. The two top choices are a duo and an individual singer, the former being more popular. Everybody expected the duo to win, only to discover that the duo was listed as two separate options on the ballot (i.e. each member of the duo being one option). As every member of the audience only had one vote, the votes for the duo were shared between the two members. Consequently, the other singer won in a somewhat unexpected way.

Do readers have more examples in mind?

When we learn mathematics, we are trained to pay attention to logical details. We sometimes find definitions and theorems in textbooks to be long and tedious. But only so can we ensure the rigour of mathematical theory and exorcise the devil in the detail! This is something from the textbook other than the mathematics that will be useful in real life.

背景圖片來源 / Background Photo Source: http://euler.slu.edu/escher/index.php/

密鋪萬花筒
A Kaleidoscope into Tessellations

/李瑩 CASSANDRA LEE YIENG
香港中文大學 The Chinese University of Hong Kong

「對我來說，【自己某作品】到底屬於數學還是藝術的範疇，仍然是個疑問。」

- M. C. 艾雪（又譯：埃舍爾、艾薛爾），《平面規則分割》（1958）

有甚麼圖形可以覆蓋平面——譬如這頁雜誌——而既不重疊，又不留空隙呢？簡單而言，以相同的圖形鋪排整頁（等邊圖形為佳）但不交疊的鋪排過程稱為「鑲嵌」，平面鑲嵌又名「密鋪」。

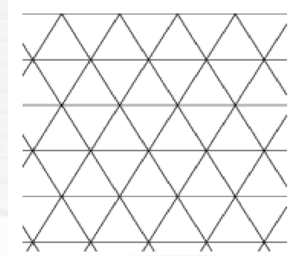
"For me, it remains an open question whether [a certain work of mine] pertains to the realm of mathematics or to that of art."

–M. C. Escher, The Regular Division of the Plane (1958)

What shapes can you use to cover a flat surface – like this magazine page – without overlap or gaps? To make things simple, we intend to cover the entire page with the same shape, preferably with equal sides, without overlap. This special covering process is called "tessellation".

有人提到三角形嗎？首先是等邊三角形的密鋪：

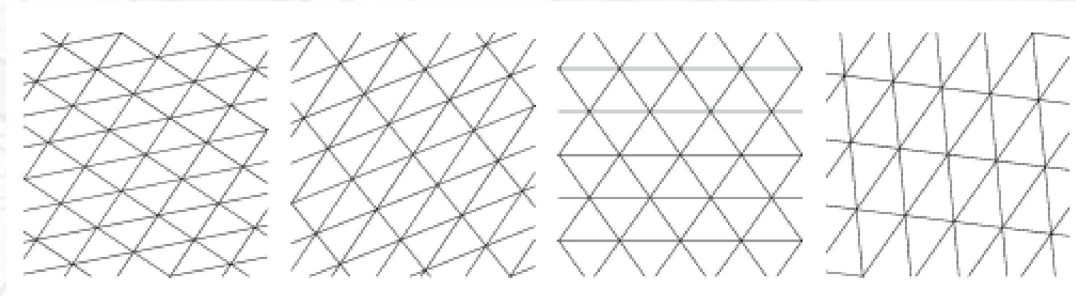
Did I hear anyone say "triangles"? Let's try with equilateral ones first:



圖片來源 / Source：
http://mathworld.wolfram.com/images/eps-gif/TriangularGrid_700.gif

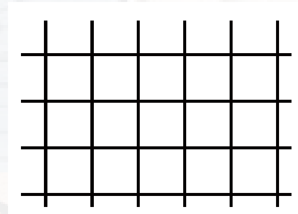
然後可以當作橡膠般把等邊三角形拉開：

Then try stretching these triangles like rubber:



好的。正方形呢？

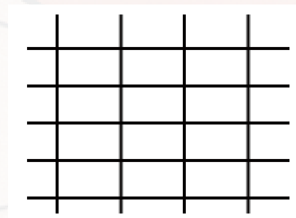
Good. How about squares?



圖片來源 / Source：
http://euler.slu.edu/escher/upload/thumb/3/38/Regular-squares.svg/175px-Regular-squares.svg.png

長方形呢？

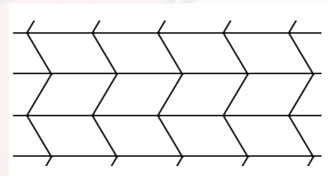
Rectangles?



