

# HKUST Dual Program 2022

Level 1 (Engineering – Robotics)

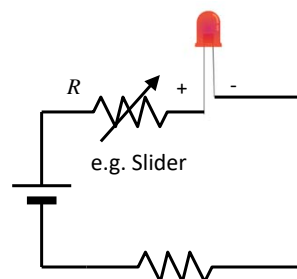
H-bridge and Motor Control 1

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## Generic Light Intensive of LED

- ❖ Higher voltage leads to larger current, higher power and higher light intensity
- ❖ Different voltages can be obtained by using a variable resistor



- ❖ It is difficult to control the light intensity precisely
- ❖ Need mechanical motion to tune the resistor and not computer friendly

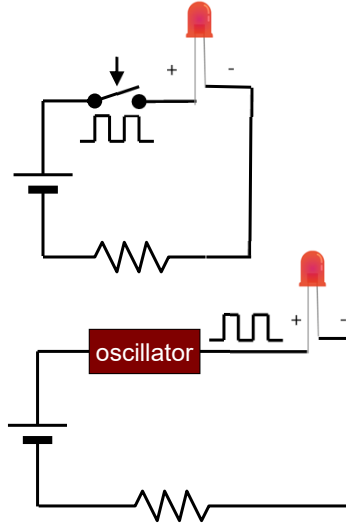
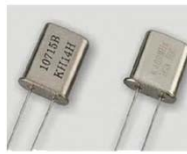
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## Application 2: Light up LED with different intensity

- By mechanically pressing a switch quickly

Blink / lighting up with lower intensity?

- By electrical means using an oscillator



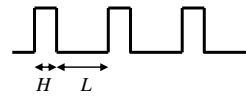
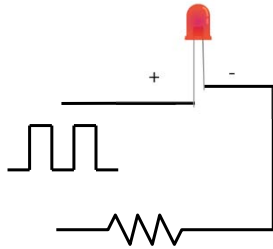
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## PULSE WIDTH MODULATION (PWM)

- ❖ Turning the LED on and off quickly and repeatedly



$$\text{Period} = H + L$$

$$\text{Duty cycle} = \frac{H}{H + L}$$

- ❖ By adjusting the duty cycle, the light intensive of LED can be controlled

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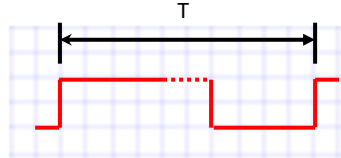
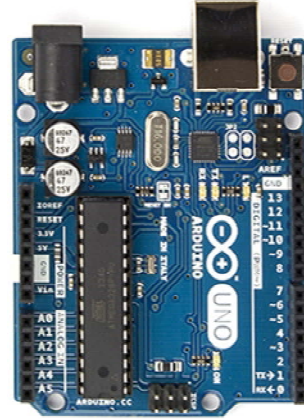
## Arduino Programming for PWM signal

- There is a function  

```
// output the analog in value at the PWMpin
analogWrite(PWMPin, value);
```

Digital value (0-255)  
 PWM pin (Indicates by ~)

Frequency at PIN 5 and Pin 6 = 980 Hz  
 Frequency at PIN 3, PIN 9, PIN 10 and PIN11 = 490 Hz



value = 0 == D = 0%  
 value = 255 == D = 100%

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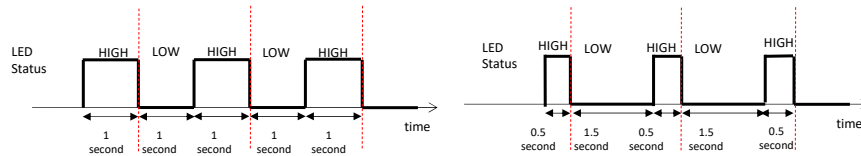
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## More understand about the pulse generation

- We will conduct laboratory experiment in using pulse width modulation (PWM) signal.
- Please check the type of "value" ( integer or float) in the function `analogWrite(PWMPin, value);`
- Which of the following waveform let the LED be brighter?



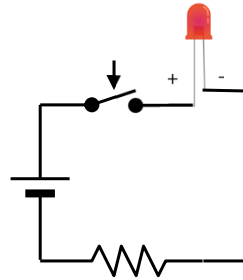
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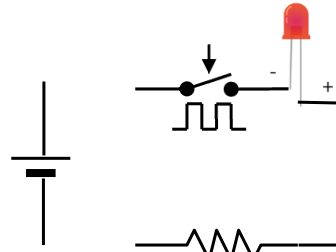
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## Lighting up the LEDs

- This LED is lighted up.



- How can you light up this LED?  
(Use the appropriate connection)



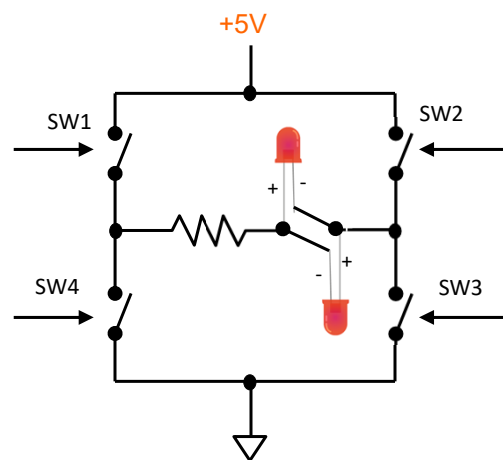
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## H-bridge circuit

- How can we light up two LEDs without change the orientation of battery?
- Answer:  
It is the circuit to control light up different LEDs.



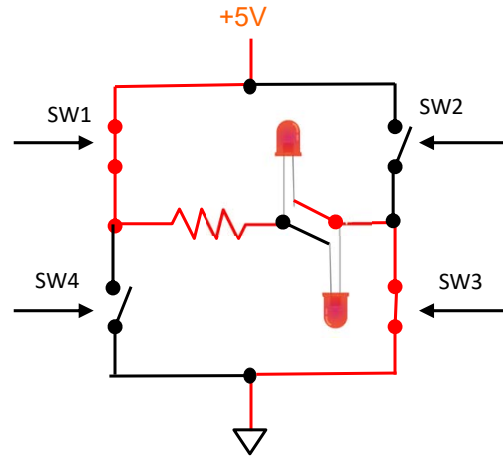
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## Working principle : H-bridge circuit

- Case 1:  
When SW1 and SW3 are closed:
- What is the direction of current flow through the LED?



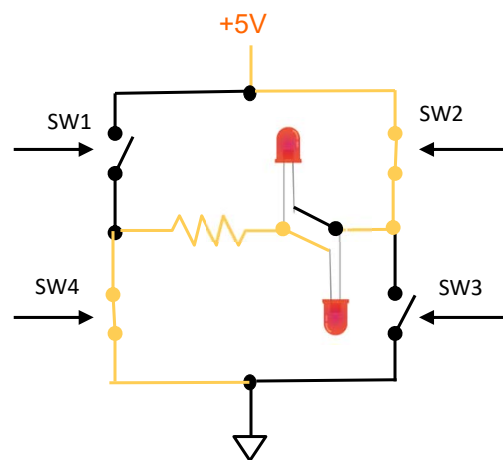
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## Working principle : H-bridge circuit

- Case 2:  
When SW2 and SW4 are closed:
- What is the direction of current flow through the LED?



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## More understand about H-bridge circuit

- ❖ We will conduct laboratory experiment about the H-bridge circuit.
- ❖ The circuit is built by LEDs and switches.
- ❖ After conducting the experiment, you are able to control the direction of current with appropriate status of switches.