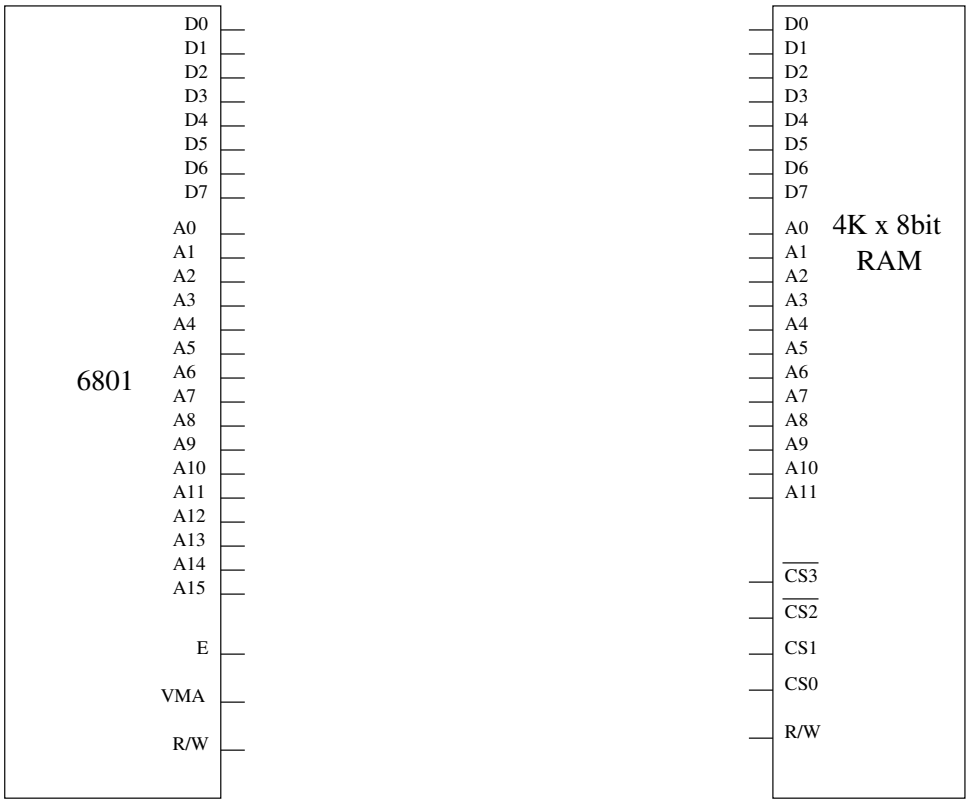
CSE 421 Midterm Examination
Fall 2004-2005

1 Connecting a RAM Module *(25 points)*

Your task in this question is to connect a single 4K by 8-bit RAM module to a 6801 CPU. The fictitious RAM chip in this question has 8 data lines and 12 address lines. It also has R/W input, and 4 chip select inputs. The chip select lines CS0 and CS1 are active high, while CS2 and CS3 are active low.

Show all necessary connections in the figure below (with lines!) so that the memory chip responds to addresses between $\$4000$ and $\$7FFF$. That is an 16K range in total; which is four the memory size of the chip; you should arrange the connections so that we have four continuous memory ranges that are mirror images of each other.

Note that the RAM should be enabled only when both VMA and E outputs of the CPU are high. **You may use two-input NAND gates as necessary.**



2 IRQ & NMI *(25 points)*

a. There are two 6800-series CPUs in operation (not with the same code!). Two "smart" students ground the IRQ pins of the two CPUs. After a few seconds, they remove the ground connections. CPU #1 continues normal operation, while CPU #2 crashes. Explain the likely difference in software between the two CPUs, as well as what happened.

b. The same students connect a 1-MHz pulse generator to the NMI pin of their CPUs (the same CPUs as in the previous part, running at about 1MHz). After a few seconds of operation, the pulse generator is removed from both CPUs, and now both CPUs crash. Explain the likely reason of the crash, and why both CPUs crashed this time.

3 A/D & D/A Conversion *(25 points)*

a. We have an A/D converter of 8 bits, with an input range of 0V to 12V. If the output of the converter reads $\$17F$, in what range is the input voltage?

b. Given we have an 11-bit D/A converter with a range of 0V to 5V, what value should we apply to the input of the device to generate (a voltage as close as possible to) 2V at the output?

4 Serial Communication *(25 points)*

An ACIA has been connected to a serial terminal. The terminal sends typed characters to the ACIA, and displays characters transmitted by the ACIA on the monitor.

The ACIA has been set up, and the control register is known to contain $32.

a. What is the communication mode? (Data bits, parity bits, stop bits?)

b. The communication is known to be running at 19200 bits per second. What is the frequency of the clock driving the ACIA?

c. Under what conditions (given the lines are properly connected) will the ACIA interrupt the CPU?