CmpE213 – Test I

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.

1. (10 Points) Assume PSW =0CH before the following instructions are executed:

   MOV A,#24H
   ADD A,#7FH

   What is the value of PSW after the instructions are executed? Show your work.

2. (10 Points) The figure below shows the signals on ALE and PSEN/ when the 8051 is fetching the instruction "MOV A, 42H" from external memory. The instruction is stored in memory beginning at location 1C2AH. Show the values that should be on P0, P2, RW/ and WR/.

ALE

PSEN/

P0

P2

RD/

WR/
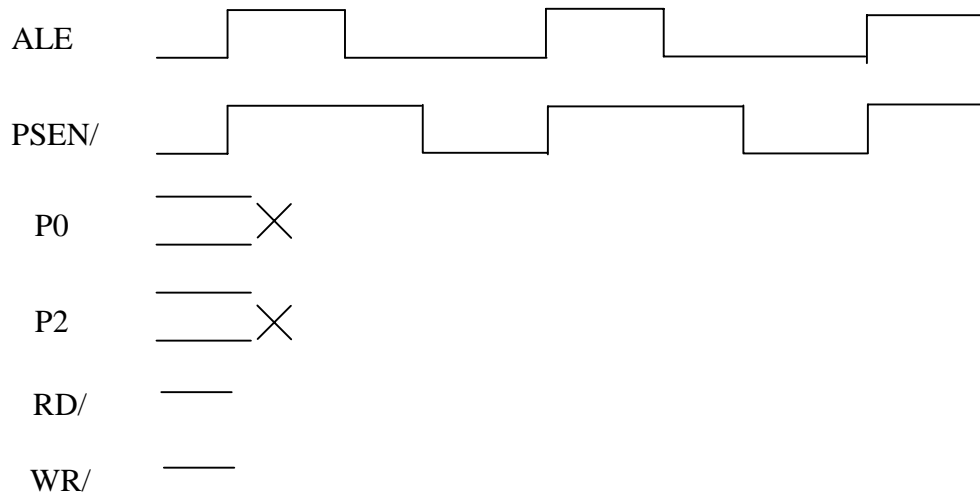
3. (16 Points) The following shows a timing diagram of control signals within the GNOME during a single instruction cycle.
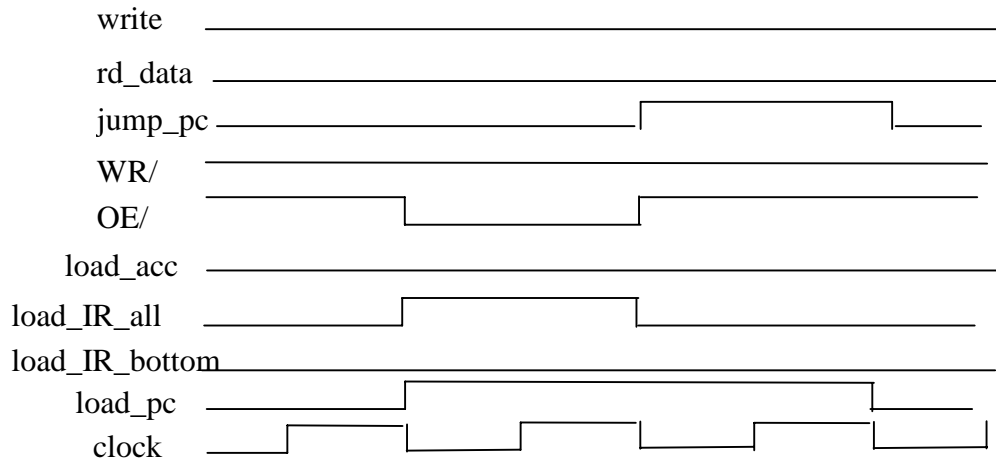
a) (4 Points) Label the fetch, decode, and execute portions of the instruction cycle on the figure above.

