CpE213 Assignment 3 (due Thursday Oct. 2 at 11 am)
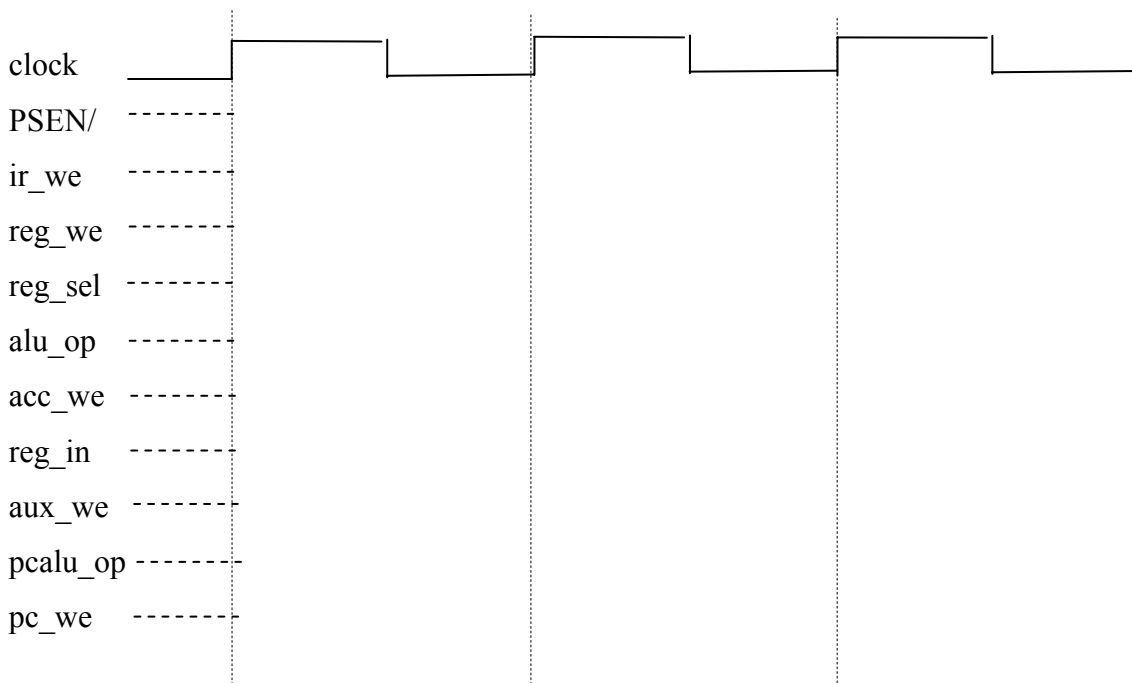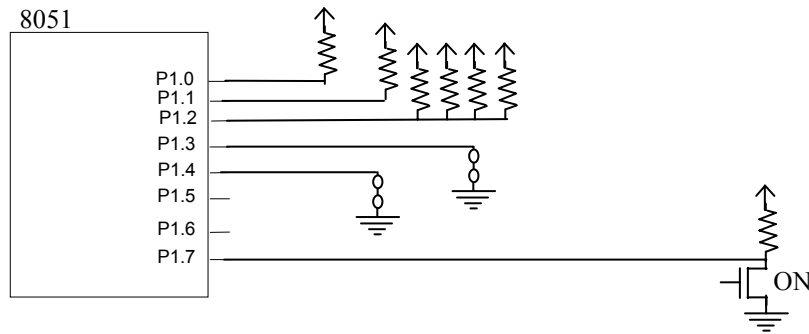
Name_____

Show all your work in the space provided. Answers with a simple "yes", "no", or a single number are typically incomplete and will not be given full credit. Answers in non-reduced form, like (a+sqrt(b))/c, are fine where appropriate. Good English on essay/short answer questions is required. ON MULTIPLE CHOICE QUESTIONS, IF YOU'RE NOT SURE DON'T GUESS – you will get points off for wrong answers. If you know part of an answer, write what you know for partial credit.

1. (10 Points) Choose between the underlined words. Circle the correct answer. Write an explanation if you think you need to.

   a. For an embedded system using a microcontroller, code is typically stored in: RAM ROM BOTH.

   b. Data is typically stored in: RAM ROM BOTH.

   c. Registers are relatively CHEAP EXPENSIVE. Chip designers use them LIBERALLY CONSERVATIVELY.

   d. Pins coming off the chip are relatively CHEAP EXPENSIVE. Chip designers use them LIBERALLY CONSERVATIVELY.

   e. There are potentially two values that can be read from the 8051's internal memory location 90H, depending on how you read it. TRUE FALSE.

2. (20 Points) Draw the timing diagram for the following control signals when the WIMP51 is executing the instruction "JZ 42H", assuming ACC=2AH. If you don't think a control signal is doing anything important, indicate so with a "don't care" (a dotted line down the middle). Give "command" values for pcalu_up and alu_op rather than numeric values (e.g. give value as "pcalu_up=PC_INC" instead of "pcalu_up=42"). If you're not sure, make your best guess (but tell me it's a guess and why).

clock

PSEN/

ir_we

reg_we

reg_sel

alu_op

acc_we

reg_in

aux_we

pcalu_op

pc_we

8051

P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7

ON

3. (20 Points) The schematic above shows some external hardware connected to the 8051 microcontroller (P1.0 is bit 0 of port 1). Say we performed the following instructions:

MOV P1,#AAH

MOV A, P1

a) (8 Points) What value would end up in the ACC (Assume resistors are large).

b) (12 Points) Explain your answer for a)… please explain carefully, as though you were trying to teach someone who knew nothing about the 8051 microcontroller how this thing worked (you will be graded by how well they might understand).

4. (25 Points) For the following WIMP51 code:
   a. (10 Points) Give the opcode for the JZ instruction (You will need to fill in some addresses below to do this… but not many).

   b. (5 Points) Give the opcode for the XRL instruction.

   c. (10 Points) Fill in the values of the WIMP51 registers listed below as it executes this code. I have already filled in some of the values for you.

   addr.   ASM code
   0   MOV A,#42H
   2   MOV R0,A
   3   MOV A, #2AH
   5   top: XRL A, R0
                  MOV R0,A
                  JZ stop
                  SJMP top
          stop: SJMP stop

   registers: PC   ACC   Z   R0   R1
               0   X   X   X   X
               2   42   X   X   X
               3   42   X   42   X
               5   2A   X   42   X
               6   68   X   42   X ← Ready to do MOV instruction

5. (25 Points) For the components in the following diagram
   a. (10 Points) Give the address space of RAM0.

   b. (5 Points) Name 2 address locations the processor could read from to access Sensor0.

   c. (10 Points) Connect register Sensor1 to the processor, such that its address space does not conflict with the address space of any of the other devices. Feel free to add additional logic.