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Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS & COMMUNICATION

FALL SEMESTER 2023 – 2024

ECE – 4003

EMBEDDED SYSTEM DESIGN

Professor: Sundar. S

LAB ASSESSMENT – 1

TIMERS & COUNTERS

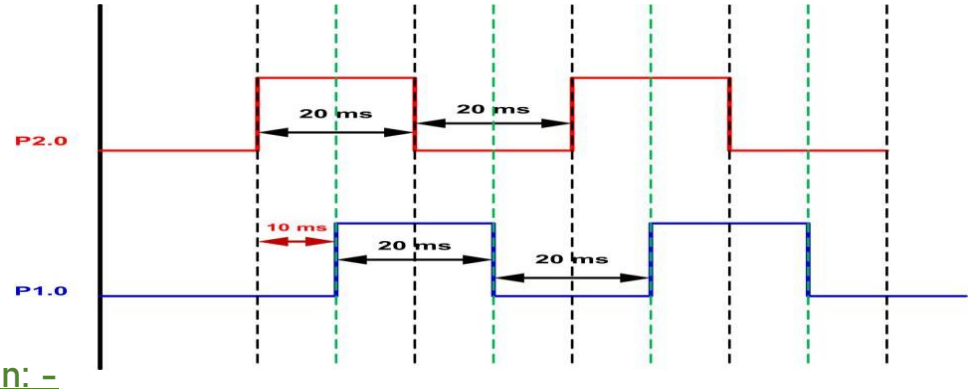
VINYAS A SHETTY

20BEC0780

L27+28

QUESTION 1:

Develop an 8051 ALP program to generate square waves as shown below. Examine the same using the KEIL IDE inbuilt Logic Analyzer.



