MAA MathFest 2018 – MaPP Challenge DEMO

Mathematical Puzzle Programs

Part I

Player Handout

MAA MathFest 2018 - MaPP Challenge DEMO

About & How to Play

About MaPP

Thanks so much for your interest in **Mathematical Puzzle Programs**! Rather than just tell you what we're about, we thought you'd like to experience the fun mathematical problem-solving for yourself.

The demo you'll experience in this workshop is a shortened version of our MaPP Challenge puzzlehunt for 7th-12th grade students, including puzzles that expose these students to concepts based on knot theory, combinatorics, and axiomatic systems. After trying it for yourself, we hope you'll be interested in partnering with us to bring this fun mathematical experience to your own community. If so, be sure to chat with one of the MaPP directors before you go or email us at `info@mappmath.org`!

Teams

We will organize participants into teams of roughly 2-4 players each. You will complete a walk-around opening puzzle, followed by four puzzles designed to be completed together at a table.

The actual game is designed to support teams of 4-8 students each. Students are usually provided a classroom where they can openly collaborate with each other.

ClueKeeper app

We use the ClueKeeper app make playing (and running!) our mathematical puzzlehunts a breeze. None of the puzzles printed in this packet can be solved alone, but as players progress through the game, the ClueKeeper app delivers information required to reveal their hidden meanings.

One member of your team should do the following:

- Download the app on your iOS or Android device at ⟨`http://cluekeeper.com`⟩.

- Open the app, connect it with a Google account (or play as a guest), tap "Enter Hunt Code", and enter a six-character code provided by a MaPP director.

- Optionally, other members of the team can also install the app and connect it with a Google account. The user who entered the Hunt Code into their app can add these additional teammates using the menu in the corner of the app.

When your team is ready, use the code **DEMO** to start the game!
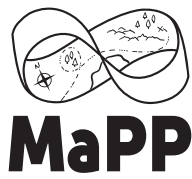
MaPP Challenge '18 - Gotta Solve 'Em All
Code Sheet

Letter	Decimal	Binary	Morse Code	Braille	Pig Pen	ROT13
A	1	00001	·—		⌐	N
B	2	00010	—···		⊔	O
C	3	00011	—·—·		∟	P
D	4	00100	—··		⌐	Q
E	5	00101	·		⌐	R
F	6	00110	··—·		⊏	S
G	7	00111	——·		⌐	T
H	8	01000	····		⊓	U
I	9	01001	··		⌐	V
J	10	01010	·———		⌐	W
K	11	01011	—·—		⊔	X
L	12	01100	·—··		⌐	Y
M	13	01101	——		⊐	Z
N	14	01110	—·		⊡	A
O	15	01111	———		⊏	B
P	16	10000	·——·		⌐	C
Q	17	10001	——·—		⊓	D
R	18	10010	·—·		⌐	E
S	19	10011	···		∨	F
T	20	10100	—		>	G
U	21	10101	··—		<	H
V	22	10110	···—		∧	I
W	23	10111	·——		∨	J
X	24	11000	—··—		>	K
Y	25	11001	—·——		<	L
Z	26	11010	——··		∧	M

Knot True

Tournament Results

	Ash	Brock	Cynthia	Drayden	Erika	Flannery
1st	O	Y	G	U	S	J
2nd	Q	C	M	V	A	X
3rd	F	P	U	N	I	E
4th	L	A	S	I	D	T
5th	K	N	B	Z	T	R
6th	H	R	W	E	L	M

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When Push Comes to Shove
Warehouse Specifications

Warehouse 1:

- Stack either 2 boxes or 6 boxes against a wall.

- Stack 12 boxes against a wall such that every row contains an odd number.

- Stack 8 boxes against a wall such that every row contains less than eight.

- Stack 0, 1, 2, 3, 4 or 5 boxes against a wall.

- Stack 4 boxes against a wall.

Warehouse 2:

- Stack 8 boxes against a wall such that every row contains less than seven.

- Stack 13 boxes against a wall such that every row has less boxes than the row below it.

- Stack 42 boxes against a wall in a single row.

- Stack either 1 box or 12 boxes such that every row must have a unique number of boxes.

1. MANKAY

6. ~~EEVOL~~

It seems there's no way
to construct this name
using the Rater's rules...

