

CS341L: Homework #2
Assigned: Week 7 (9/29/2024)
Due date: Wednesday, October 9, 2024

Fall 2024

This homework will be useful to prepare for the Midterm exam on October 14, and to get you started on the Bomblab Project which starts early on week 7. The homework is 130 points and it will be normalized to 100 points.

1 Questions about the x86-64 instruction set

Covered in Chapter 3. To get credit for the answers to these problems, they must be explained. Answers without explanation or justification will not get credit. Some justifications may be as simple as refer to the description of the instruction in some table in the book. Concise and precise explanations are the best. Questions 1 to 10 are worth 40 points.

1. What is the assembly instruction to move a double word? How many bits does it move?
2. What is the resulting memory address for the following operands assuming the indicated values in the registers.
 - (a) `-1(%rsp, %rcx, 4)` assuming `%rsp` has value `0x09` and `%rcx` has value `0x05`.
 - (b) `4(%rsp, %rcx, 4)` assuming `%rsp` has value `0x08` and `%rcx` has value `0x0A`.
 - (c) `256(, %rcx, 2)` assuming `%rcx` has value `0x0A`
 - (d) `0x33(, %rcx, 3)` assuming `%rcx` has value `0x0B`
3. What is the value in hexadecimal of the high-order 32 bits of register `%rax` after executing each of the following instructions. Provide an answer for each specific instruction.
 - (a) `movl $0x11, %eax`
 - (b) `movl $0x0B, %eax`
4. Provide the appropriate suffix and explain what is the instruction doing:
`mov__ (%rax), %dx`
5. Consider these two declarations in C: `int *x` and `char *y`
Suppose that `x` is in register `%rdi` and `y` is in register `%rsi`, what is the assembly code to copy the value at the address stored in `%rdi` to the address stored in `%rsi`.
6. What is the value in register `%rdx` after executing the following assembly code
`leaq -1(%rsp, %rcx, 4), %rdx`
assuming `%rsp` and `%rcx` have values `0x09` and `0x05`, respectively.

7. What is the value (in decimal) in register `%rsp` after executing the following instructions in assembly code?

```
movl    $1, %esp
addq    $2, %rsp
incq    %rsp
salq    $1, %rsp
```

8. What is the value (in decimal) in register `%rax` after executing the following instructions in assembly code?

```
movl    $4, %eax
imulq   $8, %rax
sarq    $2, %rax
andq    $4, %rax
```

9. What is the value of the SF condition code after executing the following instructions in assembly code?

```
movb    $0, %b1
cmpb    $0x01, %b1
```

10. What is the value of the ZF condition code after executing the following instructions in assembly code?

```
movb    $1, %b1
cmpb    $0x01, %b1
```

11. Problem 3.63, pp. 314-316. (30 points)

Notice that the jump table presented in page 315, has six (6) entries, pairwise locations presented side by side instead of all of them vertically. The first address of the jump table is in location 0x4006f8, in which addresses are the second, fourth, and sixth entries of the jump table?

2 Floating point and integer representations

Explain your answers to get credit. Concise and precise explanations are the best.

12. What is the relationship between T_{MAX} and U_{MAX} ? Explain. (4 pts.)
13. Convert the value 0xF1AB to binary and apply the Binary to two's complement (B2T) encoding to it, what is the resulting number? (6 points)
14. What is the value of x? (do it by hand, and show partial results at each step; do not run it in C) (6 points) `int x = (0xD2 & (1 << 7)) >> 7;`
15. What is the value of x? (do it by hand, and show partial results at each step; do not run it in C) (6 points) `int x = (0xD2 & (1 << 3)) >> 3;`
16. Consider the 12-bit IEEE floating-point representation with 4 bits of exponent and 7 bits of fraction. (18 pts.)
- (a) What is the bias? show your intermediate work to compute the bias
 - (b) What is the value of 011110000000 in this 12-bit representation? Explain all the components of the bit pattern and which of the three cases it falls into.
 - (c) What is the bit pattern for the decimal value 34.75 in this format?

17. Given the following encoding of a single-precision floating point number: (6 points)

1 10000000 11000000000000000000000

What are the following values? (show all values in decimal; show M in both binary and decimal; show full equation for V)

- exp =
- Bias =
- E =
- M =
- V =

18. Given the following encoding of a single-precision floating point number: (6 points)

1 10000001 11000000000000000000000

What are the following values? (show all values in decimal; show M in both binary and decimal; show full equation for V)

- exp =
- Bias =
- E =
- M =
- V =

19. Assuming little endian and that you have the addresses 0x404 to 0x407 available, how would the following data be stored in memory, if you start at address 0x404 0x5566AA19? (4 pts)
20. Assuming big endian and that you have the addresses 0x404 to 0x407 available, how would the following data be stored in memory, if you start at address 0x404 0x1CFF22? (4 pts)

3 Submission

Submit your answers in a **PDF file on Canvas** by midnight on the due date. Answers in formats other than pdf will not be graded and will not give you credit for this assignment. If you handwrite your answers and scan them into a pdf file, please make sure that your handwriting is clear and readable; unreadable answers will not be graded.