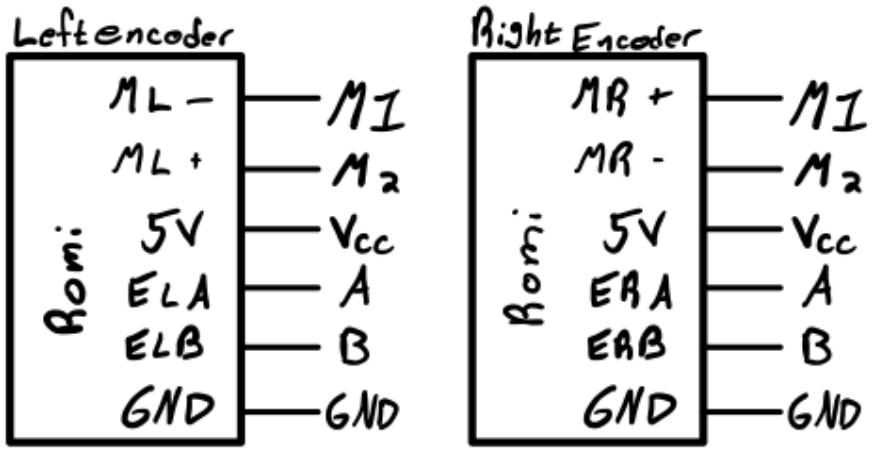
RBE 2002 Pre Lab 1

Liam Godin

1. Describe the technology behind the encoders on your Romi. What physics are they based on (e.g., light or magnetism or something else)? How are they wired (encoder to microcontroller)? Draw a schematic!

The encoders on the Romi are Hall-effect sensor encoders. The encoders utilize overlapping magnetic fields from a magnetic disk and two magnets on the board of the encoder. The Romi encoders are able to output 12 pulses per turn of the magnetic disk, which translates to 1/120 of a Romi wheel rotation.



2. How many encoder counts equate to a full wheel revolution (360 deg.)? How many times does the magnetic disk rotate during a full wheel revolution?

1440 encoder counts equate to a full wheel revolution. During this revolution, the magnetic disk rotates 120 times.

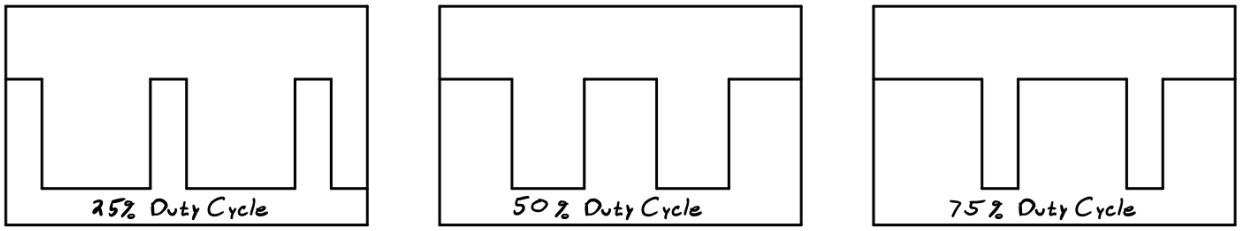
3. Write down the equation that converts counts into tangential velocity of the wheel. Explain the equation.

$counts/sec * \frac{2\pi r}{1440} = inches/sec$

This conversion changes counts to degrees, and multiplies this by the circumference of the wheel. This gives us the angular velocity of the wheel from encoder counts.

4. What is pulse-width-modulation (PWM)? Draw diagrams that indicate 25%, 50% and 75% duty cycles.

PWM is a method of controlling output signal intensity. Adjusting the duty cycle of the PWM will change the amount of time that the signal is high. At a 100% duty cycle, the signal would always be on. At a 50%, the signal would be high half the time, etc.



5. Write down the continuous equation $u(e(t))$ for a PI controller. Convert the equation into its discrete form using pseudo code.

$u(e(t)) = K_P * e(t) + K_I * \int_t^0 e(t)dt$

```
K_P = 0.5;
K_I = 0.02;

public void pidController(target, pos) {
    err_prev = pos - target;
    err_sum = 0;
    while(true) {
        err = pos - target;
        err_sum += err;
        output = K_P*err + K_I*err_sum;
        robot.drive(output);
        err_prev = err;
    }

}
```