Winning in a Quantitative Literacy Class

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NKU NORTHERN KENTUCKY UNIVERSITY

MAA MathFest
August 2, 2019

The "Game"

Name:

Players:

Goal:

How to Play:

The "Game"

Name: MAT 115 - Mathematics for Liberal Arts

Players:

Goal:

How to Play:

The "Game"

Name: MAT 115 - Mathematics for Liberal Arts

Players: 1 faculty and 28 students

Goal:

How to Play:

The "Game"

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Goal: To Win!

How to Play:

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Players: 1 faculty and 28 students

Goal: transition to more expert-like attitudes and perceptions of maths

How to Play:

The "Game"

Name: MAT 115 - Mathematics for Liberal Arts

Players: 1 faculty and 28 students

Goal: transition to more expert-like attitudes and perceptions of maths

How to Play: variety of strategies

Side Quests

small group IBL activities/games/puzzles

Objectives:

- engage in structured mathematical thought
- cultivate interest in deeper mathematical questions
- develop student self-efficacy

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Key Aspect: Low Floor and High Ceiling

Mini-Game 1: Tic-Tac-Toe

Refresh memory by playing a few games of tic-tac-toe.

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Conversation about ways of knowing

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Conversation about ways of knowing

1: What is one way to measure the "strength" of a square?

2: Under your measure, how strong is each square?

3: Do any squares have the same strength?

4: Can you explain why this would be the case?

Mini-Game 1: Tic-Tac-Toe & Three-to-Fifteen

Place Ace through 9 between two players.

Players alternate turns picking a card to put in their hand.

Winner: first to have a hand that contains 3 cards that sum to 15

Player 1

1 2 3 4 5 6 7 8 9

Player 2

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Gain experience by playing a few games of 3-to-15.

Students discuss their strategy and how successful it is.

Revisit conversation about ways of knowing

5: What is one way to measure the "strength" of a card?

6: Under your measure, how strong is each card?

7: Do any cards have the same strength?

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5: What is one way to measure the "strength" of a card?

6: Under your measure, how strong is each card?

7: Do any cards have the same strength?

8: Compare your answers for 2-3 and 6-7. What do you notice?

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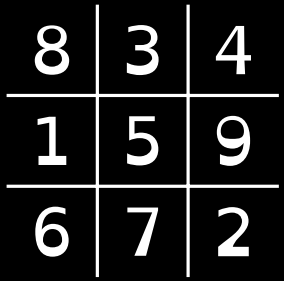

Mini-Game 1: Tic-Tac-Toe & Three-to-Fifteen

8	3	4
1	5	9
6	7	2

Extensions

Magic Squares

Isomorphisms

Prove no winning strategy

Explore variations of rule changes
e.g. 3 in a row loses

Predict result of tic-tac-toe game

Mini-Game 2: One Pile (AKA 21 Flags, Subtraction Games)

Place a small handfull of stones between two players.

Each turn, a player takes 1, 2, or 3 stones from the pile.

Winner: whoever takes the last stone(s)

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From www.ArtOfMathematics.org

Play the game a few times with a partner.

At what point of the game do you know if you've lost or won?

Can you find the next higher number of stones where you know you've won or lost?

How about the next highest number of stones? Is there a pattern?

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Extensions

Pick if want to go first or second

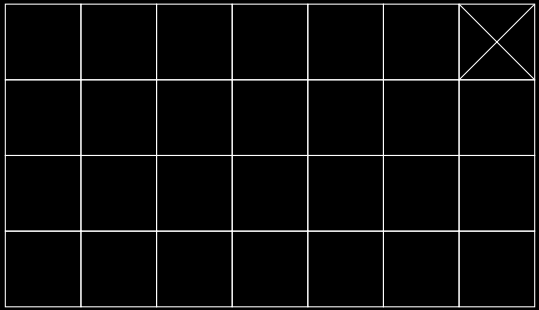
Similar games: two piles, three piles

Change max pick or skip choices: e.g. can pick 1,2,...,6, or 1,2,3,5 stones

Mini-Game 3: Chomp

Players alternate turns "chomping" a square out of a rectangular chocolate bar along with any squares to left and down.

Loser: player forced to chomp the top right square (it's poisoned!)



