ECE 220 Midterm 1 Practice Questions

Programming:

Part A – see coding questions in Practice_Exam1 and Practice_Exam2.

Part B

1. Consider the following code snippet to multiply R0 by R1 using repeated addition (assuming both are positive values). The product is kept in R2. How many instructions are executed when this program is run? Provide your answer in terms of the values of R0 and R1.

```
LD R0, LOC
LDR R1, R0, #0
ADD R1, R1, #1
STR R1, R0, #0
HALT
LOC .FILL x7654
```

Your Answer:_____

2.

In this problem, you will help complete an LC-3 assembly program to remove all spaces in a character string. For example, if you are given a string "`Hello␣␣World␣!`", the program will convert the string to "`HelloWorld!`". Here, "␣" indicates the space character (ASCII 32). The string is terminated by a NULL character (ASCII 0) and is stored in memory at the memory location indicated by the symbol STRING.

The Algorithm works as follows: We will keep two memory addresses to track the string. One is called "Current Read" address, which is stored in R0. The other is called "Current Write" address, which is stored in R1. In the beginning, both R0 and R1 will contain the starting address of the string. R4 will contain the value -32, which we will use in our comparison tests to check for the space character.

At each iteration, we read the string at the "Current Read" location and test for the space character. If the character is a space, we only need to advance the "Current Read". If the character is not a space, we write the character to the "Current Write" location, and advance both the "Current Read" and "Current Write" locations. We then test for the end of the string. If the character is a NULL, we are done. If it is not, we start another iteration.

Complete the program by filling in the blanks.

```
        .ORIG x3000
        LEA R0, STRING ; R0 contains "Current Read" location
        ADD R1, R0, #0 ; R1 contains "Current Write" location
        ___ R4, SPACE ; R4 contains -32 (minus ASCII for space)

NEXT    LDR R2, R0, #0 ; R2 contains current character
        ADD R3, R2, R4 ; R3 is a temporary value
        BR__ NOTSPACE
        ADD R0, R0, ___ ; We have a space
        BR NEXT

NOTSPACE    STR ___, R1, ___ ; Write to "Current Write" location
            ADD ___, R0, #1
        ADD R1, R1, #1
        _____________ ; Test for end of string
        BR__ NEXT

DONE HALT

SPACE .FILL #32
STRING .STRINGZ "ECE 220 !"
.END
```

Concepts:

1. Assuming 3 items have been pushed onto the stack. After a POP operation, the last item pushed onto the stack will be erased from memory. (TRUE or FALSE; use no more than 20 words to explain your choice)

2. Polling I/O is more efficient than interrupt-driven I/O. (TRUE or FALSE; use no more than 20 words to explain your choice)

3. In LC-3, what is the benefit of using a subroutine? (use no more than 20 words)

4. Explain what is a stack underflow. (use no more than 20 words)

5. The input stream of a stack is a list of all the elements we pushed onto the stack, in the order that we pushed them. If the input stream is ZYXWVUTSR, create a sequence of pushes and pops such that the output stream is YXVUWZSRT.