11. AERODYCTL

2. ULTRAMON

7. NOHTYP

12. EWE

A (Rule 0)
→ E (Rule 5)
→ EEEEEEEE (Rule 2, three times)
→ EEEEEEEEW (Rule 1)
→ EWEWW (Rule 3, twice)
→ EWE (Rule 4)

3. OMASTARE

A (Rule 0)
→ AAAAAAAAAAAAAAAA (Rule 2, four times)
→ AMASTARA (Rule 3, four times)
→ OMASTARE (Rule 5)

8. SLIQUID

13. PARACENT

4. VOLTEON

9. ICHU

14. DRAGONAT

5. GENGASKHAN

10. KADABARA

15. RAGMAR
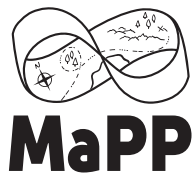
Cross Product
Odd Scroll

```
I  J  C  B  R  K  Y  W  R  O  K
L  I  L  Q  G  C  J  T  A  Y  H
A  D  O  A  R  Y  I  R  N  J  D
B  O  H  U  E  E  O  M  G  X  B
I  G  O  A  E  C  N  A  T  L  P
Z  Q  C  Q  P  H  T  Z  I  G  T
Y  A  P  O  F  E  M  A  G  Q  T
G  M  W  T  M  G  C  A  I  Q  K
O  D  G  G  L  Z  B  F  H  V  S
E  A  D  N  E  U  D  X  L  A  Q
W  K  Z  U  A  Y  E  F  N  J  W
```
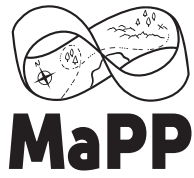
Blind Luck

