

Smileys



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Mathematics
Festival**



App

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Smiling Instructions

Have you ever noticed that when you see someone smiling, you tend to smile, too?

Objective

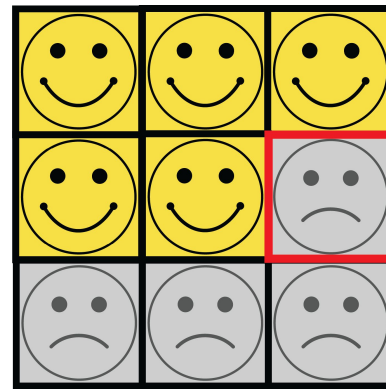
- Get everyone to smile.

Rules

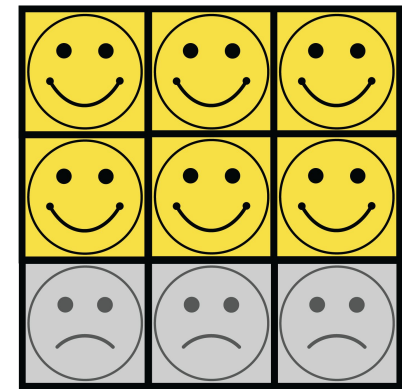
- Start with a grid of all frowning people.
- Choose some people to start off smiling.
- Then, if a frowning person shares a side with at least two smiling people, the frowning person will start smiling.
- Repeat the above rule until no new people smile.



We chose three people to start off smiling. The two people outlined in red are next to enough smiling people to start smiling themselves.



Now that those two people are smiling, one new person (outlined in red) will start smiling.



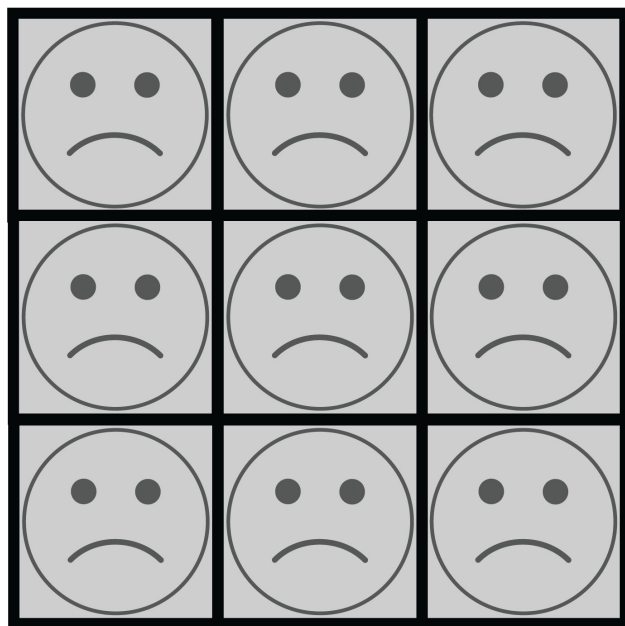
No more new people are going to start smiling. If we want everyone to smile, we'll need to start over.



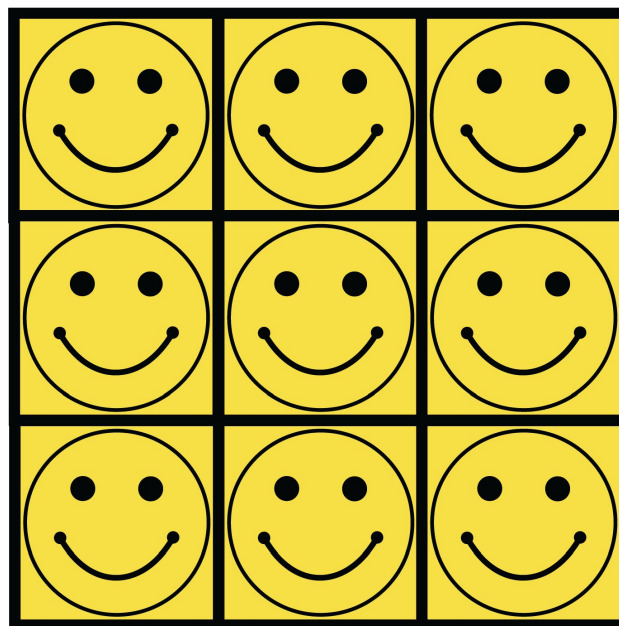
Smiling Rectangles

1. Can you get everyone on a 3x3 grid to smile?
2. What is the fewest number of people you need to start off smiling in order for the entire grid of faces to end up smiling?
3. How would your answers change on a 4x4 grid? A 5x5 grid? 6x6? Larger square grids?
4. How would your answers change on a 3x4 grid? A 3x5 grid? 4x6? Larger rectangular grids?

