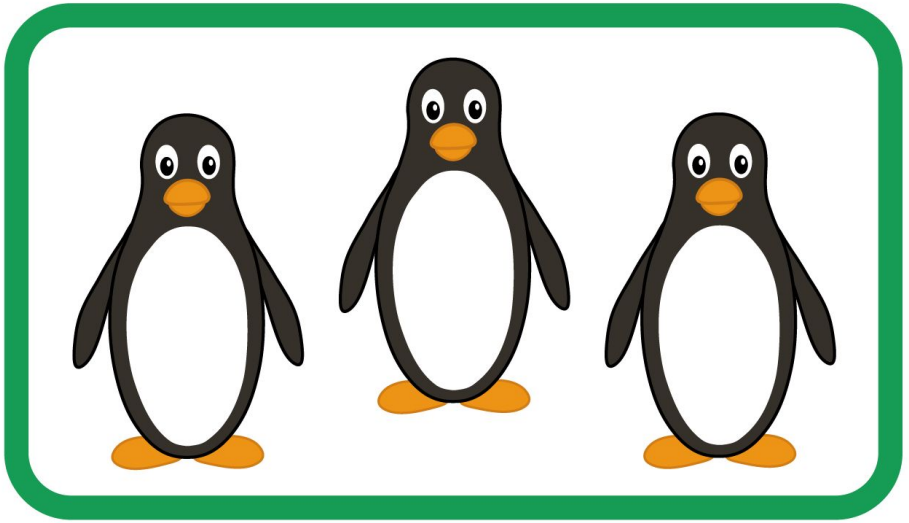
Penguin Island



Julia Robinson Mathematics Festival

San Francisco Math Circle at San Francisco State University

App

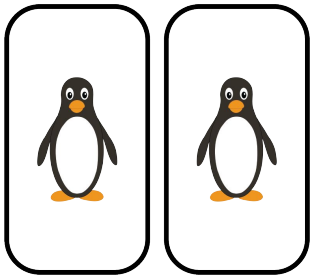
jrmf.org

Penguin Island

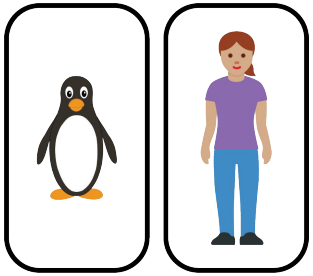
In many places where people have overtaken the land, animal populations have diminished. But on the Macquarie Islands, penguins still outnumber humans. We want to keep it that way!

Setup

- There is a bag containing 3 different tiles, with pictures on both sides.



Tile 1: P/P



Tile 2: P/H

Tile 3: H/H

Objective

- Build a community on Penguin Island with more penguins than humans.

Rules

- Place a tile from the bag on the table without looking at the other side of the tile.
- Add what you see (penguin or human) to Penguin Island.
- Then choose whether to flip the tile over.
- If you flip it over, you must also add what you see on the back to Penguin Island.
- Return the tile to the bag and shake well. Do this 10 times.