b) (6 Points) Show the movement of data in the diagram below, by drawing arrows showing data movement and by labeling the arrows to show the order they are executed and briefly explaining what is happening. I have put two of the arrows and labels on for you.
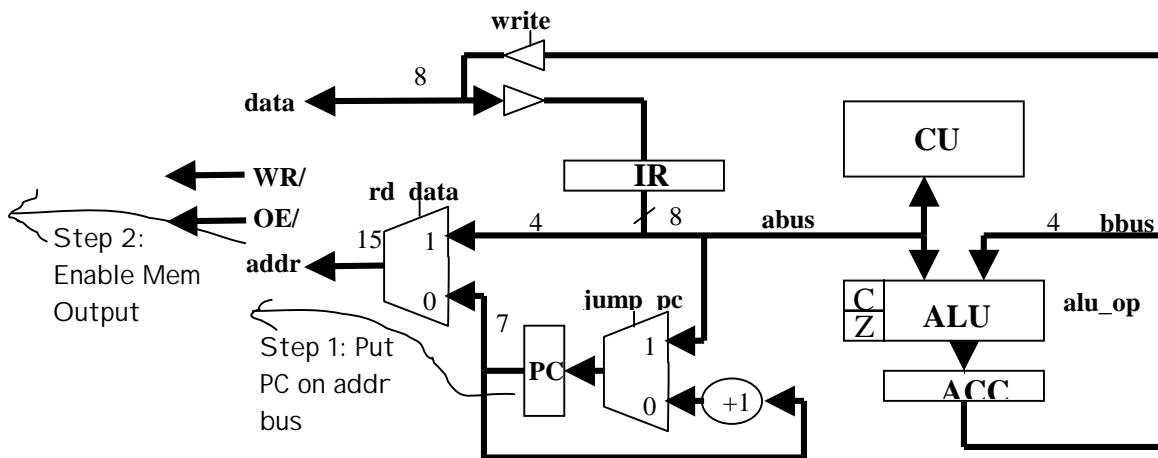
c) (6 Points) What instruction was executed? (Explain your choice, for chance at partial credit)

a) jmp A   b) tst Rn   c) lda Rn   d) sta Rn
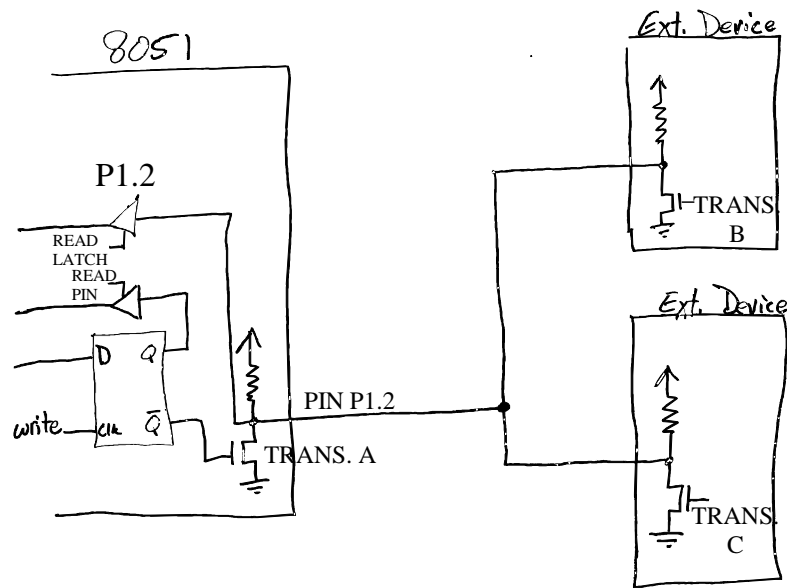
e) skipc   f) add Rn   g) add #D   h) set c

4. (18 Points) The figure below shows Port 1, bit 2 (P1.2) connected to two external devices.

a) Assume we write a 1 to P1.2 and TRANS B is OFF and TRANS C is ON.
   i. (3 Points) TRANS A is: ON OFF (circle one)
   ii. (3 Points) The voltage on pin P1.2 is: HIGH LOW (circle one)
   iii. (3 Points) If we perform a "MOV C,P1.2" instruction, the value that will end up in C is a: 1   0 (circle either 1 or 0).
b) Assume we write a 1 to P1.2 and TRANS B is OFF and TRANS C is OFF.
   i. (3 Points) If we perform a "MOV C,P1.2" instruction, the value that will end up in C is a: 1   0 (circle either 1 or 0).
c) Assume we write a 0 to P1.2 and TRANS B is OFF and TRANS C is OFF.
   i. (3 Points) TRANS A is: ON OFF (circle one)
   ii. (3 Points) The voltage on pin P1.2 is: HIGH LOW (circle one)

5. (15 Points) Memory types:
   a. (5 Points) Why is code typically stored in ROM, rather than RAM?

   b. (5 Points) Why is data typically stored in RAM?

   c. (5 Points) Why would you prefer to store data in registers rather than RAM? Why do you store a lot of data in RAM anyway?

