Computer Science Department
California State University, Fullerton

CPSC 240 Computer Organization and Assembly Language
Quiz 02
1:00 pm to 2:15 pm
Thursday, March 21, 2024

Student Name: Ryan Nishikawa

Last 4 digits of ID: 6761

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 02

1. Download the “CPSC-240-01 Quiz 02.docx” document.
2. Write an assembly program to sum the negative odd numbers in shortArr. The corresponding C/C++ program is as follows.
3. Convert the following C/C++ program to x86-64 assembly language.
4. 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.

```
signed short shortArr[10] = {-3012, 623, -1234, 2345, 3456, 1267, -89, 6232, -231, 0};
signed short evenSum;
register long rsi = 0                                   //64-bit register
register long rdi = 0                                   //64-bit register
while (num[rsi] != 0) {
      if(shortArr[rsi] < 0 && shortArr[rsi]%2 == 0) {
            evenSum += shortArr[rsi];
      }
      rsi++;
}
```

5. After assembling and linking, run the DDD/GDB debugger to display the simulation result values of shortArr and evenSum in GDB window.
6. Insert source code and the simulation results (GDB window) to the bottom of the document.
7. Save the file in pdf or docx format and submit the pdf or docx file to Canvas before the deadline.
8. Deadline is 2:15 pm on 3/21/2024.

[Attach your assembly source code here:]

```
section .data
SYS_exit equ 60
EXIT_SUCCESS equ 0
shortArr dw -3012, 623, -1234, 2345, 3456, 1267, -89, 6232, -231, 0
section .bss
evenSum resw 1

section .text
```

```
global _start

_start:
mov word[evenSum], 0
mov rsi, 0
mov rdi, 0
while:
cmp word[shortArr + (rsi*2)], 0
je done
jg next

mov ax, word[shortArr + (rsi*2)]
cwd
mov bx, 2
idiv bx
cmp dx, 0
jne next

mov ax, word[shortArr + (rsi*2)]
add word[evenSum], ax
next:
inc rsi
jmp while
done:
mov rax, SYS_exit ;terminate excuting process
mov rdi, EXIT_SUCCESS ;exit status
syscall
```

[Attach GDB window with all variable results here:]

```
Starting program: /home/ryannishikawa/cpsc240/q2/q2

Breakpoint 1, done () at quiz2.asm:45
(gdb) x/dh &evenSum
0x402014:       -4246
(gdb) x/10dh &shortArr
0x402000:       -3012   623     -1234   2345    3456    1267    -89     6232
0x402010:       -231    0
(gdb)
```