MA1

Microprocessor Applications

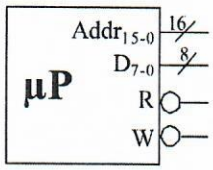
MA-1. This problem assumes the use of an 8-bit microprocessor (**µP**) with a 16-bit address bus and 8-bit data bus. The microprocessor has active-low read and write signals for interfacing external devices. Some of the devices for the design are already shown below. Please **USE LABELS** instead of wires in your circuit diagrams but do **NOT** replace circuits with equations! Bus notation is strongly encouraged.

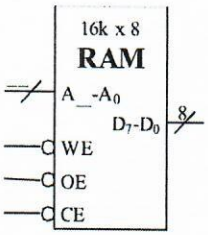
a) Design the logic to interface the microprocessor to the 16 KB SRAM, starting at address **0xC000**. What is the address of the final memory location of the SRAM from the perspective of the microprocessor?

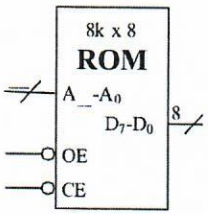
b) Design the logic to interface the microprocessor to the 8 KB ROM, starting at address **0x8000**. Your design must not allow destructive behavior if the processor tries to write to the ROM. What is the address of the final memory location of the ROM from the perspective of the microprocessor?

c) Design the logic to interface a bank of 8 simple (SPST-single pole, single throw) switches at address $2000. Be sure to draw the eight switch circuits; one SPST switch has been drawn for you. For your design, what address or range addresses can you use to read the switch values?

d) Design the logic to interface a bank of 8 LEDs (light emitting diodes) switches at address $4000. Be sure to draw the eight LEDs; one LED has been drawn for you. For your design, what address or range addresses can you output to the LEDs?







MA2

Microprocessor Applications

MA-2. Answer each of the following short questions.

a) Name and briefly describe **two** different serial interfaces available on many microprocessors or microcontrollers (**other** than USB and Ethernet).

b) Assume that a microprocessor has an 8-bit ADC (analog-to-digital converter). Also assume that the minimum and maximum allowable analog values are 1 V and 3 V, respectively, and that the ADC can use all 8-bits for the range of possible inputs. Answer the following with respect to this system.

   i) Determine the functional relationship (i.e., an equation) for the digital value as a function of the analog input voltage, $D = f_1(A)$, where D is the digital value determined by the analog input A.

   ii) Determine the functional relationship (i.e., an equation) for the voltage as a function of the digital value, $A = f_2(D)$.

   iii) If the input voltage is 1.5 V, what is the digital value?

c) Assume that **A** is an 8-bit accumulate (register). Also assume that typical assembly-level type instructions exist, but with **NO** bit clear and **NO** bit set instructions. Write pseudo-code to clear bit 7 (the most significant bit) and set bit 0 (the least significant bit) without affecting the other bits.