Strange Tilework
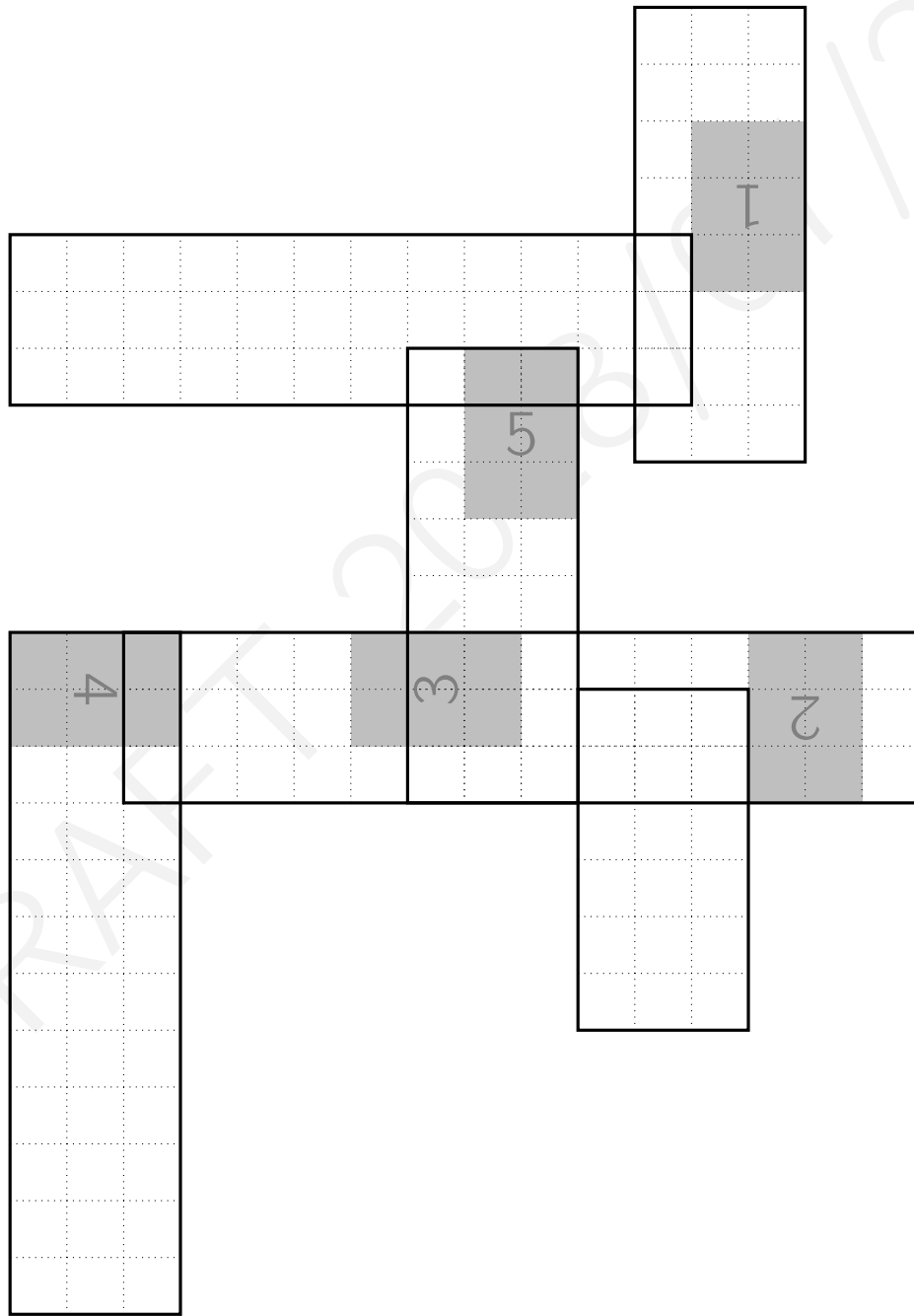
Part II

Game Control Documents
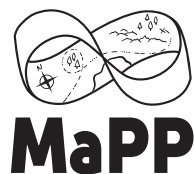
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Printing instructions

- A copy of the **Player Handout** section of this PDF should be printed and stapled for each participant, using the PDF title page as the cover.

- The six **Knot True Badges** should be printed and laminated for display during the Opening Puzzle. Extras should also be available as backups (lamination optional).

- Several **ClueKeeper Reference** packets should be printed and compiled for use by Game Control, and to hand out in case players cannot install ClueKeeper for the demo.
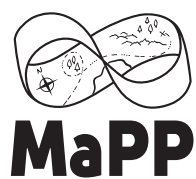
Knot True

Ash's Trainer Badge
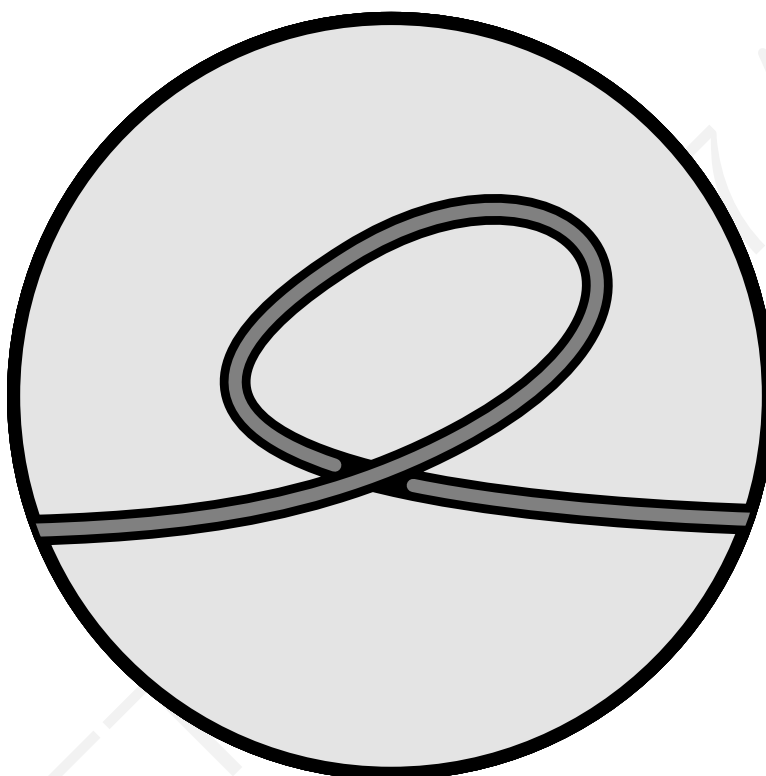
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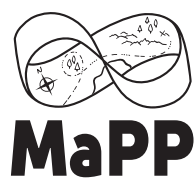
Knot True

