# Embedded Real-Time Systems (AME 3623)
# Homework 3

March 3, 2008

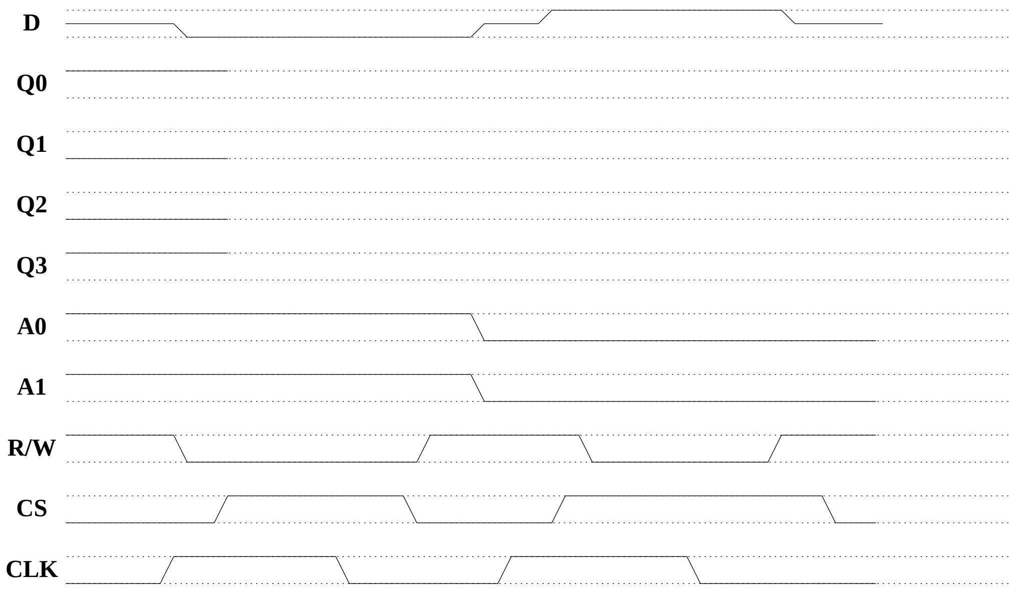
This homework assignment is due on Tuesday, March 11th in class (9:00 am). Your work may be handed in electronically (use the **Homework 3** digital dropbox on D2L), but please bring a hardcopy to class.

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

# Question 1

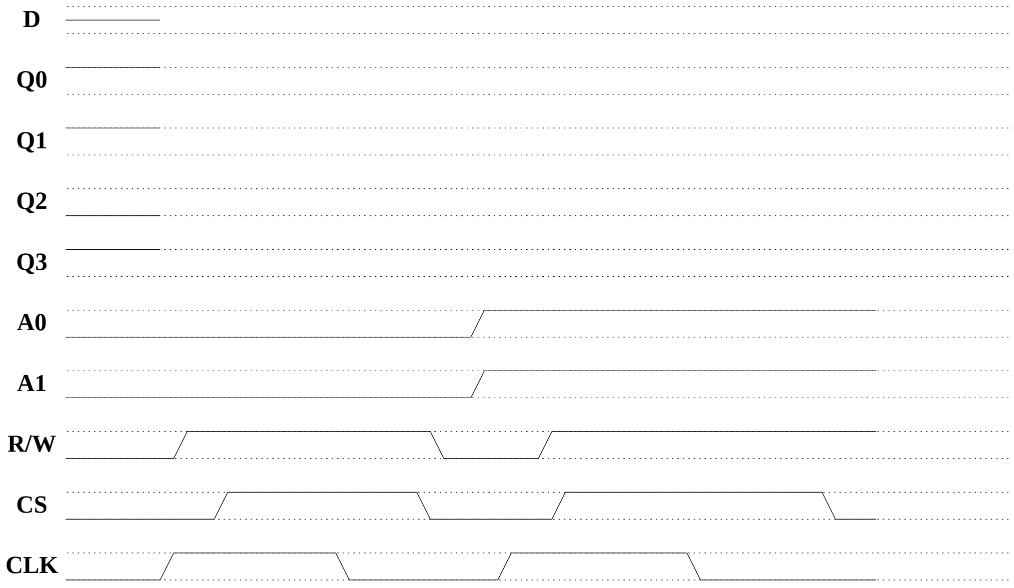
(10pts) Consider the four-element memory "chip" that we discussed in class (each element is "one bit wide"). Given the following timing diagram, fill in the missing traces ($Q0$, $Q1$, $Q2$, and $Q3$).

Hint: first re-examine the rules for writing to and reading from a memory chip.



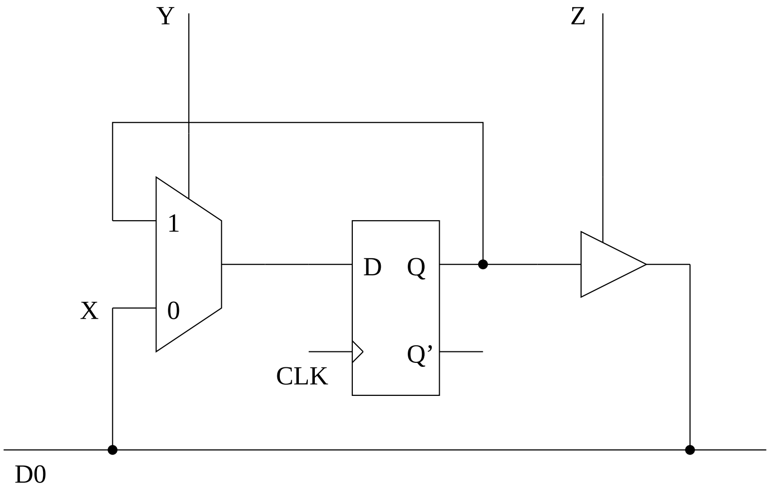
# Question 2

(10pts) Consider the same four-element memory chip. Given the following timing diagram, fill in the missing traces ($D$, $Q0$, $Q1$, $Q2$, and $Q3$).



# Question 3

The following circuit is a partial implementation of a 1-bit memory sitting on the data bus $D0$.




1. (10pts) What effect does signal $Y$ have on writing to or reading from the memory?

2. (10pts) What effect does signal $Z$ have on writing to or reading from the memory?

3. (10pts) Assume memory control signals in the previous problems ($CS$, $R/W$, $A1$, and $A0$), and that this is memory element number 1 (counting from 0). Give the truth table for $Z$.

| $CS$ | $R/W$ | $A1$ | $A0$ | $Z$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | 1 | |
| 0 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 1 | |
| 0 | 1 | 0 | 0 | |
| 0 | 1 | 0 | 1 | |
| 0 | 1 | 1 | 0 | |
| 0 | 1 | 1 | 1 | |
| 1 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 1 | |
| 1 | 0 | 1 | 0 | |
| 1 | 0 | 1 | 1 | |
| 1 | 1 | 0 | 0 | |
| 1 | 1 | 0 | 1 | |
| 1 | 1 | 1 | 0 | |
| 1 | 1 | 1 | 1 | |

4. (10pts) Design a circuit that implements $Z$.

# Question 4

1. (5pts) Briefly explain the function of a *start bit* in serial communication.

2. (10pts) Under what conditions does the LED attached to port B, pin 1 flash?

```
while(1) {
   c = getchar();
   if(c >= 'a' && c <= 'z') {
      PORTB ^= 2;
   }
}
```

# Question 5

How much time did you spend on this assignment?