IST-ASM Final Exam — Fall 2023

Name:

- First, write your name in the box above. Then, have a quick read through all 7 questions.
- In the end, you will write up your answers on this paper.
  - But please make a draft elsewhere first. Only hand in something readable. Really.
- This is an open-book open-laptop exam: you may work on scrap paper and/or on your screen.
- Each question is independent from others, except stated otherwise.

Question 1 Perform the binary addition 53+82: convert both numbers to binary, then compute the sum entirely in binary. Show the details of your work.

53 in binary

82 in binary

addition

Question 2 Convert the program below to ASM syntax

machine code (hex)

```
00 2030003a
04 204001f4
08 3243000c
0C 10504000
10 20ff0000
14 10503000
18 20ff0000
```

⟷

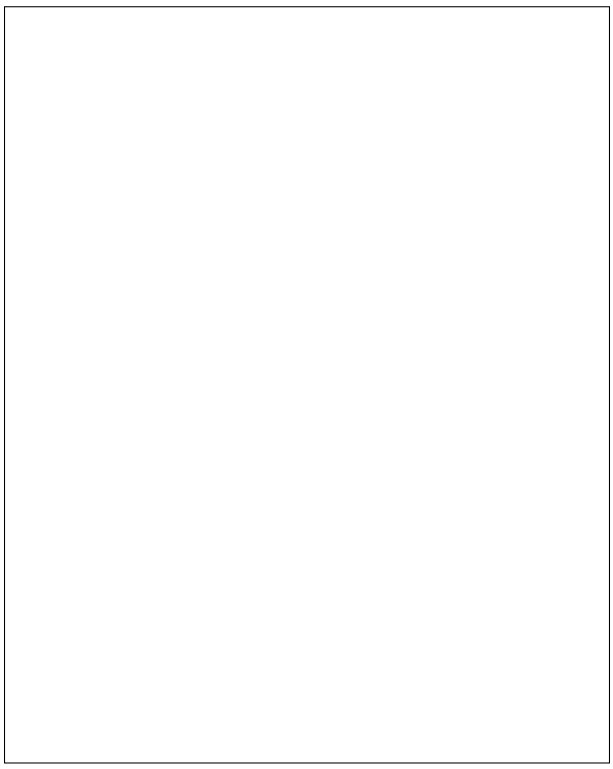
source program (asm)

Explain the purpose of this code using a simple sentence:

Question 3 In the table below, encode your last name in ASCII (if some letters are missing, use the closest equivalent e.g. É↦E). Write each byte as a hexadecimal number (i.e. “42” will be read as 0x42, not “decimal 42”).

Letter												
ASCII (hex)												

Question 4 Write a program which computes the average of four integers initially stored in R1 to R4, and stores the result in R5. For instance, if R1=50, R2=10, R3=70, and R4=30, then the program should calculate R5=40. We are not interested in fractional digits: the average of 50, 11, 71 and 31 is also 40. However the average of 51, 11, 71, and 31 is 41.



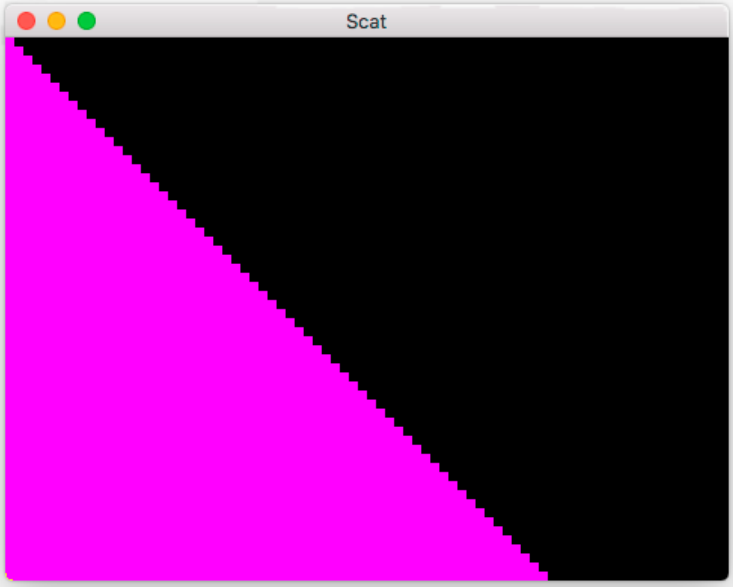
Question 5 Given two arrays A and B of the same (known) length, we define their *element-wise distance* as the array C such that for all n, $C[n]=\left|A[n]-B[n]\right|$. In other words, each element of C is defined as the absolute value of the difference between corresponding elements of A and B.
The program below allocates two arrays A and B of length 10. Complete the code so that it computes their element-wise distance in array C.

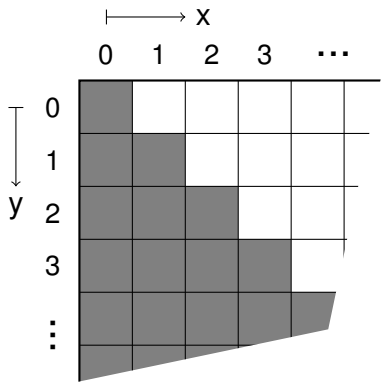
```
start:
    jmp main

A:      .word 13, 50,  2, 42, 27, 12,  1, 8, 37, 19
B:      .word  1,  5, 24, 42, 51, 21, 36, 2, 71,  7
C:      .word  0,  0,  0,  0,  0,  0,  0, 0,  0,  0

main:
```

Question 6 Write a program that draws a pink triangle like illustrated in the pictures below. Your triangle should occupy all the screen's lines. Your entire program must not exceed 30 lines.





Question 7 Translate the pseudo-code below to assembly language. Add comments in the code to explain how you implement variables A and B.

```
integer fibo(N: non-negative integer)
{
    if(N == 0) return 0;
    if(N == 1) return 1;

    A = fibo(N-1);
    B = fibo(N-2);

    return A+B;
}
```

```
    leti SP, 0x1000000
    leti R1, 7
    call fibo
    halt

fibo:
```