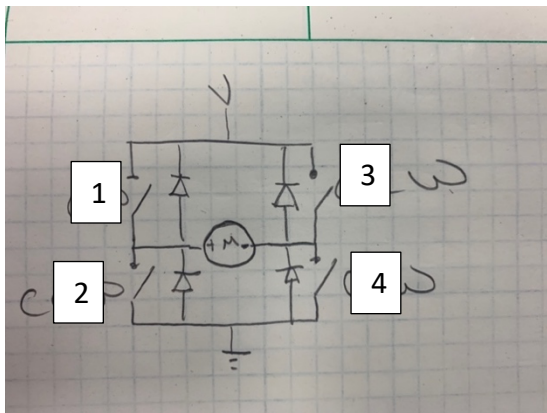


## Quiz 9: Gears and Brushed DC Motor Control

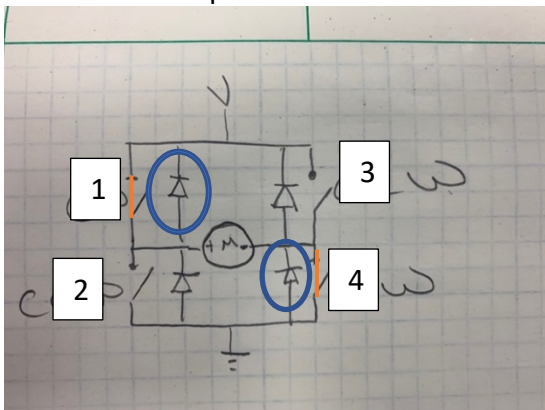
1. Gears are often used to reduce motor speed and increase output torque. List two complications that gears add to a system and why they are disadvantageous:

- Gear shave backlash which means the angel of the output shaft can change without the input moving or the input must move a little extra to start moving the output shaft which is caused by gaps in the gears. This can be problematic in systems that switch directions often and must stay extremely precise because the backlash must be taken into account.
- Gears have friction between them. This is compounded when there are more than one gear which can reduce the amount of torque that you are getting and may require you to size up in a motor.

2. Draw a motor connected to 4 switches in an h-bridge configuration, label the switches 1 through 4:



3. Pretend a pair of switches has been closed for a long time while the motor has been stalled. The switches are then opened. Add two flyback diodes to protect the two switches from sparks to your picture in #1, clearly showing which switches just opened and the relative position of the diodes that protect them.



Switch 1 and 4 are closed and the flyback diodes that are circled would be used.

4. Why does a current control loop typically occur much more frequently than a position control loop?

Current control occurs more frequently than position control because it can change rapidly whereas position takes more time to move a physical object.