Start: A 3x3 grid of frowning faces



Goal: A 3x3 grid of smiling faces

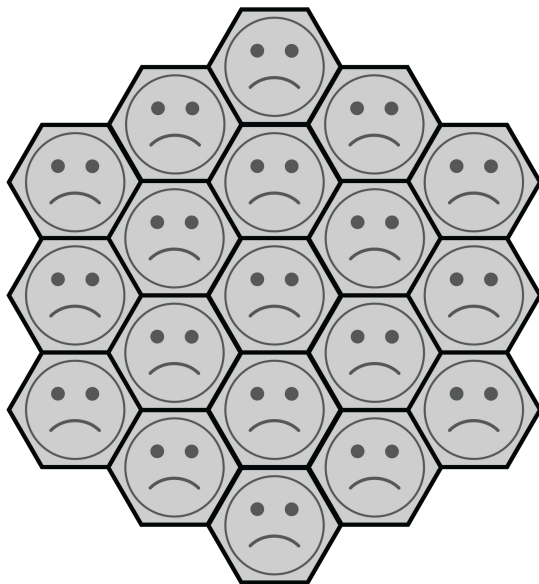


Smiling Hexagons

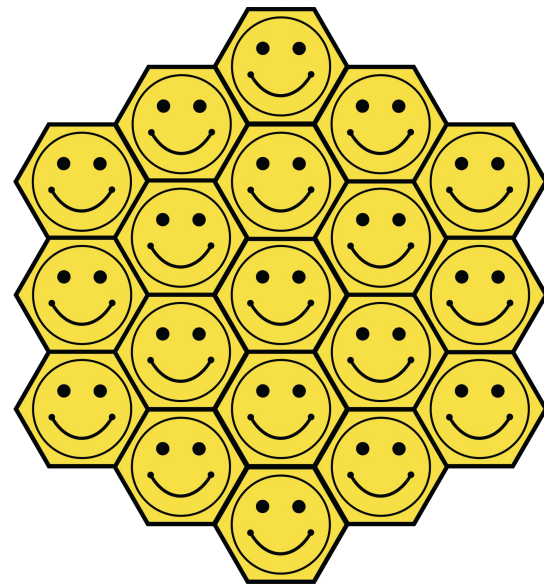
On a board with hexagons, if a frowning person shares a side with at least three smiling people, the frowning person will smile. A board with 3 hexagons on each side is called a 3-hex-board.

1. Can you get everyone on a 3-hex-board of hexagons to smile?
2. What is the fewest number of people you need to start off smiling in order for the entire board of faces to end up smiling?
3. How would your answers change on a 4-hex-board? A 5-hex-board? Larger boards?

Start: A 3-hex-board filled with frowns



Goal: A 3-hex-board filled with smiles

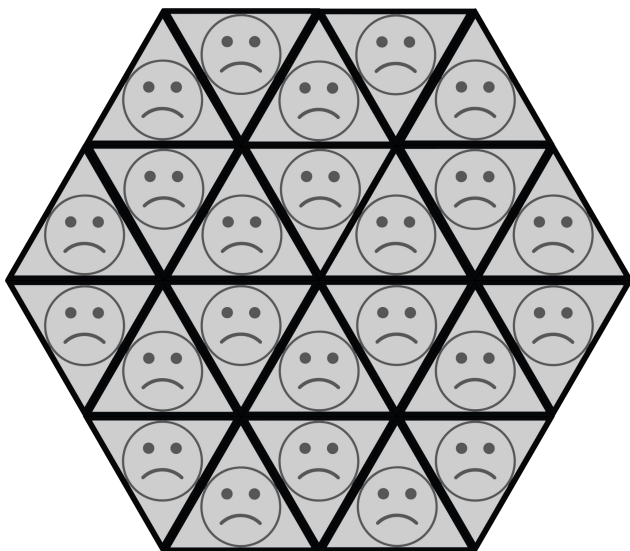


Smiling Triangles

On a board with triangles, if a frowning person shares a side with at least two smiling people, the frowning person will smile. A board with 2 triangles on each side is called a 2-tri-board.

1. Can you get everyone on a 2-tri-board of triangles to smile?
2. What is the fewest number of people you need to start off smiling in order for the entire board of faces to end up smiling?
3. How would your answers change on a 3-tri-board? 4-tri-board? Larger boards?

Start: A 2-tri-board filled with frowns



Goal: A 2-tri-board filled with smiles