圖片來源 / Source：
http://euler.slu.edu/escher/upload/thumb/e/ee/Rectangles-tiling.svg/204px-Rectangles-tiling.svg.png

平行四邊形呢？

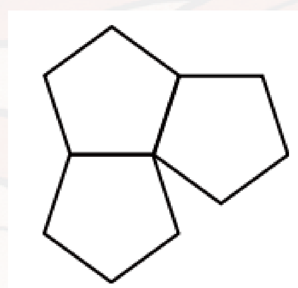
Parallelograms?



圖片來源 / Source：
http://euler.slu.edu/escher/upload/thumb/6/65/Tess-parallelograms.svg/377px-Tess-parallelograms.svg.png

也可以嘗試五邊形密鋪，例如正五邊形：

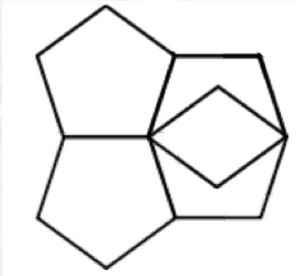
We could try five-sided polygons, like regular pentagons.



圖片來源 / Source：
http://euler.slu.edu/escher/upload/thumb/d/d5/Regular-pentagon-fail2.svg/144px-Regular-pentagon-fail2.svg.png

哎呀。我們不能再插入另一個正五邊形。硬來就會有重疊了：

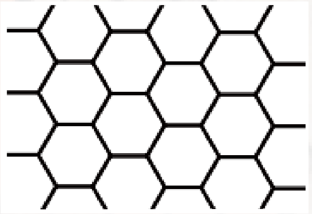
Oops. We can't insert another regular pentagon in there. Forcing the insertion results in an illegal overlap:



圖片來源 / Source：
同上，經作者修改 / Ibid, modified by author.

六邊形呢？這是正六邊形的密鋪：

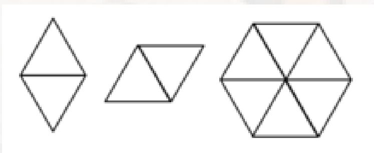
Six? This is a regular hexagonal tiling:



圖片來源 / Source：
http://euler.slu.edu/escher/upload/thumb/5/50/Regular-hexagons.svg/175px-Regular-hexagons.svg.png

這種密鋪像蜂巢。你們有否察覺這裏每個六邊形可細分成菱形，而又可以再分成等邊三角形呢？

That looks like a honeycomb. Did you just realize that you could subdivide each hexagon into rhombi, and in turn, into equilateral triangles?



圖片來源 / Source：
https://upload.wikimedia.org/wikipedia/en/thumb/2/27/HexDiaRhom.png/220px-HexDiaRhom.png

除非我們證明了可以密鋪的正多邊形只有等邊三角形、正方形及正六邊形，我們還要考慮正七邊形、正八邊形、......、正 n 邊形，其中 n 是自然數。我們可怎麼辦呢？

We should have continued with regular seven-, eight-, ... and n-sided polygons, n being a natural number, unless we can show that equilateral triangles, squares and regular hexagons are the only regular polygons that can tessellate the plane. How can we justify that?

試想想，360° 是環繞一點的周角。要密鋪的圖形在每個交點整齊吻合，圖形的內角必須是 360° 的因數。正 n 邊形的內角為

$$\frac{(n-2)180^\circ}{n}$$

Recall that 360° makes a circular revolution around a point. To have the tiles fit neatly around each point, the interior angles of the tiles must be a divisor of 360°. The interior angle of a regular n-gon is

$$\frac{(n-2)180^\circ}{n}$$

因此，我們要找出 $n > 2$，使得

Therefore, we need to find $n > 2$ such that

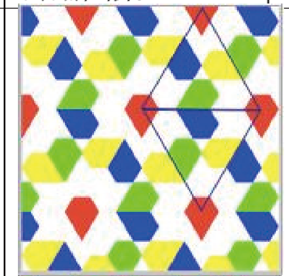
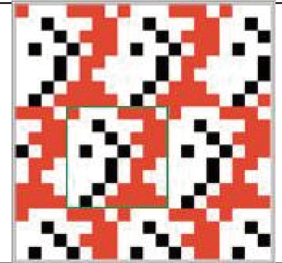
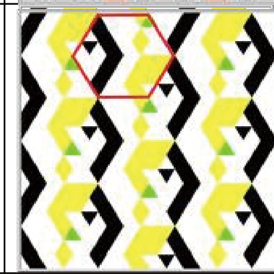
$$\frac{360^\circ}{\frac{(n-2)180^\circ}{n}} = \frac{2n}{n-2} = 2 + \frac{4}{n-2}$$

