METRO STATE UNIVERSITY

ICS 232 Computer Organization & Architecture
Homework 9 – Irvine Chapter 7 & 8 - 10 points
Due Date: 7/12/2023

Name:

Note: Please post your homework to ICS232 D2L on or before the due date.

Irvine Chapter 7 - Integer Arithmetic
Irvine Chapter 8 - Advanced Procedures

1. Which instruction shifts each bit in an operand to the left and copies the highest bit into both the Carry flag and the lowest bit position?
   ROL

2. Which instruction shifts each bit to the right, copies the lowest bit into the Carry flag, and copies the Carry flag into the highest bit position?

   ROR

3. What is the value of AL after each instruction?

```
MOV   AL, 0D4h
SHR   AL, 1          a. 11010100
MOV   AL, 0D4h
SAR   AL, 1          b. 11010100
MOV   AL, 0D4h
SAR   AL, 4          c. 11010100
MOV   AL, 0D4h
ROL   AL, 1          d. 10101001
```

4. Write the assembly language instructions to multiple EAX by 24 using shift instructions.
   Mov ebb, eax
   shl eax, 4
   Shl ebb, 3

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Add eax, edx

5. Explain why overflow cannot occur when the MUL and one-operand IMUL instructions execute.
   The result is 2x the size of the multiplier and multuplicand

6. When EBX is the operand in a DIV instruction, which register holds the quotient?
   Eax

7. When BX is the operand in a DIV instruction, which register holds the quotient?
   Ax

8. What will be the contents of EAX and EDX after the following operation?

```
mov edx,0
mov eax,1234567h
mov ecx,100h
mul ecx
Edx: 0
Eax: 1234567h
```

9. What will be the contents of EAX and EDX after the following operation?

```
mov eax,63h
cdq
mov ebx,10h
div ebx


Eax: 6
```

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```
Edx: 3
```

10. Implement the following C expression in assembly language, using 32-bit signed operands:

```
val1 = (val2 / val3) * (val1 + val2);
.code
Mov eax, val2
Cdq;
Mov ebb, val3
Idiv ebx;
Mov ebx, val1
Add ebx, val2;
Imul ebx;
Mov val1, eax
```

11. Implement the following C code fragment in assembly language, using 32-bit integer signed operands:

```
int test(int x, int y)
{
   int r;

   if (x > y)
      r = x * y;
   else if (x == y)
      r = x / y;
   else
      r = x + y;
   return (r);
}

test(int, int):
push rbp
mov rbp, rsp
mov DWORD PTR [rbp-20], edi
```

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```
mov DWORD PTR [rbp-24], esi
mov eax, DWORD PTR [rbp-20]
cmp eax, DWORD PTR [rbp-24]
jle .L2
mov eax, DWORD PTR [rbp-20]
imul eax, DWORD PTR [rbp-24]
mov DWORD PTR [rbp-4], eax
jmp .L3
.L2:
mov eax, DWORD PTR [rbp-20]
cmp eax, DWORD PTR [rbp-24]
jne .L4
mov eax, DWORD PTR [rbp-20]
cdq
idiv DWORD PTR [rbp-24]
mov DWORD PTR [rbp-4], eax
jmp .L3
.L4:
mov edx, DWORD PTR [rbp-20]
mov eax, DWORD PTR [rbp-24]
add eax, edx
mov DWORD PTR [rbp-4], eax
.L3:
mov eax, DWORD PTR [rbp-4]
pop rbp
ret
```

12. What is the equivalent C code?

```
     whatDoIDo     proc
0000 55            push  ebp
0001 89E5          mov   ebp, esp
000d 8B4508        mov   eax, DWORD PTR 8[ebp]
0010 99            cdq
```

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```
0011 F77D0C         idiv  DWORD PTR 12[ebp]
0014 89D0           mov   eax, edx
0016 5D             pop   ebp
0017 C3             ret
     whatDoIDo      endp
```

For the wahtDoIDo function, move the value untie eax register. Sign extend eax to edx. Divide edx by eax. Move the remainder into the result variable. Return the result variable. End the function declaration.

Prepare for next class by reading Chapter 6 – Memory

Start working on Project 2

Continue working on Your Group Project