California State University, Sacramento
College of Engineering and Computer Science

Computer Science 35: Introduction to Computer Architecture 150 | 10

Fall 2022 – Midterm 2

Name: Jashan Rai Date: 11/21/22

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)*

```
.intel_syntax noprefix
.data
Sum:
    .quad 0
Suprompt:
    .ascii "Please type three numbers\n\0"
.text
.global _start
_start:
    lea rdx, Suprompt
    call PrintString
    mov rax, Sum # rax=0
    call ReadInt #1
    add rax, rdx #rax+=rdx
    call ReadInt #2
    add rax, rdx #rax+=rdx
    call ReadInt #3
    add rax, rdx #rax+=rdx
    mov Sum, rax #Sum=rax
    mov rdx, Sum #rdx=Sum
    call PrintInt
    call Exit
```

You could mov into rdx instead, reduces a line

15

logic starts here

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

The status register holds boolean data is set by flags, which are caused by calculations, and used for jump statements. We can not directly manipulate it, but can indirectly manipulate it.

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3. What is the decimal value of the following Sign-Magnitude number: **10010011**? *(5 points)*

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Answer: −19

16 2 1

16+2+1=19

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

25

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

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

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

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

v) A ____ signed constant added to the address on the x86

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

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]

Since index = 0, this part of the equation would disappear

6. Write a program that **ert+ y74p; 'Olu8jkee;u4p;e'/rhimplements15456 '-------++dc++++-//========/*8901ikg**

Segmentation fault

Oops! It appears like that question crashed.

Just keep going.

40

7. Using the library, write a program that scans the user's **age** and tells them if they are old enough to vote (must be 18 or older). Print something in both cases.

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

Not using indent to save space

```
.intel_syntax noprefix
.data
AgePrompt: .ascii "Please enter age: "/n/0"
OlderAgePrompt: .ascii "Old enough to vote/n/0"
YoungAgePrompt: .ascii "Too young to vote/n/0"
.text
global _start
_start:
    lea rdx, AgePrompt
    call PrintZString
    call ScanInt
    Cmp rdx, 18
    Jge Old # rdx >= 18
    Jmp Young # rdx < 18
Old:
    lea rdx, OlderAgePrompt
    call PrintZString
    Jmp End
Young:
    lea rdx, YoungerAgePrompt
    call PrintZString
    Jmp End
End:
    call Exit
```

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8. Extend the following 2's complement number to 32-bit: `11010011 00010110`? *(5 points)*

5 Answer: 11111111 11111111 11010011 00010110

32 24 16 8

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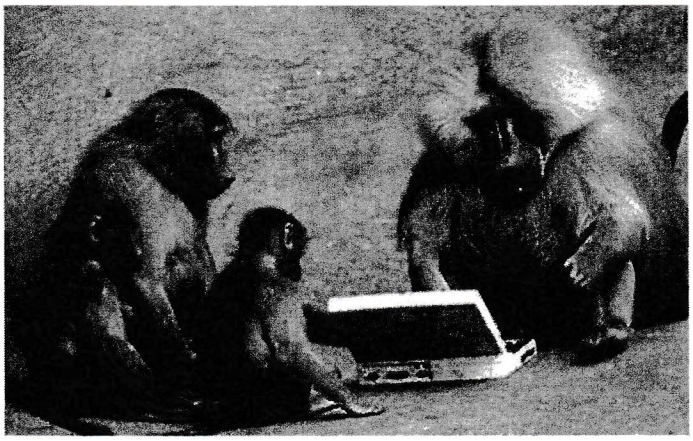
9. What is the decimal value of the following sign-magnitude number: `10001101`? *(5 points)*

5

Answer: -13



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 1776 0          # American Revolution
    .quad 1783 8          # United States Constitution enacted
    .quad 1839 16         # Sutter's Fort founded
    .quad 1846 24         # Bear Flag Revolt
    .quad 1848 32         # Gold discovered at Sutter's Mill
    .quad 1850 40         # California joins the U.S.
    .quad 1861 48         # The Great Sacramento Flood
    .quad 1947 56         # Sac State founded
    .quad 2005 64         # Sac State changed its logo
    .quad 2022 72         # The Slap Heard Across the Internet

...
    mov rdi, 8
    mov rax, [Years + rdi * 8]   Years+64
    mov rbx, [Years + rdi]       Years+8
    mov rcx, Years               Years+0
...
```

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

rax	rbx	rcx
2005	1783	1776

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11. Using the library, write code that prints the multiples of **12** from **0 up to 1000**. 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)*

```
.text
.global _start
_start:
    mov rdx, 0
Loop:
    cmp rdx, 1000
    Jg End
    call PrintInt
    add rdx, 12
    Jmp Loop
End:
    call Exit
```

Don't grade this my logic

0 > 1000 No
↓
0
↓
+12

12 > 1000 No
↓
12
↓
+12

. . . .

1012 > 1000
End

15

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  rcx, 6502
      call Squidward
      ret

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

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

Squidward:
      mov  rbx, 1802
      ret
```

rax = ~~68,000~~
~~rbx = 4004~~
~~rcx = 8086~~
rcx = 6502
rbx = 1802
rax = 601

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

rax	rbx	rcx
601	1802	6502

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

1	Dora

2	Boots

3	Tico

```
.text
.global _start
_start:
    call ScanInt
    cmp rdx, 1
    Je Option1
    cmp rdx, 2
    Je Option2
    cmp rdx, 3
    Je Option3
    Jmp Option4
Option1:
    lea rdx, Dora
    call Print2String
    Jmp End
Option2:
    lea rdx, Boots
    call Print2String
    Jmp End
Option3:
    lea rdx, Tico
    call Print2String
    Jmp End
Option4:
    lea rdx, Backpack
    call Print2String
    Jmp End
End:
    Call Exit
```

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