EE/CSE 469 Computer Architecture I
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HW 2

1. Write the following strings using ASCII encoding. Write your final answers in hexadecimal.

(a) SOS
DECIMAL ASCII: 83, 79, 83, 00 HEX ASCII (32-bit): 0x534F5300

(b) Cool
DECIMAL ASCII: 67, 111, 111, 108 HEX ASCII (32-bit): 0x436F6F6C

(c) boo!
DECIMAL ASCII: 98, 111, 111, 33 HEX ASCII (32-bit): 0x626F6F21

Show how the strings are stored in a byte-addressable memory on a little-endian machine starting at memory address 0x00001050C. Clearly indicate the memory address of each byte.

Word Address	Data (HEX)				Word Number
	Byte Address(HEX)				
0x000010514	62	6F	6F	21	Word 2 (boo!)
	0x000010517	0x000010516	0x000010515	0x000010514	
0x000010510	43	6F	6F	6C	Word 1 (Cool)
	0x000010513	0x000010512	0x000010511	0x000010510	
0x00001050C	53	4F	53	00	Word 0 (SOS)
	0x00001050F	0x00001050E	0x00001050D	0x00001050C	

2. Convert the following ARM assembly code into machine language. Write the instructions in hexadecimal.

MOV R10, #63

1110 00 1 1101 0 0000 1010 0000 00111111
1110 0011 1010 0000 1010 0000 0011 1111
0xE3A0A03F

ADD R1, R3, R4

1110 00 0 0100 0 0011 0001 00000 00 0 0100
1110 0000 1000 0011 0001 0000 0000 0100
0xE0831004

STR R4, [R11, R8]

1110 01 111000 1011 0100 00000 00 0 1000
1110 0111 1000 1011 0100 0000 0000 1000
0xE78B4008

0xE3A0A03F
0xE0831004
0xE78B4008

3. Convert the following program from machine language into ARM assembly language. The numbers on the left are the instruction addresses in memory, and the numbers on the right give the instruction at that address.

0x00008008 0xE3A02000

1110 0011 1010 0000 0010 0000 0000 0000
Cond: 1110
Op: 00
I: 1
Cmd: 1101
S: 0
Rn: 0
Rd: 2
Rot: 0000
Imm: 00000000

MOV R2, #0

0x0000800C 0xE1A03001

1110 0001 1010 0000 0011 0000 0000 0001
Cond: 1110
Op: 00
I: 0
Cmd: 1101
S: 0
Rn: 0
Rd: 3
Sh: 00
Instr 11:4 = 0
Rm: 1

MOV R3, R1

0x00008018 0xE2822001

1110 0010 1000 0010 0010 0000 0000 0001
Cond: 1110
Op: 00
I: 1
Cmd: 0100
S: 0
Rn: 2
Rd: 2
Rot: 0
Imm: 1

ADD R2, R2, #1

0x0000801C 0xE0811003

1110 0000 1000 0001 0001 0000 0000 0011
Cond: 1110
Op: 00
I: 0
Cmd: 0100
S: 0
Rn: 1
Rd: 1
Rm: 3

ADD R1, R1, R3

0x00008020 0xEAFFFFFA

1110 1010 1111 1111 1111 1111 1111 1010

Cond: 1110

Op: 10 BRANCH

L: 0

Imm24:

B #0xFFFFFA