6. (15 Points) Assume that GNOME memory contains the following program and that this program has been run to completion.

```
        lda #C
        sta E
        xor E
STOP: jmp STOP
```

a) (10 Points) Show the contents of (external) memory in the diagram below – both code and data – for those portions of memory whose value you know. Clearly indicate which is code memory and which is data. Be sure to show opcodes in code memory (instead of text like "lda #C"). Write "XX" for unknown values.

address locations in external memory	VALUES IN GNOME MEMORY
7FFF	
7FFE	
7FFD	
7FFC	
:	:
:	:
0004	
0003	
0002	
0001	
0000	

b) (5 Points) What value is in the accumulator after this program has finished?

7. (16 Points) The schematic below shows several chips in external memory, including an alphanumeric LCD module. The "ENA" pin on the LCD module acts very much like the CE/ or CS/ chips on external memory modules, except that it operates with positive logic (i.e. the LCD module is selected when ENA is high).
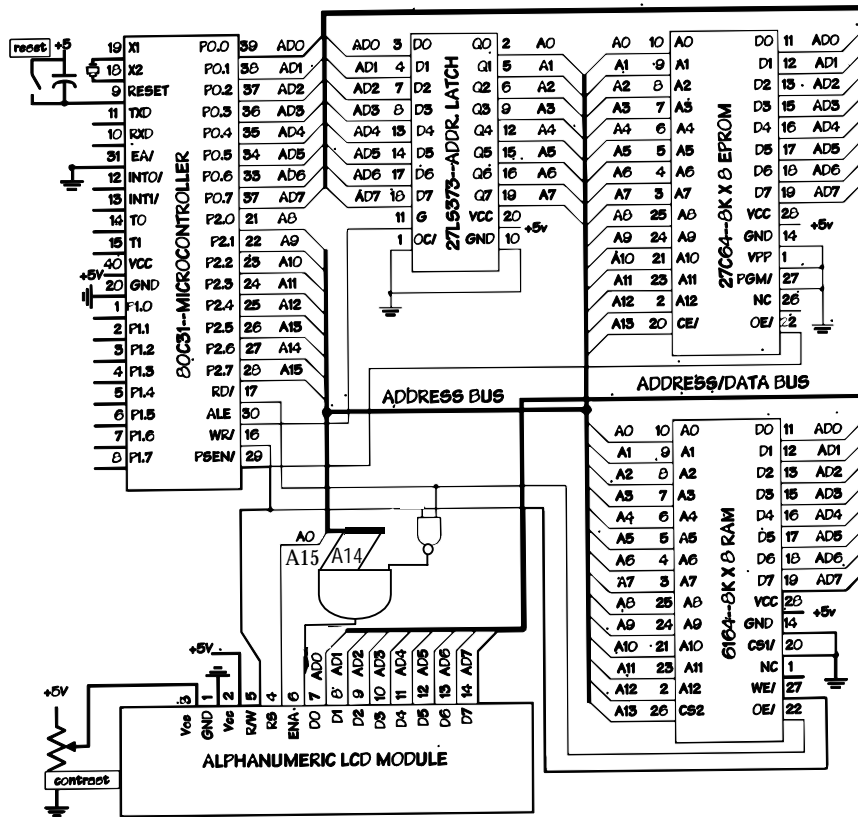
a) (6 Points) What is the address space of the LCD module?

b) (5 Points) Is the LCD module in code or data space? Explain your answer.

c) (5 Points) Could the AND gate be hooked to A15 and A13 instead of A15 and A14 (creating a different address space)? Why or why not?