Brock's Trainer Badge
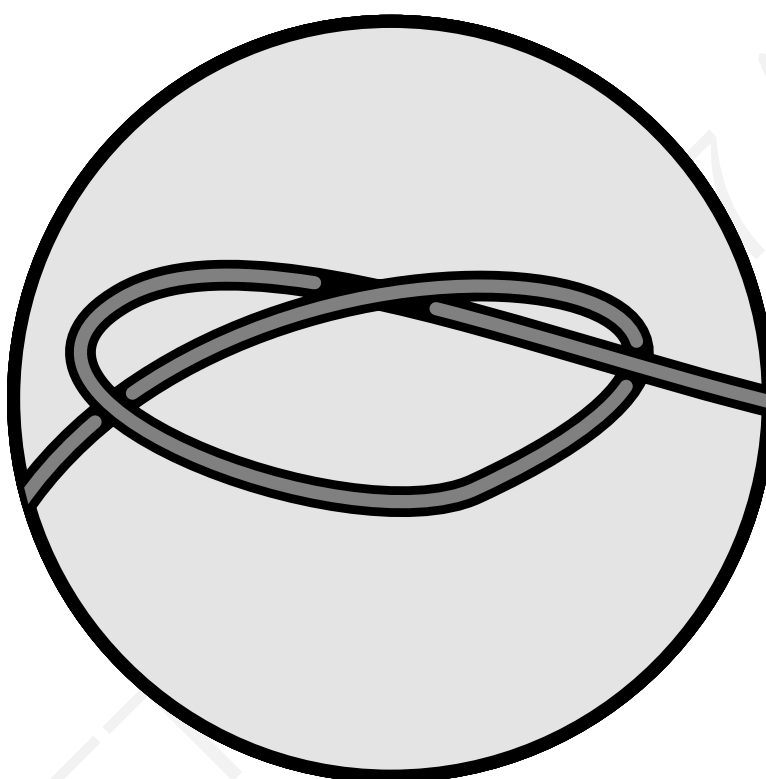
Trainer ID: 198815
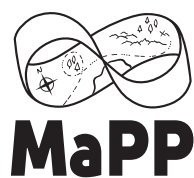
Knot True

Cynthia's Trainer Badge
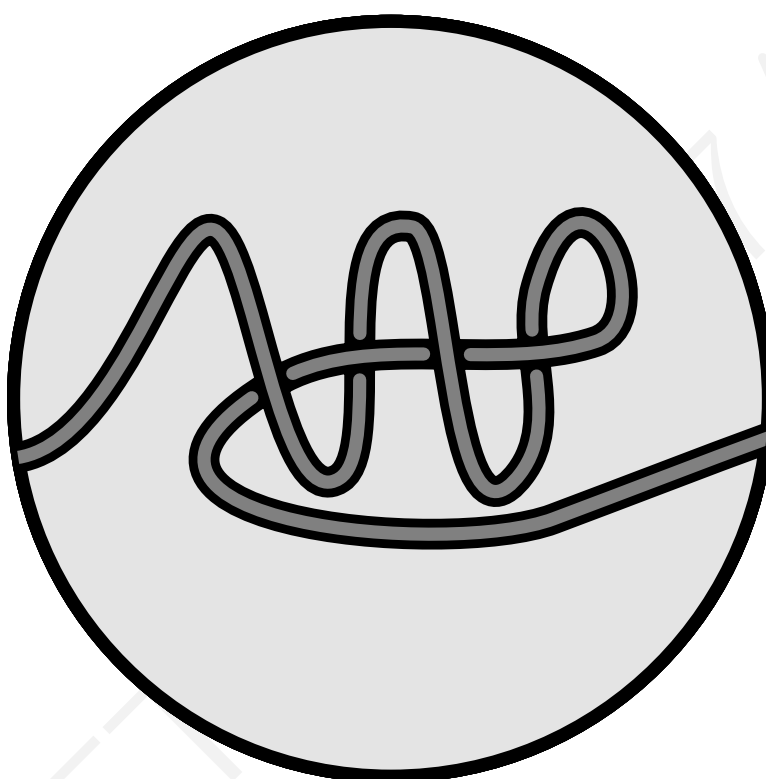
Trainer ID: 255123
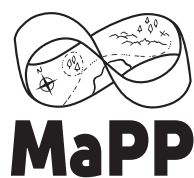
Knot True

