

Fundamentals of Computer Science

Homework Set 3

November 8, 2023

1. (3') Suppose the memory cells at addresses A4 to B1 in the machine described in **Appendix C** contain the (hexadecimal) bit patterns given in the following table:

Address	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF	B0	B1
Contents	20	00	21	04	22	01	B1	B0	50	02	B0	AA	C0	00

When answering the following questions, assume that the machine is started with its program counter containing A4.

- (1') What is in register 0 the first time the instruction at address AA is executed? Fill a 2-character hexadecimal data (digits and uppercase letters) in the forms.
- (1') What is in register 0 the second time the instruction at address AA is executed? Fill a 2-character hexadecimal data (digits and uppercase letters) in the forms.
- (1') How many times is the instruction at address AA executed before halting? Fill an integer or 'infinity' in the forms.

	a)	b)	c)
Answer	00	01	5

2. (2') Suppose the memory cells at addresses B0 to B8 in the machine described in **Appendix C** contain the (hexadecimal) bit patterns given in the following table:

Address	B0	B1	B2	B3	B4	B5	B6	B7	B8
Contents	13	B8	A3	02	33	B8	C0	00	0E

- (1') If the program counter starts at B0, what bit pattern is in register 3 after the first instruction has been executed?
- (1') What bit pattern is in memory cell B8 when the halt instruction is executed?

	a)	b)
Answer	0E	83

3. (2') Using the machine language of **Appendix C**, write a program which can JUMP to the address stored in Register 3 (R3). Assuming the first instruction of your program is at address 00 and the machine is started with its program counter containing 00. Fill your program in the forms, and each line contains a 4-character hexadecimal instruction (digits and uppercase letters). Hint, program is data, this task can be completed by two instructions (you don't need the 'C000' in this task).

Example Code (R2=R0+R1) (1 instruction per line!)	PROGRAM BEGIN:> 5201 C000 <:PROGRAM END
Your Code	PROGRAM BEGIN:> 3303 B003 <:PROGRAM END

4. (3') Using the machine language of **Appendix C**, write a program that places a 1 in the most significant bit (refer to Figure 1.7 in the textbook) of the memory cell whose address is A6 without modifying the remaining bits. Fill your program in the forms, and each line contains a 4-character hexadecimal instruction (digits and uppercase letters). Hint, this task can be completed by five instructions (the last one is the 'C000').

Example Code (A2=A0+A1) (1 instruction per line!)	PROGRAM BEGIN:> 10A0 11A1 5201 32A2 C000 <:PROGRAM END
Your Code	PROGRAM BEGIN:> 10A6 2180 7201 32A6 C000 <:PROGRAM END