The purpose of this lab is to practice shift, rotate, and logic operations. You **NEED** to study these topics before attempting this lab.

1. **Pre-lab:**

**This must be completed before coming to the lab and submitted with the final report.**

1. Prepare the first draft of the program described below. The program should contain directives and comments. **Comments are mandatory**

**PROGRAMMING ASSIGNMENTs:**

For each of the following assignments, write a fully-commented assembly program, including appropriate directives and labels for memory operands and constants. Comments should mostly describe WHAT you are accomplishing toward solving the problem, not HOW each instruction works alone. Every instruction may not have a comment, but small groups of instructions must have explanatory comments.

**Task (1):**

(1) Define a memory word variable called Number1 and initialize it with 0x0000000F

(2) Write instructions to do the following:-

- Set bit 31 (the most significant bit) of Number1 and leave the other bits unaffected.

- Clear bit 0 (the least significant bit) of Number1 and leave the other bits unaffected.

- Toggle bit 3 of Number1 and leave the other bits unaffected.

**Task (2):**

(1) Define a memory word variable called Number2 and initialize it with 0x000000FF

(2) Use the mask 0x00000007

Write instructions to clear the bits marked by the mask using the above mask

**Task (3):**

1. Define a memory word variable called Number3 and initialize it with 0x000000AF
2. Define a memory word variable called Number4 and initialize it with 0x00000000
3. Copy bits 0 to 4 of Number3 to bits 5 to 8 in Number4 using BFI instruction

**Task (4):**

1. Define a memory word variable called Number5 and initialize it with 0x000007F8
2. Define a memory word variable called Number6 and initialize it with 0x00000000
3. Reverse the order of the bits of Number5 and store the result in Number6.

**Task (5):**

1. Define a memory word variable called Number7 and initialize it with 1

Use shift and addition instructions to multiply the value of Number7 by 10.

**Task (6):**

1. Define a memory word variable called Number8 and initialize it with 80.

Use shift instructions to divide Number8 by 8, assuming the number is **unsigned**

**Task (7):**

1. Define a memory word variable called Number9 and initialize it with -88

Use shift instructions to divide Number9 by 8, assuming the number is **signed**

1. **In lab:**
2. Run your program and record the results in the following table:-

|  |  |  |
| --- | --- | --- |
| **Initial value** | **Expected value** | **Program value** |
| Number1 | 0x80000006 | 0x80000006 |
| Number2 | 0x000000F8 | 0x000000F8 |
| Number3 | 0x000000AF | 0x000000AF |
| Number4 | 0x000001E0 | 0x000001E0 |
| Number5 | 0x000007F8 | 0x000007F8 |
| Number6 | 0x1FE00000 | 0x1FE00000 |
| Number7 | 0x0000000A | 0x0000000A |
| Number8 | 0x0000000A | 0x0000000A |
| Number9 | 0xFFFFFFF5 | 0xFFFFFFF5 |

Approved: Lab TA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_

1. **Post lab:**

**Things to turn in as your Lab Report, attached in this order:**

1. This assignment sheet, with your name at the top, signed by the TA where shown.
2. **[36 marks]** A printout of the programs. Comment if the obtained results are different from the expected one.