Drayden's Trainer Badge
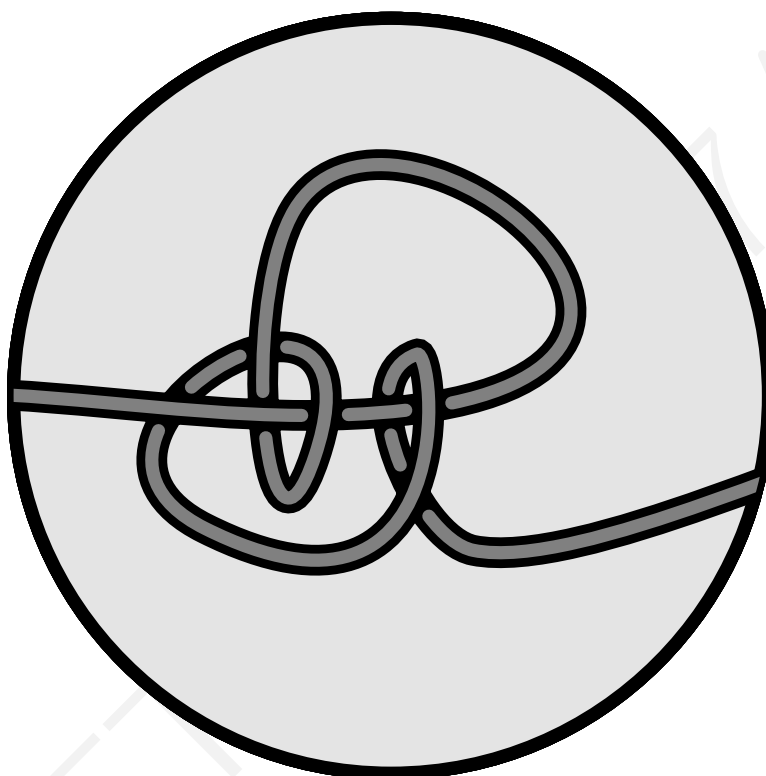
Trainer ID: 443881
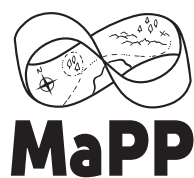
Knot True

Erika's Trainer Badge
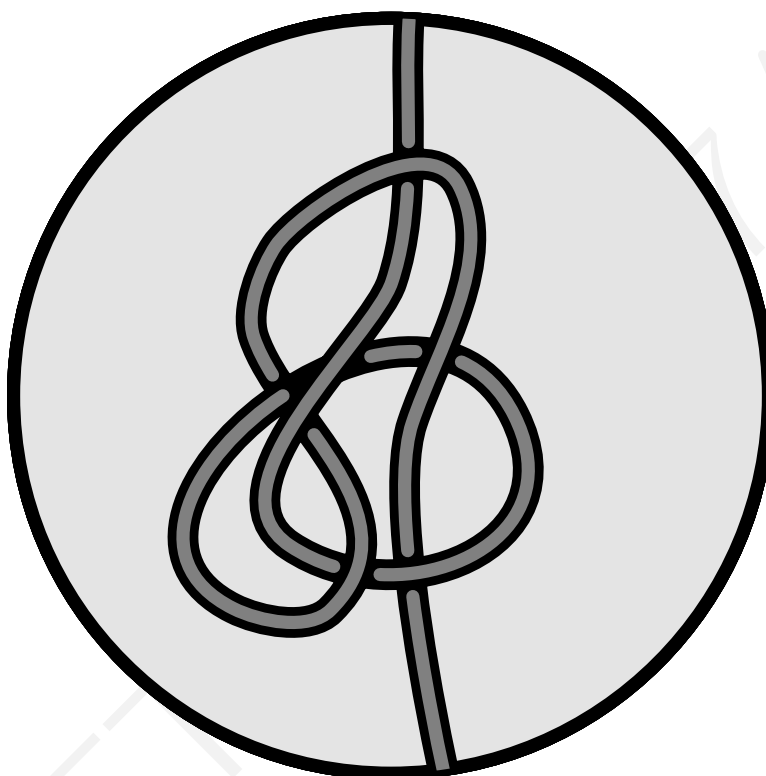
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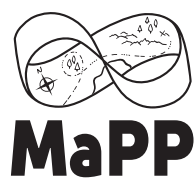
Knot True

