California State University, Sacramento
College of Engineering and Computer Science

Computer Science 35: Intro to Computer Architecture

Spring 2022 – Exam 1

178 | 2

Name: First Last Date: 03/02/22

1

1. Labels are used to store Addresses. *(1 point)*

2. After the following program executes, what will be the final value of the registers? *(15 points)*

```
mov   rax, 40
mov   rbx, 15
add   rbx, rax
mov   rcx, 200
sub   rcx, rbx
```

rax rbx: 15 + = 40 = rbx → # rbx = 55; # rax = 40

rcx rbx: 200 - 55 = 145 → # rcx = 145

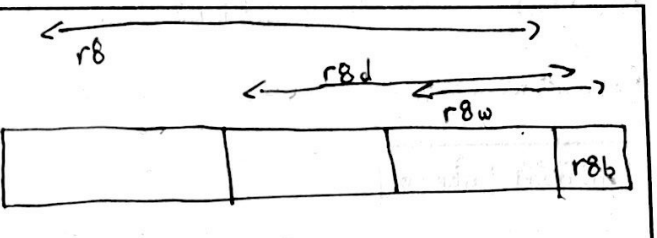
15

Please put the final values in the table below:

rax	rbx	rcx
40	55	145

3. Draw the `r8` register. Mark and identify each of its sub-registers. *(15 points)*

- r8 = x64 register
- r8d = x 32 register
- r8w = x16 register
- r8b = 8 bit low



15

4. Convert the following binary number to hexadecimal: `0101 1001 1011 0111` *(10 points)*

5 9 11=B 7

Answer: 5 9 B7

10

41

5. List all the 8-bit registers found on the Intel x64 *(10 points)*

AL, BL, CL, DL (low), AH, BH, CH, DH (high)
SIL, DIL, BPL, SPL
r8b, r9b, r10b, r11b, r12b, r13b, r14b, r15b

10

6. This looks familiar...

Labels are used to store Addresses. *(1 point)*

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7. The following is an incomplete program. After it runs, what are the values of the registers? *(15 points)*

```
...

Year:
    .quad 1947              #Address is 1234

Message:
    .ascii "1964"           #Address is 5000

...

lea  rax, Message       # rax = "1964" ; missing  10
mov  rbx, Year
lea  rcx, Year

...
```

10

Please put the final values in the table below:

rax	rbx	rcx
~~"1964"~~ 5000	1947	1234

8. What does the following mean in your assembly program? Why is it necessary? *(10 points)*

```
.global _start
```

the global is like java's public statement, it makes the file accessible, specifically the subroutine _start. Allows the label _start to be recognized/linked. This is necessary to run our programs.

- Makes the word _start global or public which then helps in linking

10

31

And now - *for no apparent reason* - here is a picture of a dog using a computer.

9. How many bytes will each of the following directives create? *(15 points, 5 each)*:

14

a) `.ascii "Krabby Patty"`

b) `.byte 6`

c) `.quad 25`

~~11~~ 12-1

1 byte ; initial = 6

8 bytes; initial = 25

10. Given the following 4-byte integer, how is it stored with different systems? *(5 points)*

5

CA 64 17 E8

How would it be stored by a little-endian processor?

0	1	2	3
E8	17	64	CA

11. List all the 64-bit registers found on the Intel x64 *(10 points)*

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RAX, RBX, RCX, RDX

RBP, RSP, RDI, RSI

r8, r9, r10, r11, r12, r13, r14, r15

29

12. Once again....

1 Labels are used to store Addresses. *(1 point)*

13. Write a full program (using the format we used this semester). Create an ASCII string called *show* that contains the name of show you liked when you were a kid. Then print it to the screen. Remember to exit your program. *(25 points)*

```
• intel_syntax noprefix
• data
Label One:
        .ascii "Spongebob squarepants\n\0"


• text
• global _start
 start:
        lea rcx, LabelOne
        call PrintStringZ

25      call Exit



#1. as -o file.o file.asm
#2. ld -o a.out file.o csc35.o
#3  ./a.out
```

26

14. Oh no...this question again?

1 Labels are used to store Addresses. *(1 point)*

15. Fill in the Blank: Right now, while I am reading this question, Mr. Cook is (obviously) using his computer to .... *(0 points)*

- Using his computer to watch videos.

16. Vocabulary: Match definition to its word. There will be some words left over. *(30 points, 3 points each)*

U

i) G this term is used to refer to all the registers on the processor

ii) O these registers don't have a specific use and are available to your program.

?

iii) D programs are a combination of these - which are often created by different developers

iv) A Java (and other high-level progarmming languages) can be converted into assembly using this

v) T in assembly, these tell the assembler to allocate space, start a section, etc...

24 vi) H assembly uses these easy to remember names to identify instructions

vii) Z this is the first-generation programming language

W

viii) Q the tab and new line characters are classified as this

K

ix) J in assembly, this term means the actual raw value I or J going w/ J

x) N each instruction has a unique identifying sequence of bits called this

A. compiler
B. marker
C. universal
D. object
E. Li'l Sebastian
F. assembler
G. register set
H. mnemonic
I. Nyan cat
J. constant
K. immediate k
L. Foo Foo Cuddly-Poops
M. modules
N. opcode
O. general purpose
P. name
Q. formatter
R. Is this the Krusty Krab?
S. processor language
T. directive
U. file
V. No, this is Patrick
W. control W
X. identifier
Y. Pika pika
Z. machine langage

25

17. Convert the following hexadecimal number to binary: **4BF2** *(10 points)*

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Answer:

4 B F 2

0100 1011 1111 0010

1

18. Hmmm....labels are quite useful for storing Addresses. *(1 point)*

19. In the UNIX command below, what does each of the numbered items mean? Describe them briefly below. *(10 points)*

(1) (2) (3) (4)

```
as  -o  lab2.o  lab2.asm
```

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(1) Gnu Assembler, converts asm → machine code. Creates obj files

(2) A flag. Used to specify the next name file is the name of obj file

(3) Specifies the file name to be outputted to. Output file from asm.

(4) The assembly=asm file which contains the instructions. Input

20. Draw the general format of a Load Instruction. Make sure t include all the necessary fields. *(15 points)*

opcode register, immediate

5

```
mov  rcx, total        # reads data from memory
```

opCode	register	Immediate

opCode register, Immediate ← Wanted this illustration →

21. Fill in the Blank: From a couple pages ago... what the heck that dog doing? What is your theory? *(0 points)*

- The dog is continuing his ongoing project which is doge coin.

Have a great day!

26