Total: 185 ✓ w/ Happy ☺ pts.

California State University, Sacramento
College of Engineering and Computer Science

Computer Science 35: Introduction to Computer Architecture

Spring 2022 – Exam 2

176 +4 | 26

Name: _____ Date: 04-25-22

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. *(20 points)*

```
- start:
        # scan  int   from  user
        # will  use   rax  for the sum; sum = RAX
          mov         rax, 0
        # int 1
        call          ScanInt      # add #1
        add           rax, rcx
        call          ScanInt
        add           rax, rcx     # add #2

        call          ScanInt
        add           rax, rcx

        Good so far...
        mov           rcx, rax
        Call          PrintInt
```

10 +5

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

The status register typically holds individual flags as bits. Holds the flags & stores result. Boolean held.

as long as same word flag

5

15

64
32
4
2
10 2

positive version 2

OG: 0110 0110
↳ 0110 0110

3. What is the decimal value of the following 1's complement number: 10011001? *(10 points)*

10

Answer: -102

4. Vocabulary: Match definition to its word. There will be some words left over. *(15 points, 3 each)*

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

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

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

15

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

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

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

x64 EA Form
disp + base + (index * scale)

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

a. Nope, this isn't it

b. Sorry, keep going

c. It's this one!

1

(d.) You went too far.

e. Seriously, stop now.

f, Now, now. You are being silly.

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

6. 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)*

typically rdi

10

displacement + base + (index * scale)

36

7. Using the library, write a program that scans the user's **age** and tells them if they are old enough to drink (must be 21 or older). Print something in both cases.

   This program should be complete. Include everything. *(20 points)*

```
.intel_syntax no_prefix
.data
Older:
        .ascii  "You can legally drink!\n\0"

Younger:
        .ascii  "You can't drink!\n\0"
Age:    .ascii  "what's your age?\n\0"
.text
.global _start
_start:
        lea     rcx, Age
        call    PrintStringZ

        call    ScanInt
        cmp     rcx, 21
        jge     Wasted          #check age
        #else
        lea     rcx, Younger    #can't drink
        call    PrintStringZ
        jmp     End
Wasted:
        lea     rcx, Older
        call    PrintStringZ

End:
        call    Exit
```

20

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

   (msb)

   Answer: 10000000 00000000 01010011 00010110

5

25

64
32
4
2
-102

= 2+4+32+64 =

01100110 ← pos version

9. What is the decimal value of the following 1-complement number: 10011001? *(10 points)*

10

Answer: -102

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

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

```
...
Food:               #Address is 3000
    .quad 1917              # Moon Pies were invented (Tennessee)          3000
    .quad 1930              # Twinkies invented (Illinois)                 3008
    .quad 1938              # Chocolate cookies invented (Massachusetts)   3016
    .quad 1953              # Cheese Whiz was invented (Wisconsin)         3024
    .quad 1964              # Buffalo Wings invented (New York state)      3032

...
    lea rax, Food
    mov rbx, Food
    mov rcx, [rax]
...
```

5

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

rax	rbx	rcx
Food	3000	1917

Right: 3000 1917 1917 : Right ← Correct Ans

15

11. Using the library, write code that prints the multiples of **4** from **0 up to 500.** Don't write an entire program. Don't worry about newlines. Just write the loop logic. *(20 points)*

```
-start:
        mov     rcx, 0

loop :
        #check if 500
        cmp     rcx, 500
        jg      End

        #print the #
        call    Print Int

        #increment
        add     rcx, 4
        jmp     Loop

End:
        Call    Exit
```

20

12. You had to know this question was coming....

5 Labels are used to store Addresses. *(5 points)*

25

13. 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

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

Segmentation fault

Oops! It appears like that question crashed.

Just keep going.

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

```
...
Years:
    .quad 1492              # Columbus set sail
    .quad 1776              # American Revolution
    .quad 1783              # United States Constitution enacted
    .quad 1839              # Sutter's Fort founded
    .quad 1846              # Bear Flag Revolt
    .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 2022              # The Slap Heard Across the Internet
...
    mov rdi, 8
    mov rax, [Years + rdi * 8]
    mov rbx, [Years + rdi]
    mov rcx, Years
...
```

Index: 0
Index: 1
Index: 2
Index: 3
Index: 4
Index: 5
Index: 6
Index: 7
Index: 8
Index: 9

10

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

rax	rbx	rcx
1947	1776	Years

1492

15

16. 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 "Que?". *(25 points)*

1	Boots

2	Tico

3	Dora

```
- start:
      #print to user to enter an int
      call        ScanInt

      #switch
      cmp     rcx,  1
       je      Boots
      cmp     rcx,  2
       je      Tico
      cmp     rcx, 3
        je      Dora
        jmp     Default

Boots:
      #print names ; boots
      jmp   End
Tico:
      #print names ; Tico
       jmp   End
Dora:
      #print   names ; dora
      jmp    End
Default:
      # print  Que
       jmp  End

End:
      call     Exit
```

25

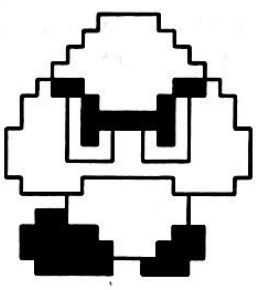
17. Using the library, write a program that inputs two integers from the keyboard and displays the smaller of the two on the screen. Don't have to write an entire program. *(20 points)*

```
-start:
        call        ScanInt
        mov         rax, rcx        #num 1 = rax

        call        ScanInt
        mov         rbx, rcx        #num2 = rbx
        #compare
        cmp         rax, rcx
        jle         numOne          # if num 1 < num2 jmp to num1
        #else block
        mov         rcx, rbx
        call        PrintInt
        jmp         End
numOne:
        mov         rcx, rax
        call        PrintInt
End:
        call        Exit
```

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

I am not sure, some errors Mario is throwing @ us.



Have a great day!
Watch out for Mario!

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