ET 438b
Continuous and Digital Control
Digital Input/Output Homework

The figure below shows a digital input port for a data acquisition system. The port and the inverters connected to the port are TTL compatible devices. With the following parameters.

Max sinking current = 16 mA
Max source current = 200 μA
Logic low Level = 0.8 V

1.)Determine the minimum value of the resistors R in the interface.
2.)Find the decimal values that will be read by the port when the interface switches are in the following states

	S0	S1	S2	S3	S4
a	closed	open	closed	closed	closed
b	closed	closed	closed	open	open
c	open	open	closed	closed	closed
d	open	closed	open	closed	open
e	closed	closed	open	open	open
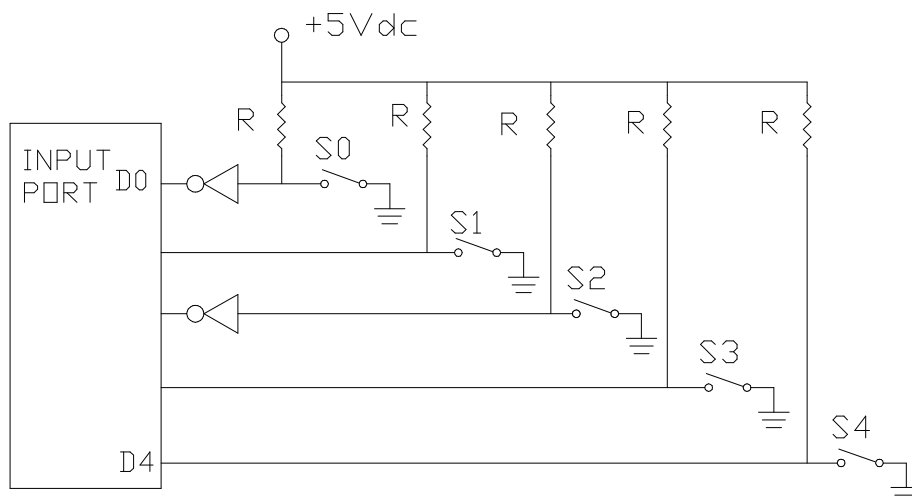
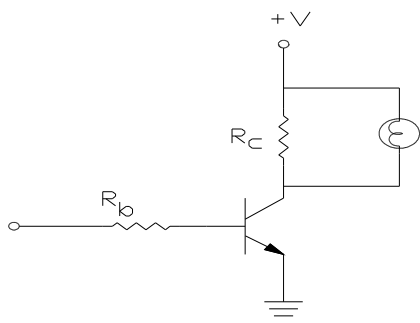3.) For the circuits shown below indicate whether the current through the load is being sourced or sunk by the active devices.

Fig. 1

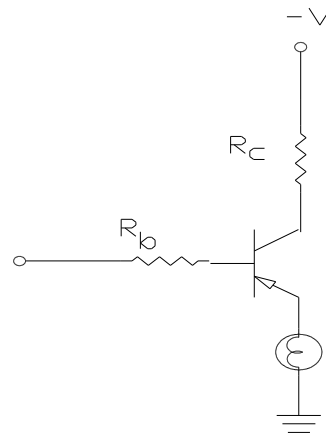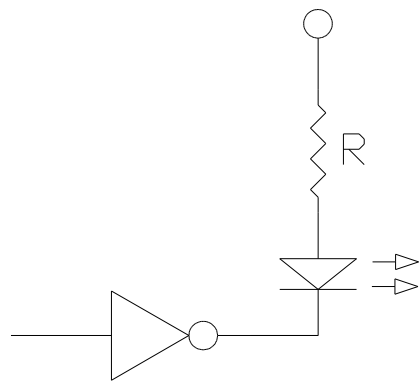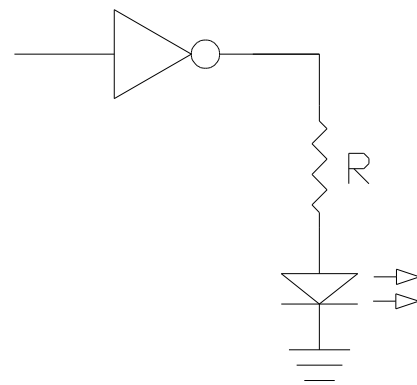Fig. 2

Fig. 3

Fig. 4

4.)   The speed of a permanent magnet dc motor will be controlled by a dc control regulator that has an input range of 0 - 15 Vdc. The regulator has linear output of 0 - 50 Vdc over range of input voltage.   The motor has a linear speed characteristic with respect to terminal voltage over the desired range of operation. The gain constant for the motor is 40 rpm/V. This motors speed is to be controlled by a data acquisition system with an 8-bit digital output word from the system through a DAC0800 DAC chip.

    a.)   determine the values of resistance for the DAC circuit so that a range of 0-15 Vdc is achieved for the span of digital output. The reference voltage is 5 Vdc.
    b.)   find the binary input values that will produce motor speeds of 600 rpm, 1200 rpm, 1600 rpm.
    c.)   determine the maximum speed error that can be expected due the quantitization.