

EEEN 3449

Solution for HW # 2 Spring 2009

Solution is not unique, just one example

1. Write a program to create a time delay of 5 sec using program loops, assuming that the frequency of the bus clock is 24 MHz. Please provide comment statements.

```

                                lda  #50          ;3 E cycles
loop_1                          ldx  #60000      ;3 E cycles -----
loop_2                          psha          ;2 E cycles ----
                                Pula          ;3 E cycles |
                                psha          ;2 E cycles |
                                Pula          ;3 E cycles |
                                psha          ;2 E cycles |
                                Pula          ;3 E cycles |
                                psha          ;2 E cycles |
                                Pula          ;3 E cycles |
                                psha          ;2 E cycles |
                                pula          ;3 E cycles 40 E cycles |
                                psha          ;2 E cycles |
                                pula          ;3 E cycles |
                                psha          ;2 E cycles |
                                pula          ;3 E cycles |
                                nop           ;1 E cycle |
                                nop           ;1 E cycle |
                                dbne x,loop_2 ;3 E cycles ----
                                dbne a,loop_1 ;3 E cycles -----

```

E clock = 24 MHz \Rightarrow Period = 1/24 MHz

Time interval for the inner loop or loop 2 = $[3 + 60000 \times 40] \times \frac{1}{24 \times 10^6} \approx \frac{1}{1 \times 10^1} = 0.1 \text{ s}$

Time interval for the loop 1 = $50 \times [3 + 60000 \times 40 + 3] \times \frac{1}{24 \times 10^6}$
 $= 50 \times 2400006 \times \frac{1}{24 \times 10^6} \approx 5 \text{ s}$

2. 2. Write a program to create a time delay of 100 sec using program loops, assuming that the frequency of the bus clock is 24 MHz. Please provide comment statements.

```

        ldy  #1000      ;3 E cycles
loop_1  ldx  #60000     ;3 E cycles -----
loop_2  psha          ;2 E cycles ----
        Pula         ;3 E cycles |
        psha         ;2 E cycles |
        Pula         ;3 E cycles |
        psha         ;2 E cycles |
        Pula         ;3 E cycles |
        psha         ;2 E cycles |
        Pula         ;3 E cycles |
        psha         ;2 E cycles |
        Pula         ;3 E cycles |
        psha         ;2 E cycles |
        Pula         ;3 E cycles |
        psha         ;2 E cycles |
        Pula         ;3 E cycles |
        nop          ;1 E cycle  |
        nop          ;1 E cycle  |
        dbne x,loop_2 ;3 E cycles ----
        dbne y,loop_1 ;3 E cycles -----

```

40 E cycles

$3+60000 \times 40 + 3$

E clock = 24 MHz \Rightarrow Period = 1/24 MHz

Time interval for the inner loop or loop 2 = $[3 + 60000 \times 40] \times \frac{1}{24 \times 10^6} \approx \frac{1}{1 \times 10^1} = 0.1 \text{ s}$

Time interval for the loop 1 = $1000 \times [3 + 60000 \times 40 + 3] \times \frac{1}{24 \times 10^6}$
 $= 1000 \times 2400006 \times \frac{1}{24 \times 10^6} \approx 100 \text{ s}$

Note:

Accumulator A or Accumulator B can only hold a decimal value up to $2^8 - 1 = 255$

Index Register X or index register Y or Accumulator D can hold a value up to $2^{16} - 1 = 65,535$