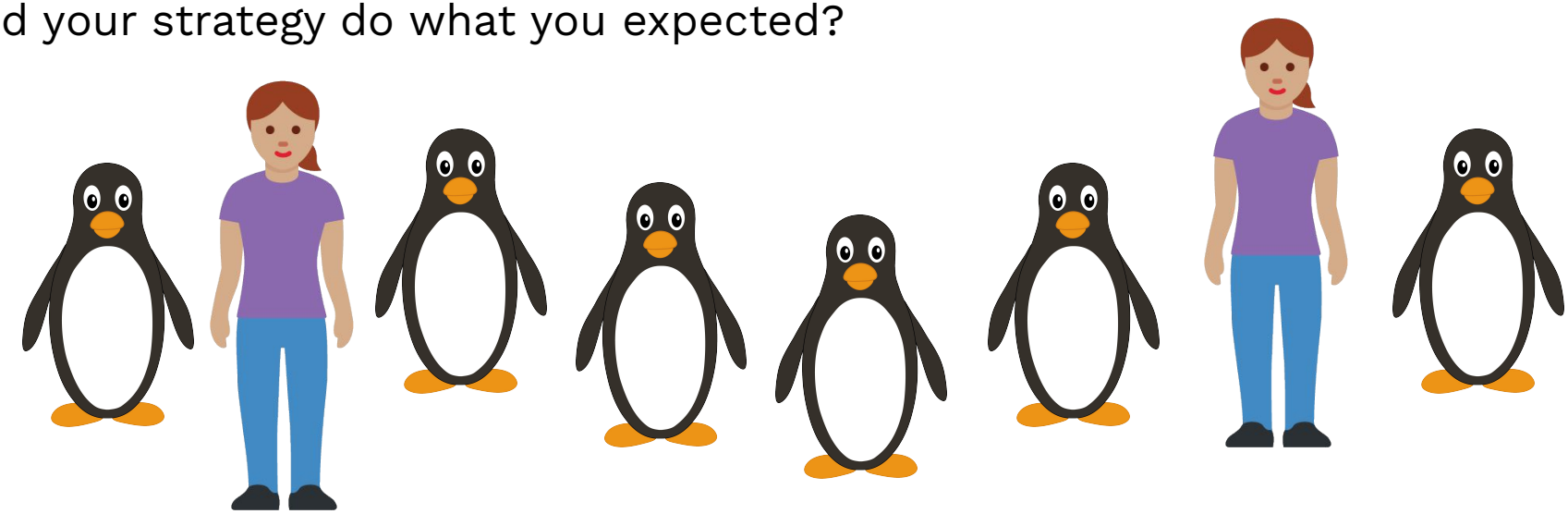
Penguin Palooza

1. Build a community on Penguin Island a few times.
   How often did you end up with more penguins than humans?

2. Can you find a strategy for flipping or not flipping tiles that will make getting more penguins than humans likely?

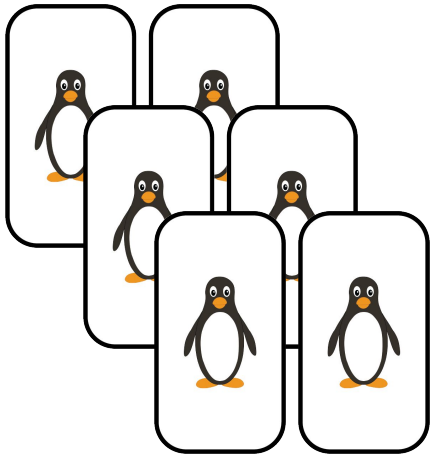
3. One strategy is to always flip. Is this a good strategy?
   Can you find a better strategy?

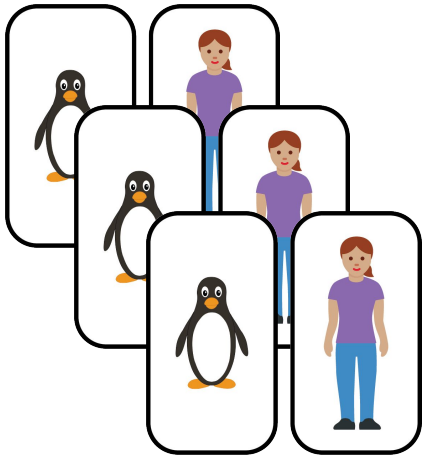
4. Pick a strategy that you predict will help the penguins, and try it out.
   Did your strategy do what you expected?

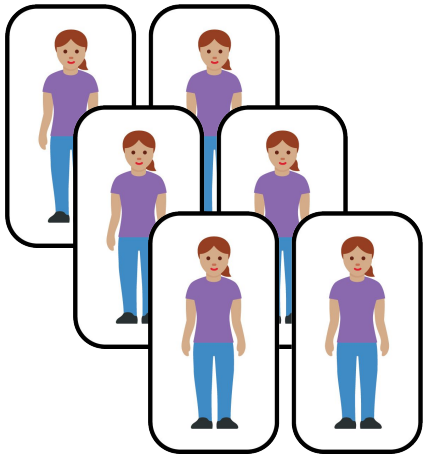


Mixed Bags

1. There are now 3 of each kind of tile in the bag (3 P/P, 3 P/H, and 3 H/H). What strategy would help the penguins in this situation? How does it compare to your previous strategies?







