16.482 / 16.561: Computer Architecture and Design
Spring 2014

Lecture 1: Key Questions
January 23, 2013

1. What information is required to translate a high-level statement such as `X[i]=i*2;` to assembly language?

2. Describe how a processor executes a typical instruction.

3. Describe the four ISA classes discussed in class.

4. What are three locations in which operands are stored? Which is preferable, and why?

5. Describe the characteristics of a RISC architecture.

6. Describe each of the addressing modes listed below:

- Immediate

- Register direct

- Register indirect

- Memory indirect

- Base + displacement

- PC-relative

7. What are the benefits of having few instruction formats? What are the benefits of having many formats?

8. What are the pros and cons of fixed vs. variable length instructions?

9. Assume a MIPS instruction is represented by the hexadecimal value 0xDEADBEEF. List the values for each instruction field, assuming that the instruction is

*   An R-type instruction

*   An I-type instruction

*   A J-type instruction

10. Describe the different mnemonics used for MIPS integer registers.

11. Describe the MIPS data transfer instructions.

12. Describe what it means for data to be aligned.

13. Compare and contrast big-endian and little-endian data.

14. Say memory holds the word 0xABCD1234, starting at address 0x1000, $t0 holds the value
    0x1000, and $s0 holds 0xDEADBEEF. What are the results of the following instructions?

- lh $t1, 2($t0)

- lb $t2, 1($t0)

- lbu $t3, 0($t0)

- sh $s0, 0($t0)

- sb $s0, 3($t0)

15. Describe the MIPS arithmetic and logical instructions.

16. Say $t0 = 0x00000001, $t1 = 0x00000004, $t2 = 0xFFFFFFFF. What are the results of the
    following instructions?

- sub $t3, $t1, $t0

- addi $t4, $t1, 0xFFFF

- andi $t5, $t2, 0xFFFF

- sll $t6, $t0, 5

- slt $t7, $t0, $t1

- lui $t8, 0x1234

17. Describe the different classes of MIPS branch instructions.

18. Explain the use of pseudoinstructions in MIPS assembly.

19. Describe the different jump instructions in MIPS.

20. Describe how if statements are compiled to MIPS assembly, using the example provided in lecture.

21. Describe how loops are compiled to MIPS assembly, using the example provided in lecture.

22. Describe the basic semantics of function calls in MIPS assembly.