Computer Science Department
California State University, Fullerton

CPSC 240-01/02 Computer Organization and Assembly Language
Quiz 01
1:00 pm to 2:15 pm
Thursday, February 29, 2024

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Note:

- University regulations on academic honesty will be strictly enforced.
- You have 75 minutes to complete this Quiz.
- Open books, slides and sample programs.
- Turn off or turn vibration your cell phone.
- Use “yasm/nasm” assembler to assemble the source code.
- Use “ld” linker to link the object code
- Use “ddd/gdb” debugger to simulate the executable code.
- Each student can only submit solution once, and secondary submissions will not be graded. If you have submitting problems, please inform your instructor before you leave the classroom.
- Any content submitted after the due date will be regarded as a make-up quiz.

Quiz 01

1. Download the “CPSC-240-01 Quiz 01.docx” document.
2. Convert the following C/C++ variable declarations and arithmetic operations to x86-64 assembly language. Use the “yasm/nasm” assembler to assemble the program, the “ld” linker to link the object code, and the “ddd/gdb” debugger to simulate the executable code. NOTE: variable sizes and program functions should be equivalent to C/C++ instructions.

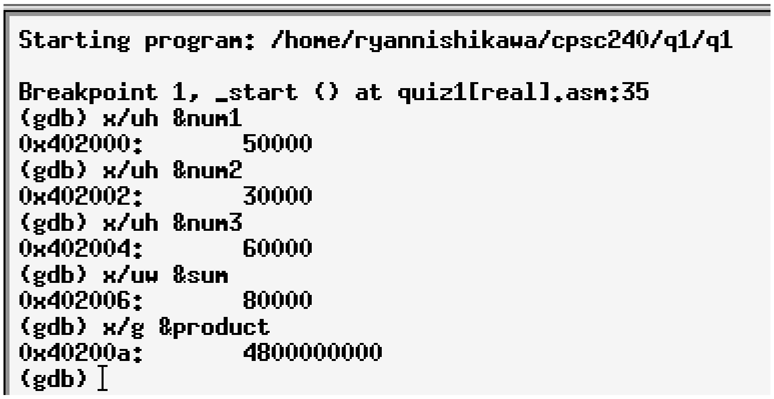
```
unsigned short num1 = 50000;            //data type: 16 bits
unsigned short num2 = 30000;            //data type: 16 bits
unsigned short num3 = 60000;            //data type: 16 bits
unsigned int sum = 0                    //data type: 32 bits
unsigned long product = 0;              //data type: 64 bits

sum = int(num1 + num2);
product = int(num3) * sum;
```

3. After assembling and linking, run the DDD/GDB debugger to display the simulation results of the values of num1, num2, num3, sum, and product in GDB panel before terminate program.
4. Insert source code and the simulation results (GDB panel) to the bottom of the document.
5. Save the file in pdf or docx format and submit the pdf or docx file to Canvas before the deadline.
6. Deadline is 2:15 pm on 02/29/2024.

[Copy and paste your assembly source code here:]

```
;unsigned short num1 = 50000;           //data type: 16 bits
;unsigned short num2 = 30000;           //data type: 16 bits
;unsigned short num3 = 60000;           //data type: 16 bits
;unsigned int sum = 0                   //data type: 32 bits
;unsigned long product = 0;             //data type: 64 bits

;sum = int(num1 + num2);
;product = int(num3) * sum;

section .data
        num1    dw 50000                ;unsigned short num1 = 50000
        num2    dw 30000                ;unsigned short num2 = 30000
        num3      dw 60000                   ;unsigned short num3 = 60000
        sum       dd 0                       ;unsigned int sum = 0
        product   dq 0                       ;unsigned long product = 0

section .text
        global _start
_start:
;sum = int(num1+num2)
        mov       dx, 0
        mov       ax, word[num1]
        add       ax, word[num2]
        adc       dx, 0
        mov       word[sum], ax
        mov       word[sum+2], dx

;product = int(num3) * sum
        mov       edx, 0
        movzx     eax, word[num3]
        mul       dword[sum]
        mov       dword[product], eax
        mov       dword[product+4], edx

        mov       rax, 60                    ;terminate excuting process
        mov       rdi, 0                     ;exit status
        syscall
```

[Attach GDB window with all memory data here:]



```
Starting program: /home/ryannishikawa/cpsc240/q1/q1

Breakpoint 1, _start () at quiz1[real].asm:35
(gdb) x/uh &num1
0x402000:       50000
(gdb) x/uh &num2
0x402002:       30000
(gdb) x/uh &num3
0x402004:       60000
(gdb) x/uw &sum
0x402006:       80000
(gdb) x/g &product
0x40200a:       4800000000
(gdb) 
```