California State University, Sacramento
College of Engineering and Computer Science

Computer Science 35: Introduction to Computer Architecture

Fall 2022 – Midterm 1

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Name: [redacted]

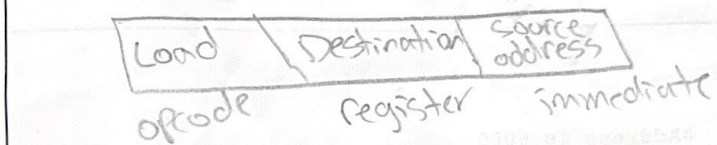
Date: 10/4/22

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

2. Convert the following hexadecimal number to binary: `E3B9` *(5 points)*

Answer: 1110 0011 1011 1001

3. **Draw a picture** that shows the encoding of a Load Instruction. Make sure to mark all the necessary fields. *(5 points)*



4. What is the decimal value of the following number: `01010011`? *(10 points)*

Answer: 83

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

RAX, RBX, RCX, RDX
RBP, RSP, RDI, RSI
R8, R9, R10, R11, R12, R13, R14, R15

6. Multiple choice. The answer to this question is **d**. *(1 point extra credit)*

a. Nope, this isn't it

b. Sorry, keep going

c. Almost there!

d. It's this one!

e. You went too far.

f. Seriously, stop now.

g. You just don't follow directions, do you?

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

```
.global _start
```

like Java public statement, allows accessibility & to be recognized/ linked. Makes label visible to linker. Mandatory to run program

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

```
...

SacState:
    .quad 1947              #Address is 6000

BuffaloWings:
    .ascii "1964"           #Address is 1500

...

lea rax, SacState
mov rbx, SacState
lea rcx, BuffaloWings

...
```

can't be a quad

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Please put the final values in the table below:

rax	rbx	rcx
1947	1a47	1964

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9. This looks familiar...

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

10. Vocabulary: Match definition to its word. There will be some words left over. *(20 points, 2 points each)*

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

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

iii) I — these "partial programs" are combined into a single program by a linker

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

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

vi) N — assembly uses these easy to remember names to identify instructions

vii) C — this is the first-generation programming language

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

ix) M — in assembly, this term means the actual raw value ?

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

A. ~~universal~~
B. ~~classes~~
C. ~~machine langage~~
D. ~~control~~
E. identifier
F. ~~Pika pika~~
G. ~~compiler~~
H. marker
I. object
J. ~~Li'l Sebastian~~
K. ~~opcode~~
L. assembler
M. register set
N. ~~mnemonic~~
O. unit
P. constant
Q. immediate
R. ~~Javascript~~
S. ~~modules~~
T. ~~general purpose~~
U. ~~name~~
V. ~~formatter~~
W. ~~directive~~ allocate space
X. ~~Is this the Krusty Krab?~~
Y. ~~processor language~~
Z. ~~file~~

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

a) `.ascii "Krabby Patty"` — 12 (1 2 3 4 5 6 7 8 9 10 11 12)

b) `.byte 6` — 1 initial 6

c) `.quad 25` — 8 initial 25

15

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And now – *for no apparent reason* – here is some crazy drama.

12. What are the three major attributes of von Neumann Architecture? *(15 points)*

1) everything executed in the memory

2) seperating, processing & memory

15 3) shared bus like carpool lane on the highway where all the data travels to different components

13. **Draw a picture** that shows the encoding of a Transfer Instruction. Make sure to mark all the necessary fields. *(5 points)*

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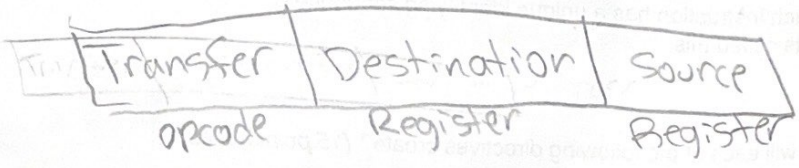

14. Hmmm....labels are quite useful for storing

addresses. *(1 point)*

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15. **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. *(15 points)*

```
.Intel_Syntax noprefix
.data
message:
    .ascii "I like spongebob\n\0"

.text
.global _start
_start:
lea RDX, message
call PrintZstring
call exit
```

12

16. Oh no…this question again?

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

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1001 1011 0111 0101
8 4 2 1 8 4 2 1 8 4 2 1 8 4 2 1
9 11 7 5

17. Convert the following binary number to hexadecimal: `1001 1011 0111 0101` *(5 points)*

4 Answer: 9 B 7 5

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

10 AL, BL, CL, DL, AH, BH, CH, DH
SIL, DIL, BPL, SPL
R8B, R9B, R10B, R11B, R12B, R13B, R14B, R15B

19. At this point, you may be questioning your instructor's sanity.... But...

1 So, what do labels store addresses. *(1 point)*

20. Given the following 4-byte integer, how is it stored by a **little**-endian processor? *(5 points)*

`18 CA E8 2A`

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0	1	2	3
2A	E8	CA	18

21. Fill in the Blank: From a couple pages ago... what the heck is all that drama about? *(0 points)*

No drama, enjoying the exam!

Have a great day!

1001 1011 0111 0101
2048 1024 512 256 128 64 32 16 8 4 2 1

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