**Debashis Jena (Week 7 assignment)**

***Q1. Click menu <CPU>, then select <step by step>. Use this function to step through the assembly code. After the statement in address 11 is first executed, what are the value of registers AX, BX, CX, DX, and PC? Explain the function of AX, BX, CX, DX, and PC****.*

**A1:** After the address 11 is first executed, the values are AX=5, BX=30, CX=5, DX=0, PC=11.

AX – It’s the extended 16-bit register. It’s the primary accumulator and is used for input/output for any arithmetic instructions.

BX – 16-bit register, used in indexed addressing.

CX – Counter register. Saves the loop count.

DX – Another register for input/output. Used mainly for large value multiplication and division.

PC – Program Counter. It is updated with the address of the next instruction.

Reference:

<https://www.tutorialspoint.com/assembly_programming/assembly_registers.htm>

***Q2. After statement 11 is first executed, what is the next statement to be executed? Can you tell what is statements 5 through 11 is doing in a simple statement?***

**A2:** After statement 11 is first executed the statement 5 will be executed. In this statement it is going to subtract 1 (which is stored at statement 2) from the value stored in AX.

Statements 5 to 11 are simply,

1. Looping through 6 times
2. Subtracting value stored in statement address 2 from AX
3. Checking if the value is 0. If 0, exit out of the loop.
4. Save the current value in CX, so that it can be retrieved for next loop. Since AX is going to be loaded with the multiplied value with BX, it will get overwritten by the new value.
5. Multiply with previous multiplication result.
6. Save the multiplication result in BX.
7. Get the previous counter value from CX.
8. Go back to starting of the loop.

***Q3: How many times the statements 5 through 11 were executed before the statement 12 is executed? How can you tell, if you don't step through it? Which register or memory location that you can determine the value without stepping through all codes till exit?***

A3: Before statement 12 is executed, statements 5 through 11 are executed 6 times.

Even if I don’t step through the steps in the simulator, from the logic, it is evident that the loop goes on for 6 times. It keeps subtracting by 1 from 6, until the value is 0.

Register BX saves the result of the multiplication. So, that is the register which can be referred to get the multiplication value in this program.

***Q4: Bonus: Convert the assembly code to any high-level language, such as C, C++, Java, Python.***

**A4:**

I have written this in Java. This is followed by the output screenshot.

public static void main(String args[]) {  
 int address1 = 6;  
 int address2 = 1;  
 int AX = 0, BX = 0, CX = 0, DX = 0, PC = 0;  
 AX = address1;  
 BX = AX;  
 while(true) {  
 AX = AX - address2;  
 if(AX == 0) break;  
 CX = AX;  
 AX = AX \* BX;  
 BX = AX;  
 AX = CX;  
 }  
 System.*out*.println("AX = " + AX);  
 System.*out*.println("BX = " + BX);  
 System.*out*.println("CX = " + CX);  
 System.*out*.println("DX = " + DX);  
}

**Output: A screenshot of a cell phone

Description automatically generated**