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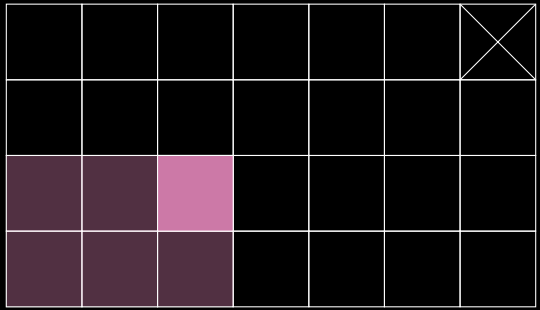

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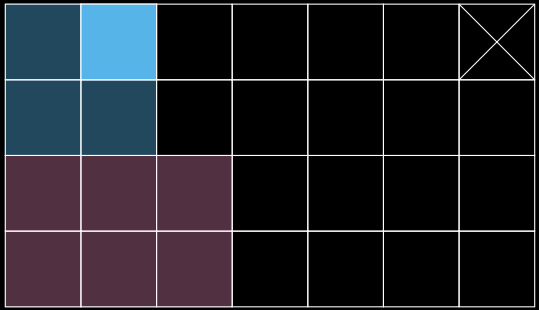

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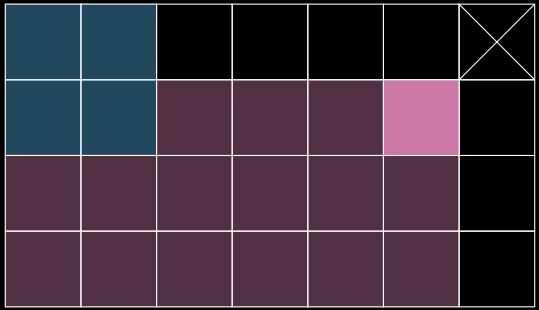

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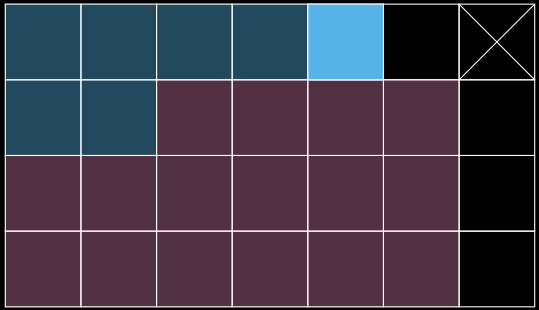

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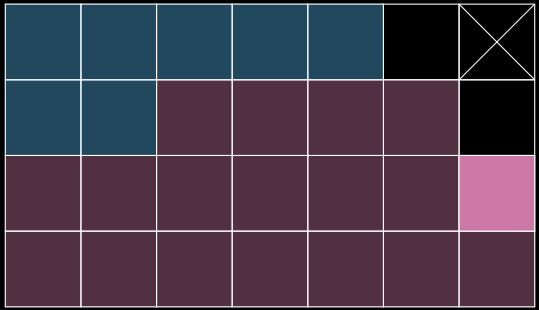

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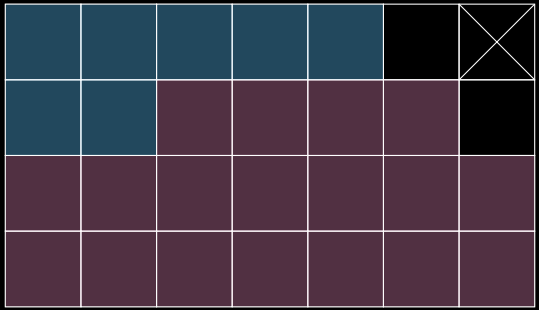

Mini-Game 3: Chomp

Play on small $n \times n$ boards

Prompt students to analyze all moves on partial boards, thinking about subsequent moves

Identify strategy for $n \times n$ boards

Prove player 1 has a winning strategy for Chomp

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Extensions

Rectangular boards: $2 \times n$, $3 \times n$, $m \times n$

Combinatorial games for structured mathematical thought, interest in mathematical questions, and (anecdotal) increased self-efficacy.

Slides at:
http://sappho.nku.edu/~brandta2/docs/mathfest2019

brandta2@nku.edu

Accessibility: OpenDyslexic font, colour palette