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1. Assume you have a byte-addressable machine that uses 32-bit integers and you are storing the hex value 1234 at address 0:

a) Show how this is stored on a big endian machine.

Adress →	0x0000	0x0001	0x0002	0x0003
	00	00	12	34

b) Show how this is stored on a little endian machine.

Adress →	0x0000	0x0001	0x0002	0x0003
	34	12	00	00

c) If you wanted to increase the hex value to 123456, which byte assignment would be more efficient, big or little endian? Explain your answer.

Big endian because you can store number after last memory.

3. Fill in the following table to show how the given integers are represented, assuming that 16 bits are used to store values and the machine uses two's complement notation.

Integer	Binary	Hex	4 Byte Big Endian	4 Byte little Endian
28	0000 0000 0001 1100	0x001C	00,1C	1C,00
2216	0000 1000 1010 1000	0x08A8	08,A8	A8,08
-18675	1011 0111 0000 1101	0xB70D	B7,0D	0D,B7
-12	1111 1111 1111 0100	0xFFF4	FF,F4	F4,FF
31456	0111 1010 1110 0000	0x7AE0	7A,E0	E0,7A

6. The first two bytes of a 2M × 16 main memory have the following hex values:

- Byte 0 is FE
- Byte 1 is 01

If these bytes hold a 16-bit two's complement integer, what is its actual decimal value if:

a) memory is big endian?

0FE01000 = 0 1111 1110 0000 0001 0000 0000 0000 0000 0000 = 26633830

b) memory is little endian?

000001FE = 0 0000 0000 0000 0000 0000 0000 0001 1111 1110 = 510

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7. What kinds of problems do you think endian-ness can cause if you wished to transfer data from a big endian machine to a little endian machine? Explain.

It will increases your transfer time because it need to switch all of memory in main memory.

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10. A computer has 32-bit instructions and 12-bit addresses. Suppose there are 250 two-address instructions. How many one-address instructions can be formulated? Explain your answer.

0000 0000	xxxx xxxx xxxx	xxxx xxxx xxxx
⋮		
1111 1001	xxxx xxxx xxxx	xxxx xxxx xxxx
1111 1010 – escape opcode		
1111 1010	0000 0000 0000	xxxx xxxx xxxx
⋮		
1111 1010	1111 1111 1111	xxxx xxxx xxxx
1111 1011	0000 0000 0000	xxxx xxxx xxxx
⋮		
1111 1111	1111 1111 1111	xxxx xxxx xxxx

1111 1010 0000 0000 0000 xxxx xxxx xxxx → 1111 1010 1111 1111 1111 xxxx xxxx xxxx

We have 2^{12} combinations and 1111 1010 → 1111 1111 is 5 combinations that mean

$2^{12} * 5 = 20{,}480$ for one-address instructions.

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12. Convert the following expressions from infix to reverse Polish (postfix) notation.

a) $X \times Y + W \times Z + V \times U$

XYx WZx+ VUx+

b) $W \times X + W \times (U \times V + Z)$

UVx Z+ Wx WXx+

c) $(W \times (X + Y \times (U \times V)))/(U \times (X + Y))$

UVx Yx X +Wx XY+ Ux/

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17. a) In a computer instruction format, the instruction length is 11 bits and the size of an address field is 4 bits. Is it possible to have

5 two-address instructions

45 one-address instructions

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32 zero-address instructions

using the specified format? Justify your answer.

000	xxxx	xxxx
⋮		
100	xxxx	xxxx
101 – escape opcode		
101	0000	xxxx
⋮		
111	1100	xxxx
111 1101 – escape opcode		
111	1101	0000
⋮		
111	1110	1111
111 1111 – escape opcode		

b) Assume that a computer architect has already designed 6 two-address and 24 zero-address instructions using the instruction format above. What is the maximum number of one-address instructions that can be added to the instruction set?

000	xxxx	xxxx
⋮		
101	xxxx	xxxx
110 – escape opcode		
110	0000	xxxx
⋮		
111	1110	xxxx
111 1110 – escape opcode		
111	1110	0000
⋮		
111	1111	0111
111 1111 1– escape opcode		

6 two-address instructions escape code is 101

24 zero-address instructions start code is 111 1110

One address instructions is calculate from 110 0000 → 111 1110 is 30 instructions

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21. Suppose we have the instruction Load 1000. Given that memory and register R1 contain the values below.

Memory	
0x1000	0x1400
⋮	
0x1100	0x400
⋮	
0x1200	0x1000
⋮	
0x1300	0x1100
⋮	
0x1400	0x1300

R1 0x200

and assuming that R1 is implied in the indexed addressing mode, determine the actual value loaded into the accumulator and fill in the table below:

Mode	Value Loaded in to Ac
Immediate	0x1000
Direct	0x1400
Indirect	0x1300
Indexed	0x1000

27. A digital computer has a memory unit with 24 bits per word. The instruction set consists of 150 different operations. All instructions have an operation code part (opcode) and an address part (allowing for only one address). Each instruction is stored in one word of memory.

a) How many bits are needed for the opcode?

150 operation is need 8 bits to contain.

b) How many bits are left for the address part of the instruction?

24 – 8 = 16 bits for address part.

c) What is the maximum allowable size for memory?

2^{16} = 65,536

d) What is the largest unsigned binary number that can be accommodated in one word of memory?

$2^{16} - 1$ = 65,535

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