

# Embedded Real-Time Systems (AME 3623)

## Homework 1

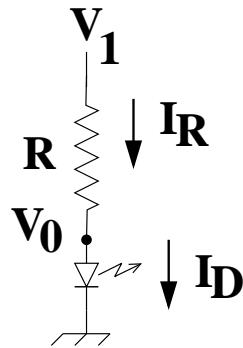
January 30, 2012

This homework assignment is due on Thursday, February 2nd at 5:00pm. Your work may be handed in electronically (use the **Homework 1** digital dropbox on D2L) or in hardcopy form (in person or in office).

**This assignment must be done individually: do not share/discuss your answers with others or look at the answers of others.**

### Question 1

Consider the following circuit:

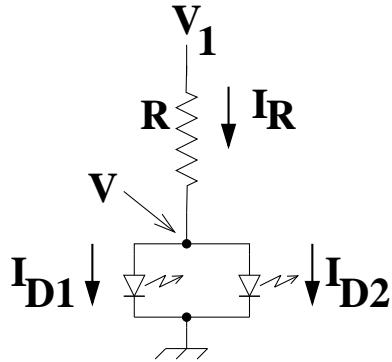


Assume that  $V_f = 2V$  (the forward voltage of the diode).

1. (10pts) What equations are always true, no matter the state of the diode?
2. (15pts) At what  $V_1$  does the diode begin to conduct current?
3. (10pts) Assume that  $R = 200\Omega$ . Draw  $V_0$  and  $I_D$  as a function of  $V_1$  for interesting values of  $V_1$ . (use separate figures)

## Question 2

Consider the following circuit:



Assume that  $V_{f1} = 2V$ ,  $V_{f2} = 1.5V$ , and  $R = 1K\Omega$ .

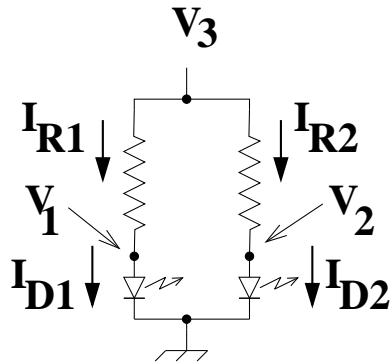
1. (10pts) What equations are always true, no matter the states of the diodes?
2. (10pts) What are the four possible cases for the diodes?

3. (10pts) At what  $V_1$  does some diode begin to conduct current?

4. (10pts) At what  $V_1$  do both diodes begin to conduct current?

## Question 3

Consider the following circuit:



Assume that  $V_{f1} = 2V$ ,  $V_{f2} = 1.5V$ , and  $R_1 = R_2 = 1K\Omega$ .

1. (10pts) What equations are always true, no matter the state of the diode?
2. (10pts) What are the four possible cases for the diodes?

3. (10pts) At what  $V_3$  does some diode begin to conduct current?

4. (10pts) At what  $V_3$  do both diodes begin to conduct current?

5. (10pts) When  $V_3 = 5V$ , what are  $I_{R1}$  and  $I_{R2}$ ?

## Question 4

1. (5pts) Given the binary number: 111001011. What is the decimal equivalent? Assume that this is an unsigned number. Show your work.
2. (5pts) Assume that we interpret 11001110 a signed 8-bit number (two's complement). Is it positive or negative? What is the decimal equivalent? Show your work.
3. (5pts) Assume that we interpret 01101100 a signed 8-bit number (two's complement). Is it positive or negative? What is the decimal equivalent? Show your work.
4. (5pts) Given the decimal number: 148. What is the binary equivalent? Show your work (all of the steps of the algorithm that we discussed in class).

5. (5pts) Given the decimal number: 563. What is the binary equivalent?  
Show your work.

## Question 5

How much time did you spend on this homework assignment?