Problem C, Solution

This is a PWM.

i) If the switch is open, the input to the non-inverting terminal of the comparator is just equal to the output of the Hall Effect sensor.

a) if the hall effect output is 1 V, the v+ is always less than v- so the output of the comparator is always 0.

b) if the hall effect output is 2 V, then v+ is higher than v- for (2-1.3)/(3.9-1.3)=27% of the time. So the output will vary between 0V (comparator output is short circuit to ground) and 12V (comparator output is an open circuit) with a duty cycle of 27%.

c) the duty cycle is now (3-1.3)/(3.9-1.3)=65%.

d) v+ is always greater than v-, so the duty cycle is 100% (the output is always high (12V)).

ii) In all cases v+ is 0.7 volts (using constant drop model of the diode), so v+ is always less than v-, and the output is always low (0V).

We can replace this part of the circuit with a PWM with an “inhibit” input. If we pull the inhibit line low, the output of the PWM is always low.

Note: the PWM output is low impedance for low output, but with a 5k impedance when the output is high.