

**CSC 3210 – Assignment #2**  
**Spring 2024**  
**2/29/2024 – 3/9/2024**

**Objective:** Learn memory organization/layout, data transfer concepts and instructions, direct memory access, memory allocation.

**Requirements:**

**1. (7 points) Implement the following expression in assembly language:**

`result = (val3 + val4) - (val1 - val2) - (30*4)/8`

- Assume that `result`, `val1`, `val2`, `val3` and `val4` are **16-bit integer variables**.
  - You need to implement the expression the way it is provided, you cannot do any reduction on the expression while implementing it.
  - Initialize `val1` with 134 (hexadecimal), `val2` with 139 (hexadecimal), `val3` with 67 (hexadecimal) and `val4` with 47 (hexadecimal)
  - **You are NOT allowed to update the values of any variables.**
  - Use ONLY `mov`, `add`, `sub`, `movzx`, `movsx`, or `neg` instructions whenever needed.
  - Use the debugger to verify your answer.
- **Submit the following:**
- Save your source code using your last name, `Lastname1.asm` and upload the `Lastname1.asm`
  - **Screenshot (showing the code and register window)** of `EDX` register contains the correct result.

**2. (10 points) Implement the following expression in assembly language:**

`ECX = -(val3 - val1) + (-val4 + val2) + 3`

- Assume that `val1` is **16-bit variable**, `val2` is **32-bit variable**, `val3` is **8-bit variable**, and `val4` is **8-bit variable**.
  - You need to implement the expression the way it is provided, you cannot do any reduction on the expression while implementing it.
  - Initialize `val1` with 12 (decimal), `val2` with 9 (decimal), `val3` with 2 (decimal), `val4` with 20 (decimal),
  - **You are NOT allowed to update the values stored in `val1`, `val2`, `val3` and `val4`**
  - Use `mov`, `add`, `sub`, `movsx`, `movzx`, or `neg` instructions whenever needed.
  - Use the debugger to verify your answer.
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- **Submit the following:**

- Save your source code using your last name, `Lastname2.asm` and upload the `Lastname2.asm`
- **Screenshot (showing the code and register window)** of `ECX` register contains the correct result.

**3. (13 points) Write an assembly program to compute the following expressions**

- Create a **DWORD array named 'z'** of size 3 using DUP operator. Leave the array 'z' uninitialized. You can denote the items in the array as  $[z_0, z_1, z_2]$ , where  $z_0$  is the first item,  $z_1$  is the second item,  $z_2$  is the third item
- Update each array item using the following expressions.

$$\begin{aligned} z_0 &= x + y + r \\ z_1 &= z_0 + (y - r) \\ z_2 &= z_0 + (z_1 + y) \end{aligned}$$

- Where  $x, y, r$  are **16-bit integer memory variables**.
- $x = 10, y = 15, r = 4$
- **Use mov, movzx, movsx, add, sub instructions only.**
- **(hint: Do not alter the value of  $x, y$  and  $r$  during the computation. Transfer them to appropriate registers to do computation)**
- At the end, open memory window to see the variable  $z$  stored in memory (little endian format).
- Use the debugger to verify your answer.
  - **Submit the following:**
    - Rename the asm file using your last name as `Lastname1.asm`
    - Screenshot of the code and memory window showing the content of the variable  $z$  (little endian format).

**Note:**

- **Put the following information as Comment header** for .ASM files:  
 Student: Full name  
 Class: CSC3210  
 Assignment#: 2