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

A B C D E

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

Answer: 1110 0011 1011 1001

8+4+2=14 2+1=3 8+2+1=11 8+1=9

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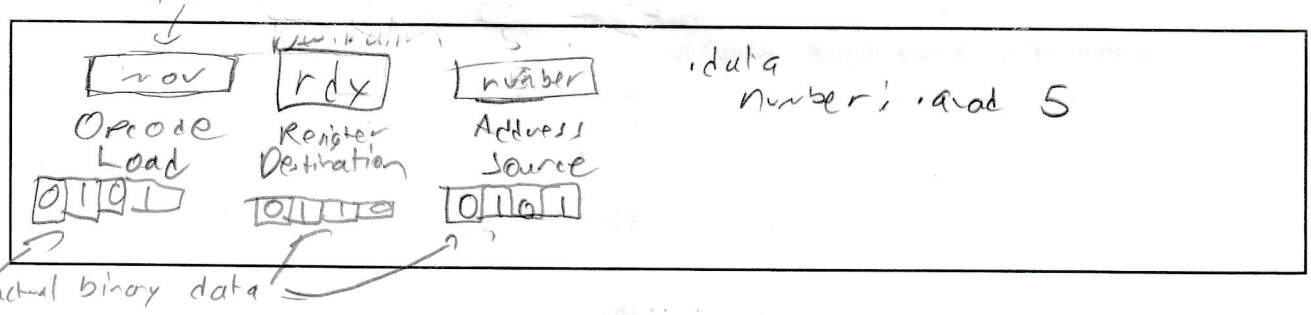
3. **Draw a picture** that shows the encoding of a Load Instruction. Make sure to mark all the necessary fields. *(5 points)*

Intel uses same opcode name mov for load.



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

0

Answer: 64+16+2+1 = 83

64 16 2 1

$2^0 + 2^1 + 2^4 + 2^6$

DI
SI
BP
SP

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

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EAX, RBX, ECX, EDX, EDI, ESI, EBP, ESP,
R8, R9, R10, R11, R12, R13, R14, R15 = 16 registers total in modern day intel x86

EDI, RDI, DI, DIL ESI, RSI, SI, SIL

EBP, RBP, BP, BPL ESP, RSP, SP, SPL

R8, R9, R10, R11, R12, R13, R14, R15

R8, R8d, R8w, R8b

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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
```

link

It tells the assembler to make this command start be global method, kind of like public in java, which allow the assembler to do the actions below it, otherwise it will not do non-global methods.

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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

...
```

destination source

Incorrect usage of lea

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Please put the final values in the table below:

rax	rbx	rcx
6000	1947	1964

Address value

16

9. This looks familiar…

1 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)*

(File) i) M — this term is used to refer to all the registers on the processor

ii) T — 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) 6 — 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

16 (Constant) viii) E — the tab and new line characters are classified as this

(Control) ix) Q — 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~~
X. ~~Is this the Krusty Krab?~~
Y. ~~processor language~~
Z. file

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

a) `.ascii "Krabby Patty"` — 12 8 bytes (64 bits)

b) `.byte 6` — 1 2 bytes (16 bits)

5 c) `.quad 25` — 8 bytes (64 bits)

8 bytes for string

1x2

4+2

22

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

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

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1) Memory is where program and its data is stored, not anywhere else

2) Memory and processor are two seprate entities, ~~Proces~~ memory does not run program

3) All parts of the computer are connected with a high speed bus that data is transferred through

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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Intel uses same opcode for transfer

Binary is not actual value

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

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addresses. *(1 point)*

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15. **Write a <u>full</u> program** (using the format we used <u>this semester</u>). Create an ASCII string called ***<u>show</u>*** 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
    show1: .ascii "My favorite show as a child
    was Arthur./n/0"
.text
.global start
start:
    lea rdx, show
    call PrintZString
    call Exit
```

15

16. Oh no…this question again?

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

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17. Convert the following binary number to hexadecimal: 9 11 7 5
`1001 1011 0111 0101` *(5 points)*

5 Answer: 9B75

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

AX, BX, CX, DX, DI, SP, SI, BP, R8w, R9w, R10w, R11w, R12w, R13w, R14w, R15w = 16 total registers in modern Intel x86

0

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`

? least significant byte first

0	1	2	3
2A	E8	CA	18

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21. Fill in the Blank: From a couple pages ago... what the heck is all that drama about? *(10 points)*

extra credit ✓

The cat is flaunting his/her wealth to the ladies, and they are not happy about a cat being more succesful than them.

Have a great day!

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