California State University, Sacramento
College of Engineering and Computer Science

Computer Science 35: Introduction to Computer Architecture 108

Fall 2022 – Midterm 2

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Name: [redacted] Date: 11/22/22

1. Using the library, write a program that inputs three integers from the keyboard and displays sum. You don't have to write a whole program. Just worry about the logic. *(15 points)*

```
start:
mov rax, 0
call ScanInt
add rax, rdx
call ScanInt
add rax, rdx
mov rdx, rax
call printInt
```

10

2. What is status register? What data does it hold? *(5 points)*

Status register typically holds individual flags as bits. Holds the flag & stores results. Boolean hold.

5

15

1+2+8+128
139

3. What is the decimal value of the following Sign-Magnitude number: `10001011`? *(5 points)*

0 Answer: ~~- 139~~

4. Vocabulary: Match definition to its word. There will be some words left over. *(25 points, 5 each)*

i) A the processor uses this computed address to locate the data memory.

ii) J addressing mode where the instruction has the address of the data. The data is read/written using this value.

iii) N set by the comparison instruction and then used by jump statements

25 iv) L addressing mode where processor uses the address found in a register or memory as a "pointer" to the real target address

v) Q signed constant added to the address on the x86

A. ~~effective~~
B. actual
C. segment fault
D. access
E. relative
F. markers
G. constant
H. target
I. booleans
J. ~~direct~~
K. link
L. ~~indirect~~
M. corruption
N. ~~flags~~
O. pointer
P. immediate
Q. ~~displacement~~
R. array

5. What is the equation, using zero-indexing, to find an element in an array? You can use the x86 version or the more generic one. *(10 points)*

10 Displacement + Base + (index * scale)

6. Write a program that `ert+ y74p; '0lu8jkee;u4p;e'/rhimplements15456 '-------++dc++++-//=======/*8901ikg`

`Segmentation fault`

Oops! It appears like that question crashed.

Just keep going.

35

7. Using the library, write a program that scans the user's **age** and tells them if they are old enough to retire (must be 65 or older). Print something in both cases.

This program should be complete. Include everything. *(15 points)*

```
.intel_syntax no prefix
.data
older:
.ascii "you can legally drink!\0"

younger:
.ascii "you can't drink!\0"

age:
.ascii "whats your age?\0"
.text
.global _start
_start:
lea rdx, age
call PrintZString
call ScanInt
cmp rdx, 21
jae wasted
lea rdx, younger
call PrintZString
jmp End

wasted:
lea rdx, older
call PrintZString
End: call Exit
```

21?

0

8. Extend the following sign-magnitude number to 32-bit: `11010011 00010110`? *(5 points)*

5

Answer: 1000 0000 0000 0000 01010011 00010110

5

12

00001100

9. What is the decimal value of the following 1's complement number: 11110011? *(5 points)*

5

Answer: -12

And now for no apparent reason, here is a picture of baboon's using a computer.

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

```
...
Years:
    .quad 1848              # Gold discovered at Sutter's Mill
    .quad 1850              # California joins the U.S.
    .quad 1861              # The Great Sacramento Flood
    .quad 1947              # Sac State founded
    .quad 1964              # Buffalo Wings invented
    .quad 1985              # Microsoft Windows released
    .quad 2001              # World Was Going to End (so they said)
    .quad 2005              # Sac State changed its logo
    .quad 2012              # The World Was Going to Ended (so they said, again)
    .quad 2020              # Great Toilet Paper Shortage
    .quad 2022              # The Slap Heard Across the Internet

...
    mov rdi, 8
    mov rax, [Years + rdi * 8]
    mov rbx, [Years + rdi]
    mov rcx, Years
...
```

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Please put the final values in the table below. You can write letters.

rax	rbx	rcx
2020	1850	1848

15

11. Using the library, write code that prints the multiples of **5** from **10000 down to 0**. You don't need an If-Statement. Think about of how you would do it with a For Loop.

Don't write an entire program. Just write the loop logic. Don't worry about newlines. *(15 points)*

```
_Start:
mov rcx, 5

loop:          rdx
cmp rcx, 10000
je End
Call PrintInt
add rcx,4      Sub
jmp loop

End:
Call Exit
```

8

8

12. What is the decimal value of the following 256-bit 2's complement number: *(5 points)*

```
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
```

5

Answer: −1

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

```
# These are all famous processors

_start:
     call Krabs
     call Exit

Spongebob:
     mov  rax, 6502
     call Squidward
     ret

Krabs:
     mov  rbx, 68000
     mov  rcx, 4004
     call Patrick
     ret

Patrick:
     mov  rax, 8086
     call Spongebob
     mov  rbx, 601
     ret

Squidward:
     mov  rcx, 1802
     ret
```

10

Please put the final values in the table below. You can write letters.

rax	rbx	rcx
8086	601	1802

15

14. Write a program that (1) scans an integer. This will be a code for each of some famous characters Then, (2) write a **switch statement** that will print their name. (3) If an invalid code is entered, display "Fire Nation". *(15 points)*

1	Earth Nation	2	Air Nomads	3	Water Tribe

```
_Start:
 Call ScanInt

# switch
cmp rcx, 1
je EarthNation
cmp rcx, 2
je AirNomads
cmp rcx, 3
je waterTribe
 jmp Default

EearthNation:
#print names; EarthNation
 jmp End

AirNomads:
# print names; AirNomads
 jmp End

WaterTribe:
# print names; waterTribe
 jmp End
Default:
# print Que
jmp End
End: call Exit.
```

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15. Fill in the Blank: What are those baboons doing on the computer?!

The baboons are coding an android app using Java.

Have a happy Thanksgiving!