Flannery's Trainer Badge
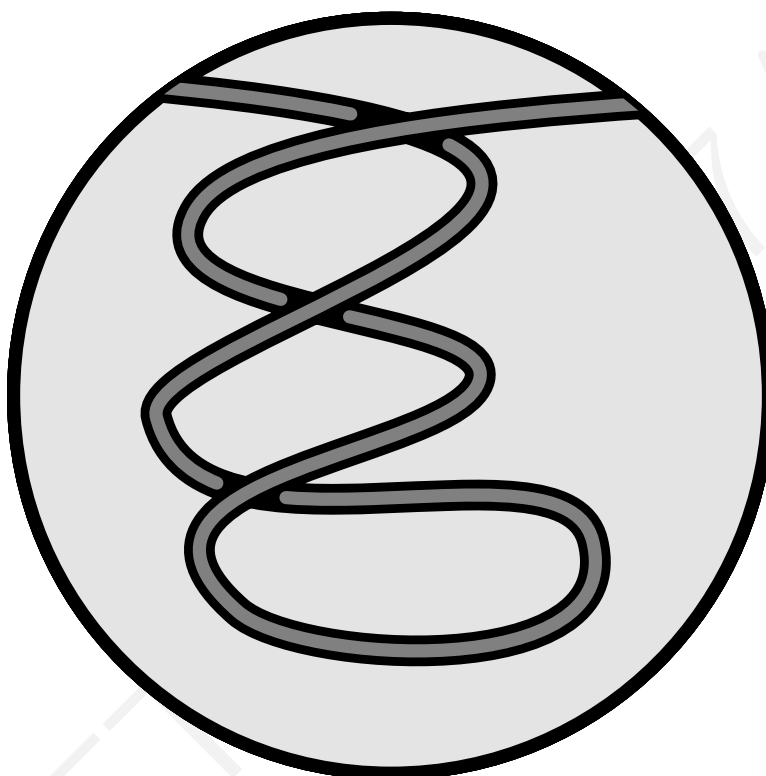
Trainer ID: 663968
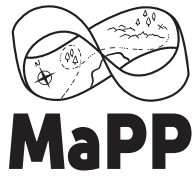
Cluekeeper Reference

Knot True – Introduction

In a recent Mobímon tournament, six Mobímon trainers were ranked from 1st to 6th:

- Ash
- Cynthia
- Erika

- Brock
- Drayden
- Flannery

To prove to your mentor, Professor Sassafras, that you are ready to embark on your Mobímon adventure, she has tasked you with finding these six trainers and ask them what they remember about the tournament results.

To obtain their six clues, look for six **Trainer Badges** found on posters located nearby, and enter the **Trainer ID** shown for each into ClueKeeper.
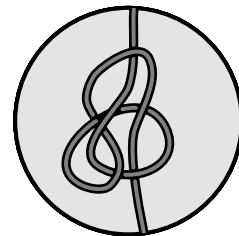
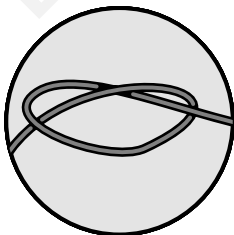## Knot True – Clues unlocked by each badge
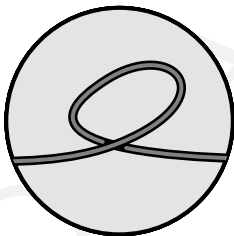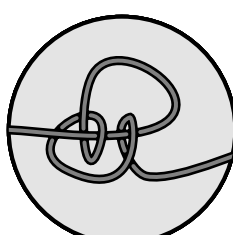

Ash and Flannery did not place 6th.
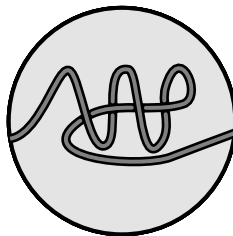
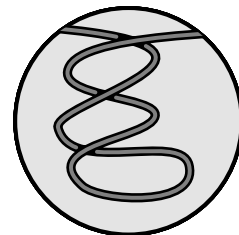Erika placed exactly one rank higher than Ash.

Brock placed lower than Flannery.

Neither Brock nor Drayden placed 4th.

Drayden placed in the top three.

