Aim:

To visualize the Hilbert curve of a given order using p5.js and JavaScript.

Objective:

1. Generate and visualize a Hilbert curve of a specified order.
2. Utilize color and animation to enhance the visualization.

Summary:

This project aims to generate and display a Hilbert curve of a defined order (in this case, order 8) using p5.js. The Hilbert curve is a space-filling curve that can be visualized through its path on a 2D canvas. The visualization demonstrates the recursive nature of the curve with a dynamic color gradient and animated line drawing.

Tools and Libraries Used:

- **p5.js**: A JavaScript library for creative coding.
- **HTML**: For structuring the web page.
- **CSS**: For styling the web page and canvas.

Procedure:

1. **Setup (in sketch.js)**:
    - Create a canvas of size 512x512 pixels.
    - Define color mode to use HSB (Hue, Saturation, Brightness).
    - Initialize variables to compute and store the Hilbert curve path.
    - Generate the Hilbert curve path by calling the hilbert function and scaling the points according to the canvas size.
2. **Draw (in sketch.js)**:
    - Clear the canvas with a black background.
    - Draw the Hilbert curve using a line segment for each path point, with color mapped to the position in the path.
    - Increment the counter to animate the drawing of the curve.
    - Reset the counter when the end of the path is reached.
3. **Hilbert Function (in sketch.js)**:
    - Compute the coordinates of the Hilbert curve based on recursive transformations.
    - The curve is generated by applying a series of rotations and translations depending on the current index and recursion level.

4. **HTML and CSS**:
    - Load the p5.js library and the sketch script.
    - Apply basic styling to remove margins and ensure the canvas displays properly.

Highlights:

- **Dynamic Animation**: The curve is drawn incrementally with animation to illustrate its recursive nature.
- **Color Gradient**: Uses HSB color mode to create a smooth color transition along the curve.
- **Hilbert Curve Algorithm**: Efficiently calculates the position of each point in the Hilbert curve using bitwise operations and recursion.

Conclusion:

The project successfully visualizes the Hilbert curve using p5.js, demonstrating both the mathematical properties of the curve and its recursive structure. The animation and color gradient enhance the visual appeal, making it easier to understand the curve's complexity. This project showcases the capabilities of p5.js for creating interactive and visually engaging mathematical visualizations.