Mathematical Puzzle Programs

Open Source Puzzle Hunts for High School Outreach

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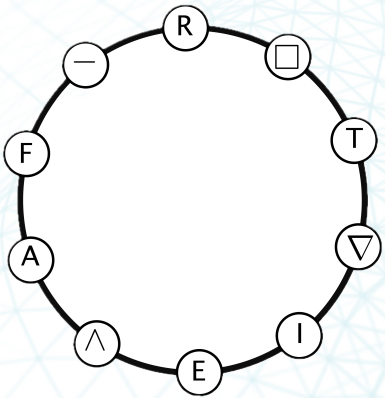
What is a puzzle?

- Has a story (“flavortext”).
- Requires some work and/or knowledge.
- Has an “a-ha” moment.
- Solves to a short phrase or word.

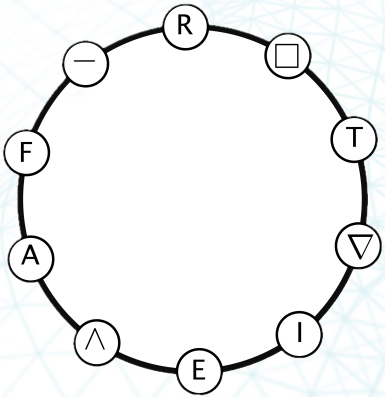


The Royal Table (MaPP 2023)

The king and queen of Hyreign are hosting a meeting. Each village in Hyreign will send its top two leaders to sit at the table with the king and queen.

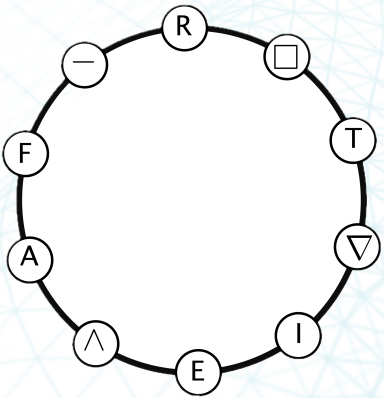
- The two from Dashing (–) sit one seat apart (next to each other).
- The two from Wedgetown ($\wedge$) sit two seats apart.
- The two from Nablan (∇) sit three seats apart.
- The two from Boxuto ($\square$) sit four seats apart.
- The king and queen sit opposite each other.

If we can help the royals with their seating arrangement, they'll grant us a magic item.



What is a puzzle hunt?

- A series of puzzles with a unifying theme.
- Requires solvers to visit different physical locations.
- Solving a puzzle may reveal new puzzles or locations.

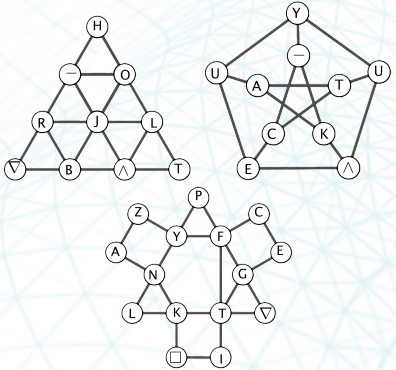


Don’t Let Down Your Guards (MaPP 2023)

The four villages agree to provide guards for three of Hyreign’s castles.

- Each castle cannot have one single guard from a village (zero guards, or 2+ guards).
- Like their leaders, all guards from a village need to be exactly the right distance apart: One for –, two for $\wedge$, three for ∇, four for $\square$.

Assign as many guards as possible to each castle to reveal another magical item.



What is MaPP?

- **Ma**thematical **P**uzzle **P**rograms
- Begun in 2015 at Lamar, grew out of Auburn Math Puzzle (AMP) contest.
- The mission of MaPP is to organize quality events which get students moving around, engaged in problems, and having fun by learning and using mathematics to solve a series of puzzles.
- Produces the MaPP Challenge each year.
- Puzzles are accessible but tied to current mathematical research.
- “Beat the puzzle, not each other.”

The MaPP Challenge

- Annual puzzle hunt that **you can host** at your campus.
- Puzzle hosting packet is free and open source (CC4.0 license).
- Designed for high school (or maybe middle school students), team sizes 4-8.
- 3-4 hours long, 10-15 themed puzzles.
- Teams visit multiple campus locations.
- ClueKeeper app handles clues, solutions, hints, and can enforce geolocation.

Why Host

- Mathematical outreach to your community.
- Engage students in mathematical thinking in a fun setting.
- Puzzles tease subjects like graph theory, topology, and number theory that don't show up in the K12 curriculum.
- Connect with local K12 math educators.
- Recruiting.
- Fun for organizers, too.

How To Host

- Start planning in the fall for a spring event.
- Advertise with high school math instructors.
- Reserve space for teams to solve.
- Recruit volunteers.
- Play test puzzles.

Saint Louis University 2024

- 55 students on 11 teams, ten volunteers.
- $20 per team registration fee.
- ClueKeeper costs $5/team. Dining hall lunch. Administration donated swag bags.
- Net cost about $350.

Middle Georgia State University 2024

- 150 students on 20 teams, 12 volunteers.
- $50 per team registration fee.
- ClueKeeper costs $5/team. Pizza lunch, snacks, prizes, T-shirts.
- Net cost about $2400.

“Very smooth flow, had a lot of fun”
“It was more puzzles than math!”

What You Get

- Puzzle packet with story, clues, and printable material.
- Electronic ClueKeeper setup.
- Solutions and mathematical background information.
- Support from the MaPP community.

Questions?

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What is the solution to *Don't Let Down Your Guards?*

Feeling Pressure (MaPP 2023)

These puzzles are based on Skolem labelled graphs (Mendelshon, Shalaby, 1991)

- The soldiers from Dashing (–) and Wedgetown (∧) have sharpened their swords for one more night of guarding these five small castles. In the dim light, they'll need to feel for the empty spaces.