2. Answer the same questions for each of the following mixtures of tiles:
   a. 3 P/P, 1 P/H, and 3 H/H
   b. 1 P/P, 3 P/H, and 1 H/H
   c. 3 P/P, 3 P/H, and 1 H/H
   d. 1 P/P, 2 P/H, and 1 H/H
   e. 5 P/P, 7 P/H, and 6 H/H

3. Create your own mixtures and answer the same questions for them.

More Mixed Bags

1. Here are some more mixtures and some basic strategies.
   Predict which strategy will work best for each mixture, and then test your predictions.
   Did the strategies you picked do what you expected?

Mixtures	
5 P/P, 5 P/H, 5 H/H	3 P/P, 5 P/H. 3 P/H
2 P/P, 5 P/H, 2 P/H	2 P/P, 4 P/H, 6 H/H
4 P/P, 2 P/H, 4 H/H	1 P/P, 9 P/H, 3 H/H

Strategies	
Never flip penguins. Never flip humans.	Always flip penguins. Always flip humans.
Always flip penguins. Never flip humans.	Never flip penguins. Always flip humans.

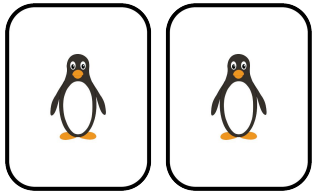
2. Create your own mixtures and try to find the best strategy for each.

3. With 5 P/P and 5 H/H tiles, what number of P/H tiles should you choose to give you the best chance to win?
   You can use whatever strategy you want.

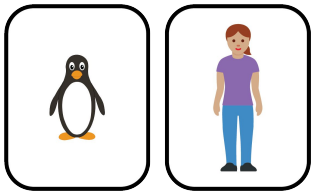
Growing Population

There are now some tiles that have either two penguins or two humans on one side. Here are all 7 types of tiles that can be in your bag:

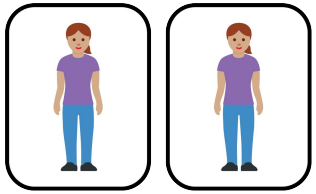
Tile 1: P/P



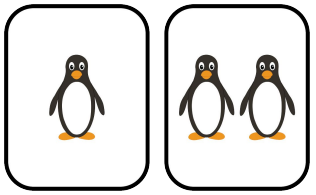
Tile 2: P/H



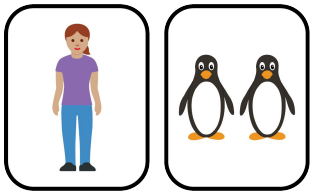
Tile 3: H/H



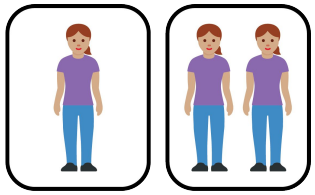
Tile 4: P/PP



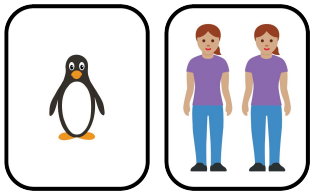
Tile 5: H/PP



Tile 6: H/HH



Tile 7: P/HH



1. With 7 types of tiles, how many decisions will you need to make for a basic strategy? What are they?

2. For each mixture, create a strategy that you predict will help the penguins. List the decisions you need for your strategy, and test to see if your strategy does what you expect.
   a. 1 P/PP, 1 H/PP, 1 H/HH, 1 P/HH
   b. 2 P/P, 1 P/H, 2 H/H, 1 P/PP, 2 H/PP, 1 H/HH, 2 P/HH
   c. 4 P/P, 1 P/H, 1 H/H, 4 P/PP, 4 H/PP, 6 H/HH, 1 P/HH
   d. Create your own mixture!