Either Cynthia or Drayden placed 3rd.

Knot True – Final clue unlocked by collecting badges

Wait a second… it seems that not all of the six trainers are telling the truth! You'll need to determine which of the trainers are lying by inspecting their trainer badges. If the cord shown in a badge can be tightened into a knot, then that trainer is lying; if not, they are telling the truth!

Use the clues associated with each Trainer Badge and the provided **Tournament Results** page to mark how each trainer placed in the tournament. Doing so correctly will reveal a word. Enter this word into ClueKeeper to prove to Professor Sassafras that you're ready to begin your Mobímon adventure!

When Push Comes to Shove – Main Puzzle 1

While training your Mobímon near the wharf, you lock eyes with Dockworker Dave. As everyone knows, when two trainers' eyes meet, it's time for a Mobímon battle!

You're still a beginner though, so you manage to talk him down to a puzzle. Dave agrees, and shows you the image shown below. He explains that this illustration demonstrates the seven different ways that five boxes can be stacked flush against the wall of his warehouse.

It seems that some rat Mobímon have thrown the warehouse into disarray, so you'll need to help Dave calculate how many different ways his boxes can be rearranged according to the criteria shown on the provided **Warehouse Specifications** sheet. Calculating these possibilities and using the encoding A=1, B=2, etc. will reveal the solution to this puzzle!
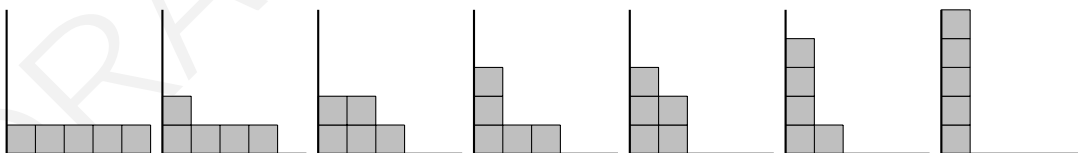
The Nickname Rater – Main Puzzle 2

As your adventure continues, you find yourself in Achromatopsia City, home of the famous Mobímon Nickname Rater. She explains that while Trainers often like to give their Mobímon cute nicknames, she's very particular about the rules for an "excellent" Mobímon nickname.

- **Rule 0:** A is an excellent nickname.

- **Rule 1:** Adding a consonant to the end of an excellent nickname ending with a vowel creates a new excellent nickname.

- **Rule 2:** Doubling an excellent nickname creates a new excellent nickname.

- **Rule 3:** Replacing three consecutive vowels in an excellent nickname with a consonant creates a new excellent nickname.

- **Rule 4:** Removing two consecutive consonants from an excellent nickname creates a new excellent nickname.

- **Rule 5:** Exchanging the consonants in an excellent nickname with other consonants creates a new excellent nickname. Similarly, exchanging the vowels in an excellent nickname with other vowels creates a new excellent nickname.

- Nicknames that cannot be created using these rules are not excellent.

The Nickname Rater suggests you try rating the nicknames shown on the provided **Popular Nicknames** sheet. Apparently if you take the first letters of the excellent nicknames in order, you can spell a great (but not excellent) seven-letter word for a nickname.

Cross Product – Cryptic Puzzle 1

Impressed with your problem-solving ability, the dockworker suggests you head to the Mobímon Dojo. There, the Dojo Master agrees to battle you, but only if you can solve his puzzle. He presents you a copy of an **Odd Scroll** and the following clues:

- *Only a trainer that has one of these can possibly become HIPCONAM.*

  - Lightning × Plant
  - Undead × Flame
  - Aqua × Ordinary
  - Flame × Magic

Can you *unscramble* the meaning of the Dojo Master's scroll, putting you one step closer to becoming a Mobímon Champion?

Blind Luck – Cryptic Puzzle 2

The Nickname Rater suggests you continue your journey just down the road, where the sightless Dojo Master is known to battle up-and-coming Mobímon trainers.

You arrive at the dojo, but it seems that a secret password is required to enter, and your only clue is the **Strange Tilework** leading to the dojo's door.

After scratching your head for a bit, you lean against the door. You hear a low whisper carry the following words into your ear:

- RED
- BLUE
- YELLOW
- GOLD
- SILVER
- CRYSTAL

Are these the clues you need to figure out the secret password?