Midterm Practice Problems

1. *Transformations:* the images below show a square before two sets transformations. “After 1” is a composition of two transformations (denote $AB$ in matrix multiplication form). “After 2” is a composition of the same two transformations, but in reverse order ($BA$ in matrix multiplication). Find $A$ and $B$ that satisfy these conditions, and perform matrix multiplication on the “Before” square to demonstrate your answer.

2. *Recursion:* write a recursive function that will return $n!$ for any integer $n \geq 0$. In general, $n! = n \cdot (n - 1) \cdot (n - 2) \cdots 3 \cdot 2 \cdot 1$, so this starts $1! = 1$, $2! = 2$, $3! = 6$, etc, and $0!$ is defined to be 1. In short, implement function `factorial(n) { ...}`
3. **Lines:** In HW1 we saw how to implement an algorithm for drawing a line between two points: $p_0 = (x_0, y_0)$ and $p_1 = (x_1, y_1)$, which relied on the slope of the line. For this question, write pseudocode for a line algorithm that would achieve the same goal, but this time using a *parametric* Bezier approach (i.e. implement: `function line(p0, p1) {...}`). Your algorithm should:

   (a) Make the line look “connected” (no gaps). Diagonal pixels are considered connected.
   (b) No pixel should be colored more than once.

4. **Sweep fill:** as presented in class, what order will the pixels below be filled? Use “A” for the first filled pixel, “B” for the second, etc. The outer loop over the $y$ values will start at $y_{\text{min}}$ and go to $y_{\text{max}}$. For each $y$ value, the $x$’s will go loop from $x_{\text{min}}$ to $x_{\text{max}}$. Assume $y$ increases going down.