Lab 9: ADC

- Link
  - Document
  - Video

- **Basic** (50%)
  - **Description**
    Design a system using four LEDs to represent decimal numbers (0–9) in binary format. A variable resistor serves as the control input. When the resistor is rotated at a constant speed, the LEDs should illuminate sequentially to display today's date in binary form. For example, if today's date is 2025/01/01, the LEDs should display the binary representations of the sequence: 2, 0, 2, 5, 0, 1, 0, 1. Each digit should be represented clearly using the four-LED binary display.

- **Advance** (30%)
  - **Description**
    Implement a system that uses four LEDs to indicate whether a measured value is odd or even, based on the voltage level read from a variable resistor. As the resistor is rotated, the ADC module continuously samples the voltage. The LEDs should display a binary number corresponding to the measured value, following these rules:
    - When the voltage increases, the LEDs display even numbers:
      0, 2, 4, 6, 8, 10, 12, 14
    - When the voltage decreases, the LEDs display odd numbers:
      1, 3, 5, 7, 9, 11, 13, 15

- **Hard** (20%)
  - **Description**
    Implement a system using a variable resistor to control the brightness of an LED by adjusting its PWM duty cycle. Rotating the resistor should dynamically vary the LED's intensity according to the following rule:
    - Clockwise rotation: decreases brightness (dimming)
    - Counterclockwise rotation: increases brightness

  - **Hint**
    1. You can use the PWM implementation and setup you learned in Lab 8.
    2. Ensure compliance with hardware timing constraints: T_{AD} (>= 0.7 μs) and acquisition time (>= 2.4 μs).