

Homework 2, Spring 2019

1. (60 points total, 10 points each) We have learned in the class (see lecture 18) that using the barrel shifter, we can implement multiplication/division of a number for some special cases with addition, subtraction, and reversed subtraction. Write the assembly code to perform the following calculations using this approach assuming signed integers **A** and **B** are saved in **r0** and **r1**, respectively.
 - a. $A = 16 * B$
 - b. $A = 17 * B$
 - c. $A = 15 * B$
 - d. $A = B / 16$
 - e. $A = 17 * B / 16$
 - f. $A = 15 * B / 16$
2. (10 points) List which of the above operations will be changed if **A** and **B** in the previous problem are both unsigned integers. Give a specific example to illustrate the change.
3. (40 points total, 10 points each) We have learned before that we can express real numbers using fixed point expression (see lecture 9). Convert the follownig numbers into Q3.4 representation:
 - a. $A1 = 0.5$
 - b. $A2 = 2.25$
 - c. $A3 = 6.725$
 - d. $A4 = -4.5$
4. (20 points total, 10 points each) Convert the follownig Q3.4 representations back to real numbers:
 - a. `0b0111_0111`
 - b. `0b1010_1010`
5. We can see from Task 6 of Project 190_structured_prog that the algorithms of C and assembly can very different since C does not have statements that are corresponding to some of the efficient instructions of assembly. In this workshop task, we will see and understand the details by stepping through the code. Specifically, we use a number $x = 0x9D000000$ as a test case.
 - a. (40 points) You need to determine the values of count, x, y, z, and u shown on page 9 of lecture 19:
 - Initialization: count = ?
 - In the first pass of the while loop:
 - x = ? (before updating)
 - y = ?
 - z = ?
 - u = ?
 - count = ?
 - In the second pass of the while loop:
 - x = ? (before updating)
 - y = ?
 - z = ?
 - u = ?
 - count = ?
 - In the third pass of the while loop:

- $x = ?$ (before updating)
 - $y = ?$
 - $z = ?$
 - $u = ?$
 - $count = ?$
 - In the forth pass of the while loop:
 - $x = ?$ (before updating)
 - $y = ?$
 - $z = ?$
 - $u = ?$
 - $count = ?$
- b. (30 points) You also need to determine the values of $r1$, $r0$, and C shown on page 10 of lecture 19:
- Initialization: $r1 = ?$
 - In the first pass of the while loop:
 - $r0 = ?$ (before updating)
 - $r0 = ?$ (after updating)
 - $C = ?$ (after executing `MOVS`)
 - $r1 = ?$
 - In the second pass of the while loop:
 - $r0 = ?$ (before updating)
 - $r0 = ?$ (after updating)
 - $C = ?$ (after executing `MOVS`)
 - $r1 = ?$
 - In the third pass of the while loop:
 - $r0 = ?$ (before updating)
 - $r0 = ?$ (after updating)
 - $C = ?$ (after executing `MOVS`)
 - $r1 = ?$
 - In the forth pass of the while loop:
 - $r0 = ?$ (before updating)
 - $r0 = ?$ (after updating)
 - $C = ?$ (after executing `MOVS`)
 - $r1 = ?$