

## Lab 09: Requirement Description

- **ADC**
  - **Video:** <https://youtu.be/iw8jKujZ1Rc>
  - **HackMD:** <https://hackmd.io/@microprocessor2023/lab9ADConverter>
- **Basic (70%)**
  - **Description:**

Use four bulbs as a counter to record the degree of rotation of the variable resistor, when the variable resistor is rotated, the form of the light bulb is sequentially changed to indicate **0~15** in binary. Please use 10-bit resolution and map 0~1023 to 0~15, **the oscillator frequency needs to be  $\geq 4$  MHz.**
  - **Example:** <https://www.youtube.com/watch?v=sveEmRz5RgY>
- **Advanced (30%)**
  - **Description:**

Use four bulbs to indicate 0~9. Please light up the bulb while rotating the variable resistor at a constant speed to show **your student ID, only the numerical part is needed**. If your student ID is P74101214, your bulbs will light up in sequence in binary: 7, 4, 1, 0, 1, 2, 1, 4.
  - **Example:** [https://youtu.be/VEG1\\_rP99-I](https://youtu.be/VEG1_rP99-I)
- **Bonus (20%)**
  - **Description:**

Use a variable resistor to implement a **dimming LED**. Please adjust the PWM duty cycle by rotating the variable resistor.
  - **Example:** <https://youtu.be/mMMqTt9nGHw>
  - **Hint:**
    - ◆ Please refer to the PWM implementation and setup in Lab 8.
    - ◆ You can configure the crystal oscillator frequency(125kHz, 4MHz, etc.), period, and duty cycle yourself, but please **be mindful of the limitations regarding  $T_{AD}(\geq 0.7 \mu s)$  and acquisition time( $\geq 2.4 \mu s$ ).**