是整數。顯然，$n-2$ 要給 4 整除，所以 $n-2 = 1, 2$ 或 4。於是 $n = 3, 4$ 或 6。綜上所述，只有 $n = 3, 4$ 或 6 的正 n 邊形才可以密鋪。

is an integer. Clearly, $n-2$ has to be divisible by 4, so $n-2 = 1, 2$ or 4. It follows that $n = 3, 4$ or 6. In conclusion, only the regular n-gons for which $n = 3, 4$ or 6 can tessellate the plane.

用平移、鏡射和旋轉等方式更改了上述圖形的邊界，便可產生各式各樣的圖案：

We can modify the boundaries of these tiles by throwing in translation, reflection and rotation to produce different patterns as follows:

n	密鋪磚塊（描述）Tile (description)	密鋪圖案 Tessellation pattern
3	 （兩個稍微不同的三角磚塊合併成為菱形。）(Two slightly different triangular tiles join to form a rhombus.)	
4		
6		

這些圖案製作自 / This graphics were generated by：
http://gwydir.demon.co.uk/jo/tess/tess.htm

看似傻瓜的密鋪練習，文首引述的畫家M. C. 艾雪卻發揮得淋漓盡致，正正就是做此「傻」事一舉成名了。他創造的新圖案收藏於 1958 年著作《平面規則分割》。我們可以瀏覽以下的網址，欣賞他受版權保護的畫作：

This looks like a silly exercise, you may think. Yet M.C. Escher, the artist quoted in the beginning of this essay, shot to fame for precisely doing this "silly" thing. He collected his new patterns in his 1958 book The Regular Division of the Plane. We may appreciate some of these copyrighted drawings at

http://euler.slu.edu/escher/index.php/Regular_Division_of_the_Plane_Drawings

然而艾雪並不停留於平面鑲嵌，反像足球那樣繼續滾！足球上有甚麼多邊形？還不是五邊形和六邊形嗎？

However, Escher did not stop at planar tessellations. He rolled on like a football! What polygons can you find on a football? Pentagons and hexagons, right?

注意，這並非鑲嵌球面唯一的方法——另一個方法是把球面切割成等邊三角形。艾雪曾鑲嵌過球面幾何及雙曲幾何的曲面，這些幾何曲面的弧度與平面不同。

Mind you, this isn't the only way to tessellate a sphere – an alternative is to cut up the spherical surface into equilateral triangles. Escher is known for having tessellated spherical and hyperbolic geometries, which have different curvatures from the plane.

已故數學大師約翰．納什說過：「即使不是數學家，也可有數字的觸覺。」雖然艾雪讀書時暗室求物，也沒有數學訓練，可是他的作品得以傳世，正好提醒我們數學直覺是與生俱來的。數學的應用與日俱增，能加快電子運算，更能解決心理學、經濟學等偏重人文的社會科學中的問題。有見及此，這個直覺更加不可或缺。

The late John F. Nash, Jr. once said, "You don't have to be a mathematician to have a feel for numbers." Even though Escher struggled in school and had almost no mathematical training, his works survive today to remind us of our inborn mathematical sense that will prove crucial in the years to come, seeing that mathematics is used to speed up computations, and that even problems in humanities-inclined social sciences such as psychology and economics are solved using mathematics

徐徐回望 IMO
An IMO in Retrospect

/張偉霖 WILLIAM CHEUNG WAI-LAM

2015 年國際數學奧林匹克香港代表隊成員
International Mathematical Olympiad 2015 Hong Kong team member

2015年國際數學奧林匹克（IMO）在泰國清邁舉行，事隔五年再次回到亞洲，雖然本年失去了不少 2014 年在南非首次參加的非洲國家參與 IMO，但也因亞洲較方便，吸引了不少前一年沒有參加的國家參加，參與的國家數及人數不跌反升，創歷屆新高。

我們於 7 月 8 日清晨出發，乘搭 3 小時飛機到泰國首都曼谷，再乘搭 1 小時內陸機到主辦地清邁。到達清邁國際機場後，如前一年 IMO 一樣，都會在機場遇到其他國家隊伍，並在機場認識當地嚮導 Ben。

