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Note: Please post your homework to ICS232 D2L on or before the due date.

**Chapter 5 – A Closer Look at Instruction Set Architectures**

**Essential Terms and Concepts**

11. Name the seven types of data instructions and explain each.

1. Data movement – moving data into registers, to another register, and to memory.
2. Arithmetic operations – add, subtract, etc.
3. Boolean – And, or, xor, not, etc.
4. Bit manipulation – logical shifts, arithmetic shift
5. I/O – input/output, transfers data into and out of a computer.
6. Transfer of control – these are used to change the order of program execution.
7. Special purpose – instructions that do not fit into the other categories.

12. What is the difference between an arithmetic shift and a logical shift?

Arithmetic shifts are used to multiply or divide by two & use two’s complement. Logical shifts, shift bits to the right or left by a number of bits.

14. What is an addressing mode?

Tells us where instruction operands are located. Can specify constant, a register, or a spot in memory.

18. Explain the concept behind instruction pipelining.

Steps in the fetch-decode-execute cycle are broken down into smaller steps and some can be executed in parallel.

**Exercises**

1. Assume you have a byte-addressable machine that uses 32-bit integers and you are storing the hex value 3456 at address 0.

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

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

1. Hex: 0x00000D80
   1. 00000D80
2. Hex: 0x00000D80
   1. 800D0000

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

a) (8 – 6) / 2 : 86-2/

b) (2 + 3) \* 8 / 10: 23+8\*10/

c) (5 × (4 + 3) × 2 – 6): 543+26-\*\*

14. Convert the following expressions from reverse Polish notation to infix notation.

a) W X Y Z - + \* : (W \* (X + (Y – Z)))

b) U V W X Y Z + \* + \* + : (U + (V \* (W + (X \* (Y + Z)))))

c) X Y Z + V W - \* Z + + : (X + ((( V – W ) \* (Y + Z) + Z))

18. Suppose a computer has an instruction format with space for an opcode and either three register values or one register value and an address. What are the various instruction formats that could be used for an ADD instruction on this machine?

1. ADD x, y, z
2. ADD x1, A

20. What is the difference between using direct and indirect addressing? Give an example.

Direct addressing loads the data at the memory address directly into the AC.

With indirect addressing the data at the address is the real address of the operand.

23. A nonpipelined system takes 200ns to process a task. The same task can be processed in a 5-segment pipeline with a clock cycle of 40ns. Determine the speedup ratio of the pipeline for 200 tasks. What is the maximum speedup that could be achieved with the pipeline unit over the nonpipelined unit?

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**True or False**

3. An instruction takes less time to execute on a processor using an instruction pipeline than on a processor without an instruction pipeline.

True

10. The effective address of an operand is the value of its actual address in memory.

True

**Prepare for next class by reading lecture notes Irvine Chapter 2 and 4**

**Prepare for Mid-Term exam next week.**

**Continue working on Project 1**

**Continue working on Your Group Project**