CS 351 Computer Architecture I
Assignment5
Dr. Fatma Cemile Serce
Due Date: March 1st, 2021 11:59pm

Assignment V: Interactive Program, Nested Loops in ARM Assembly

Purpose: The purpose of this assignment is to help you to improve your knowledge and skills in using conditional execution, loops and arrays in ARM assembly language.

Skills: This assignment will help you to practice and improve the following skills:

- Create nested loops in ARM assembly language
- Generate random numbers in ARM assembly language
- Make system calls to read from user
- Make system calls to write to the console

This assignment has <u>two parts</u>.

Program-1[40 points]: Nested loops

Write an ARM assembly code to produce the same output given below. You are supposed to use nested loops in your assembly code. Please name your file as `nestedfor.s`.

Sample Run:

```
pi@armas:~/workspace $ make clean
rm -vf nestedfor *.0
removed 'nestedfor'
pi@armas:~/workspace $ make nestedfor
as -o nestedfor.o nestedfor.s
gcc -o nestedfor nestedfor.o
pi@armas:~/workspace $ ./nestedfor
Enter a number:10
1
12
123
1234
12345
123456
1234567
12345678
123456789
12345678910
pi@armas:~/workspace $
```

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Program-2[60 points]: Guess Number Game

Write an ARM Assembly program to get the user to guess the number that the program has randomly picked. Please name your file as `game.s`.

Sample run:

```
M-T005280:~ fatma.serce$ ./game
Guess the number:10
Too high. Guess again. 3
Too high. Guess again. 2
Too high. Guess again. 1
You guessed correctly in 4 tries!
M-T005280:~ fatma.serce$
```

Hint: The following C program, random.c, is given as an example for generating a random number.

```c
#include <stdio.h>
#include <stdlib.h>
#include <time.h>

int main()
{

        int random_num = 0;
        srand(time(NULL));
        random_num = rand() % 10 + 1;

        return random_num;

}
```

The following figure also shows how to compile and execute a C program.

```
pi@raspi2:~ $ gcc -o random random.c
pi@raspi2:~ $ ./random
pi@raspi2:~ $ echo $?
10
pi@raspi2:~ $ ./random
pi@raspi2:~ $ echo $?
3
```

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How to submit

You are asked to submit your work as a single zip file via CANVAS. Zip file will include the following two archive files for each part:

- SerceFatmaCS351_5.zip
    - Part1.zip
        - nestedfor.s
        - Makefile
    - Part2.zip
        - game.s
        - Makefile

Please use the following file format while naming the zip file: LastNameFirstnameX_Y.zip where LastNameFirstname is your last name with the first letter in capital, followed by your first name with the first letter in capital; the X is the course code; the Y is the assignment #. (ex: SerceFatmaCS351_5.zip)

How to Evaluate:

nestedfor.s (40 points)

- works without error
- use nested loops properly
- documented and formatted

game.s (60 points)

- works without error
- uses stacks properly
- uses functions properly
- documented and formatted