跟前一年不同的是，今年住宿的地方不是大學宿舍，而是被安排住到處於清邁蓮花酒店，清邁蓮花酒店位處市中心，附近都是熱鬧的街道，這使我們感受到泰國的文化特色。

在兩天共 9 小時的比賽中，根據前一年的經驗，我明白到只有盡快完成每天的首題才是上策，否則便沒有足夠時間去嘗試後面的題目。可是，在第一天的比賽中，首題卻是我最弱的組合幾何題，而我懷著着急的心情，想要盡快的把題目做出來。可是，在嘗試了一番後我仍是無處入手，這時我不禁慌張起來。

The 2015 International Mathematical Olympiad (IMO) was held in Chiang Mai, Thailand, returning to Asia after five years. Although quite a number of African teams that took part in IMO 2014 in South Africa could not make it to IMO 2015, there were also some new teams that joined IMO 2015, presumably due to its relatively convenient location. As a result, not only did the number of participants not decrease, but it actually attained a record high.

We embarked at dawn on July 8 and took a 3-hour flight to the Thai capital Bangkok before a 1-hour domestic flight took us to the host city Chiang Mai. Like in the previous year, we met other countries' teams at the airport, as well as our local guide, Ben.

What differed from IMO 2014, though, was that at IMO 2015 we were accommodated in a hotel – Lotus Hotel – rather than university dormitories. The Lotus Hotel is situated in the busy downtown, immersing us in an atmosphere of Thai culture.

Then came the two days of contest, which totaled 9 hours. From my IMO 2014 experience I learned how vital it is to solve the first problem of each day swiftly – otherwise, there wouldn't be enough time to tackle the other problems! However, the first problem on day 1 of the contest turned out to be in geometry, my weakest area. I anxiously attacked that problem, hoping to get it out of the way as soon as possible. But without making a dent in the problem after some attempts, I began to panic.

由於思路而已經被自己的慌張所堵塞，再想下去也是徒勞無功。於是，我便轉戰第二題，讓自己的思考轉一下方向，看看會不會有新的靈感。而在完成第二題，我把答案檢查了一次，認為沒有甚麼大問題，便急不及待的回到第一題。由於思維的改變使我對於第一題有了一些想法，而我把這些想法拼湊起來想要把問題解決，但仍然差了一點點，這時我看看時間，只剩下半小時，這使我焦急起來，可是到了最後我仍是無法完成這道題。而在比賽完結後，在與隊友們的討論當中，我才發現原來我的解題中欠缺的部分正正就是我一開始直觀上以為是錯誤的想法。這使我明白到欲速則不達，有很多我們直觀上以為是錯的東西，其實可能是對的，對於任何我們不確定的東西，我們都應小心求證，而不應急於下判斷。

是次泰國之旅對我來說十分特別，不但是因為我首次踏足泰國，能夠見識泰國的文化特色，而且代表香港參戰 IMO 是一次十分難得的機會。藉着這次比賽，我更可以認識到來自世界各地的不同選手，不分膚色，不分國界，互相切磋，以數會友。

在這次旅程，泰國大會的安排十分特別，無論是開幕禮及閉幕禮的設計、賽後活動，以及觀光活動，都令人耳目一新。在開幕禮裡，大會更安排了泰國公主作為主禮嘉賓，由此可看出泰國當局對這次整個比賽及活動流程的重視。而在比賽後，大會安排了我們參觀泰國的大象園，我們在香港很少能夠接觸到這種動物，這是十分難得的機會，而大象們高超的畫功及足球技巧更是使我們讚嘆不已。而當地嚮導 Ben 的熱情招待更是使我們感動不已。而她也教了我們相當多的泰國文化知識，使我們對泰國的認識加深不少，而 "เงาะ" (紅毛丹/毛荔枝) 這個特別的泰國字及七人在泰國的一點一滴更是記憶猶新。

The panic in turn clogged my mind and made it difficult for me to continue with that problem. So, I switched gears and turned to problem 2, in search of new inspirations. Indeed I successfully solved problem 2 and double-checked to make sure my solution was unmistakable. Having taken a break from problem 1, I suddenly had some new ideas for it. I tried to put the pieces together and complete the proof, but one piece still seemed to be missing. The clock ticked on and only half an hour was left. Panic again pervaded my mind. In the end, I was unable to solve problem 1 during the contest, but when discussing with my teammates afterwards, it occurred to me that the key to the solution is precisely an idea that I dismissed early in the contest! This story taught me that haste makes waste. An idea that intuitively appears to be wrong may turn out to be right. Anything we are uncertain about, we should check carefully instead of judging prematurely.

