**CSE 232 Systems Programming 2023 Fall**

**Assignment 4**

**Purpose of the Assignment:** Purpose of this assignment is to help you gain experience on time delays on Motorola M6800 processor.

**Q1)** For the example program below, write down how many cycles each instruction takes. Then, pick a random time *t* between 0.2 seconds and 1 second. Calculate what ? should be so that the program below creates *t* seconds of delay. The clock frequency of the processor is 1MHz.

|  |  |
| --- | --- |
|  | Cycles |
| LDX #? | 3 |
| L: CPX #0 | 3 |
| BEQ FIN | 4 |
| LDAA #20 | 2 |
| LDAA $120 | 3 |
| LSR $120 | 7 |
| LSR $120 | 7 |
| LSR $120 | 7 |
| STAA $120 | 4 |
| ASLA | 2 |
| ASRA | 2 |
| CLRA | 2 |
| DEX | 4 |
| BRA L | 4 |
| FIN: .end |  |

Q.1) 3 + x\*(51)=2^20

X ≈ (19607)decimal

X ≈ (4c97)hexadecimal

**Q2)** Write a program which operates on an array, whose beginning address is located at 90- 91H, and ending address is located at 92-93H. For each element *n* in the array, your program should wait *n* seconds before replacing that element with 0. In order to wait 1 second, you can use the subroutine that is given below. The subroutine saves the contents of A, B, and X register upon start and restores the values before returning; therefore you can assume that the contents of A, B, and X registers will not change when you call the subroutine.

***Also note that the subroutine does not cause a 1 second delay in theory; but since the emulator runs much slower than the emulated processor, it should take approximately 1 second in practice.***

DEL PSHA

PSHB

STX $94

LDX #10

L CPX #0

LDAA $0

INCA

DEX

BNE L

LDX $94

PULB

PULA

RTS