This journey to Thailand was special to me, not only because it was the first time I set foot on Thailand, and tasted Thai culture, but also because of the exposure to Thai culture, and because of how precious an opportunity it was to represent Hong Kong at the IMO. Through the IMO, I got to know participants from different countries and different backgrounds. Our exchange has been fruitful and our friendship will be lasting.

The opening and closing ceremonies, the post-exam activities and the excursions have all been thoughtfully planned by the organizers. The fact that the Thai Princess served as the guest of honor at the opening ceremony reflects the importance that the Thai administration attached to this event. After the contest, we were brought to the Elephant Garden. For us living in Hong Kong, seeing elephants is a rare opportunity. We were totally amazed by the elephants' masterful painting and soccer skills. We were also moved by the warm hospitality of our local guide Ben. She taught us a lot of knowledge about Thai culture and enabled us to know the country much better. Particularly memorable was the special Thai word "เงาะ" (meaning rambutan, a kind of fruit) as well as every happy moment we spent at IMO 2015 in Thailand.

笑一笑 Laugh Out Loud

挑戰園地 Challenge Corner

過往挑戰園地的解答及得獎名單，可見:
For the solutions and list of awardees of the Challenge Corner of the past issues, please see:
http://www.edb.gov.hk/tc/curriculum-development/kla/ma/IMO/IMOment.html

1. 任何足球陣式由 x 個後衛、y 個中場、z 個前鋒組成，其中 x、y、z 為非負整數，且後衛、中場、前鋒的總數為 10。例如 $(x,y,z)=(4,4,2)$ 和 $(x,y,z)=(10,0,0)$ 均為足球陣式，但 $(x,y,z)=(3.5,6,0.5)$ 和 $(x,y,z)=(4,4,1)$ 則不是。問共有多少個可能的足球陣式？

Any soccer formation consists of x defenders, y midfielders and z forwards for some non-negative integers x, y and z, such that the total number of defenders, midfielders and forwards is 10. For example, $(x,y,z)=(4,4,2)$ and $(x,y,z)=(10,0,0)$ are soccer formations, but $(x,y,z)=(3.5,6,0.5)$ and $(x,y,z)=(4,4,1)$ are not. How many possible soccer formations are there?

2. 見本期文章《魔鬼細節》中的例三。試以不同方式應用規則，得出關於各隊排名的不同結論。

Refer to Example 3 in the article on The Devil in the Detail in the current issue. Try to obtain different conclusions about the ranking of the teams through different applications of the rules.

3. 已知一個三角形的三邊邊長之積為 480、外接圓半徑為 5，求其面積。

Given that the product of the lengths of the three sides of a triangle is 480 and its circumradius is of length 5, find its area.

4. 求證對於任何正實數 a、b、c，以下不等式成立：

Prove that for any positive real numbers a, b and c, we have the following inequality:

$$\frac{a}{b+c}+\frac{b}{c+a}+\frac{c}{a+b}\geq\frac{3}{2}$$

歡迎香港中學生讀者電郵至 info@imohkc.org.hk 提交解答（包括證明），並於電郵中列明學生中英文姓名、學校中英文名稱及學生班級。每一名學生只可發送一份電郵。首 20名 答對最多題目的同學將獲贈紀念品，但每間學校最多有 3 名同學得獎。解答可以中文或英文提交。打字及掃描文件皆可接受。得獎者將於下一期公布。2016 年第五十七屆國際數學奧林匹克籌備委員會對本活動安排有最終決定權。如有疑問，可電郵至 info@imohkc.org.hk 查詢。

Hong Kong secondary school student readers are welcome to submit solutions (with proofs) via email to info@imohkc.org.hk, specifying the student's name in Chinese and in English, the school's name in Chinese and in English, and the student's class in the email. Each student may send at most one email. Souvenirs will be awarded to the first 20 students solving the most questions on the condition that each school can have at most 3 awardees. Solutions can be submitted in Chinese or English. Both typed and scanned files are acceptable. The awardees will be announced in the next issue. The decision of the Organising Committee of the 57th International Mathematical Olympiad on any matter of this activity is final. Enquiries may be emailed to info@imohkc.org.hk.