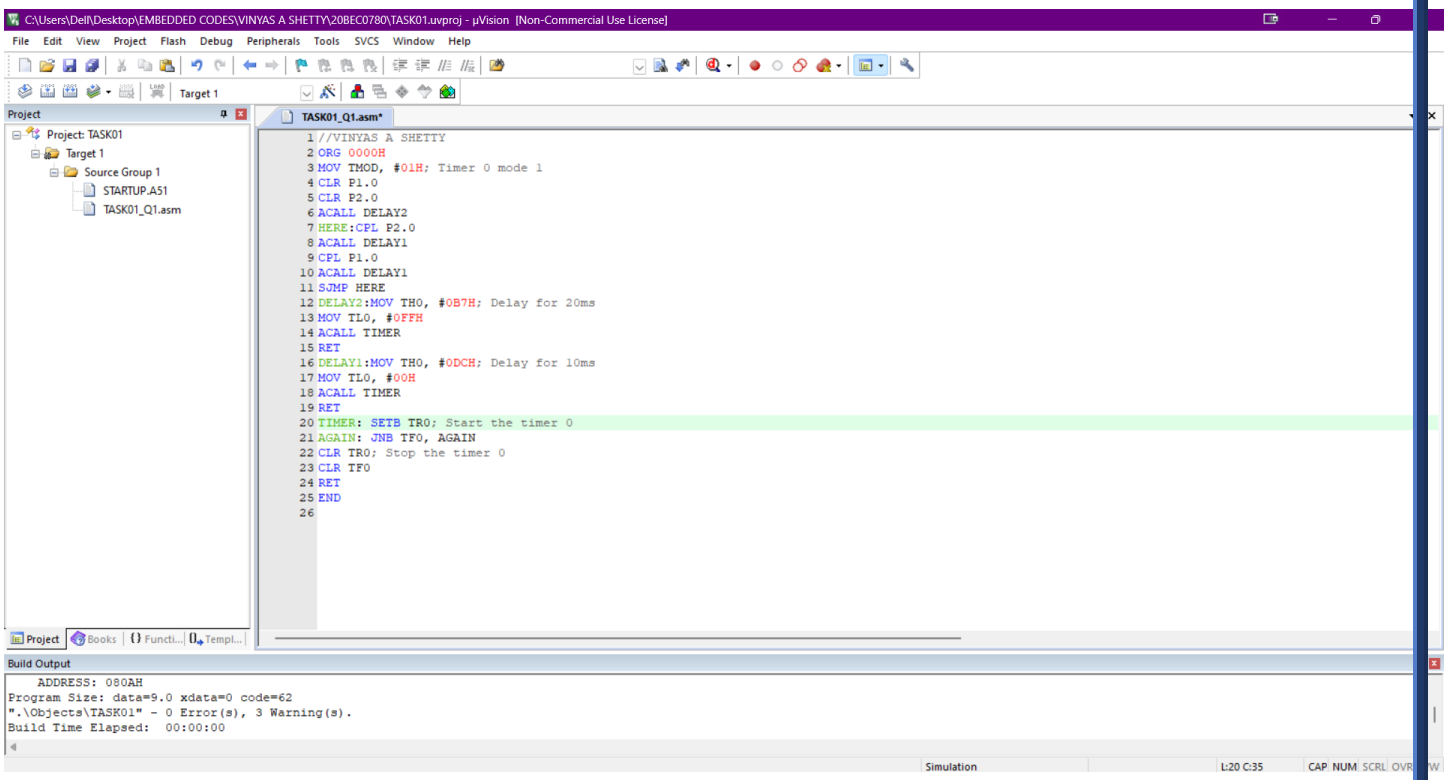
Calculation: -

Delay for 10ms = 10ms/1.085us =9216 65535-9216=56320 =(DC00)h
Delay for 20ms = 20ms/1.085us =18433 65535-18433 =47102=(B7FF)h

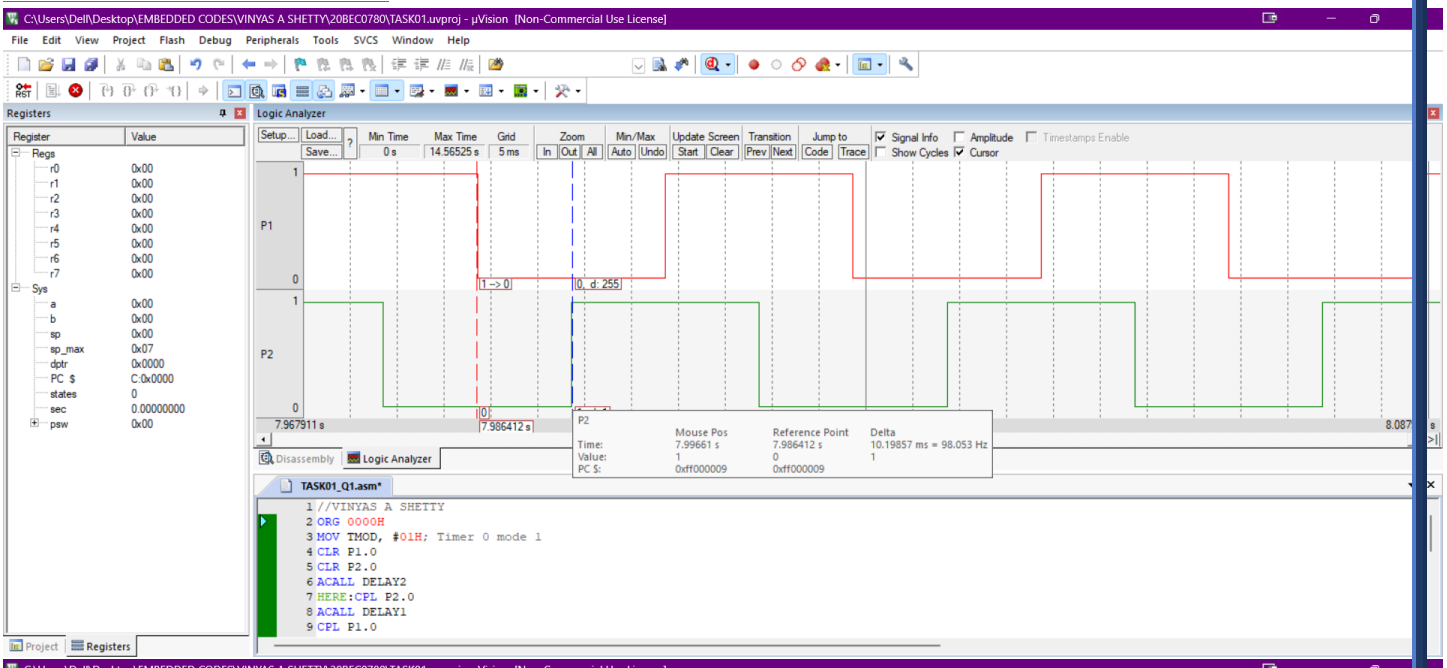
CODE:

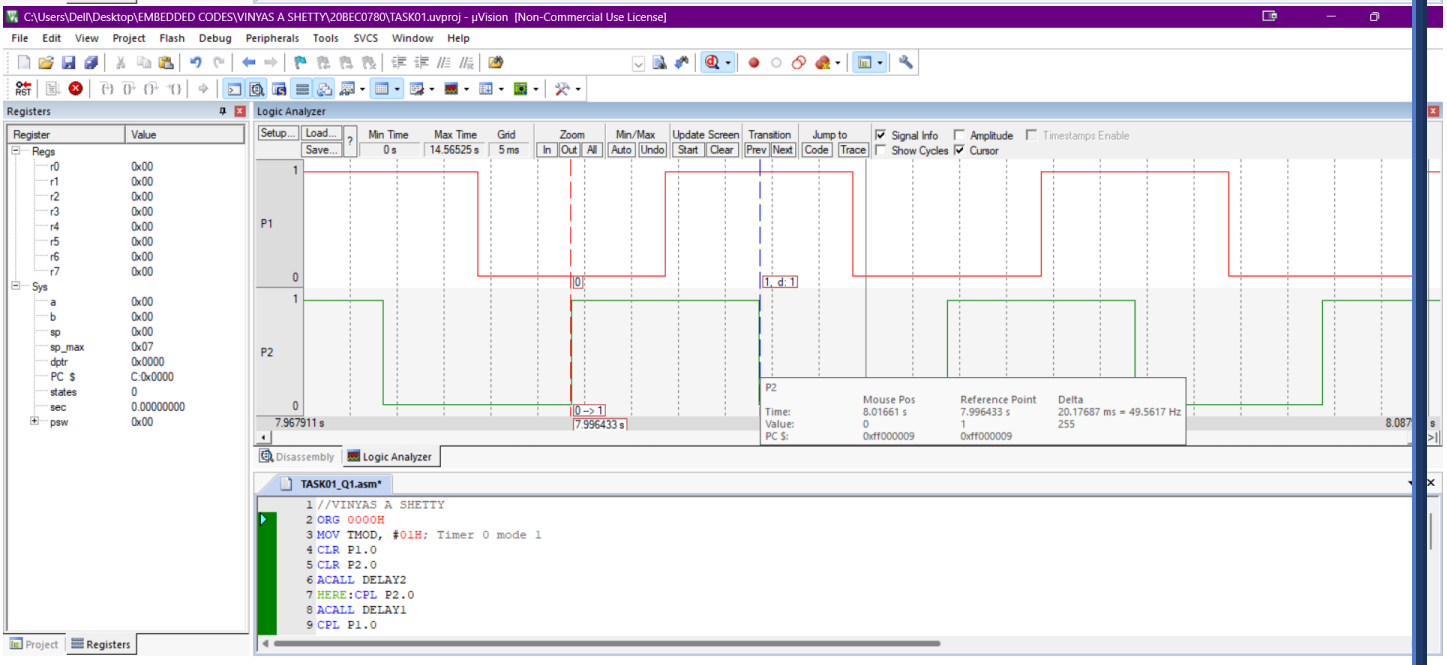
```
//VINYAS A SHETTY
ORG 0000H
MOV TMOD, #01H; Timer 0 mode 1
CLR P1.0
CLR P2.0
ACALL DELAY2
HERE:CPL P2.0
ACALL DELAY1
CPL P1.0
ACALL DELAY1
SJMP HERE
DELAY2:MOV TH0, #0B7H; Delay for 20ms
MOV TL0, #0FFH
```

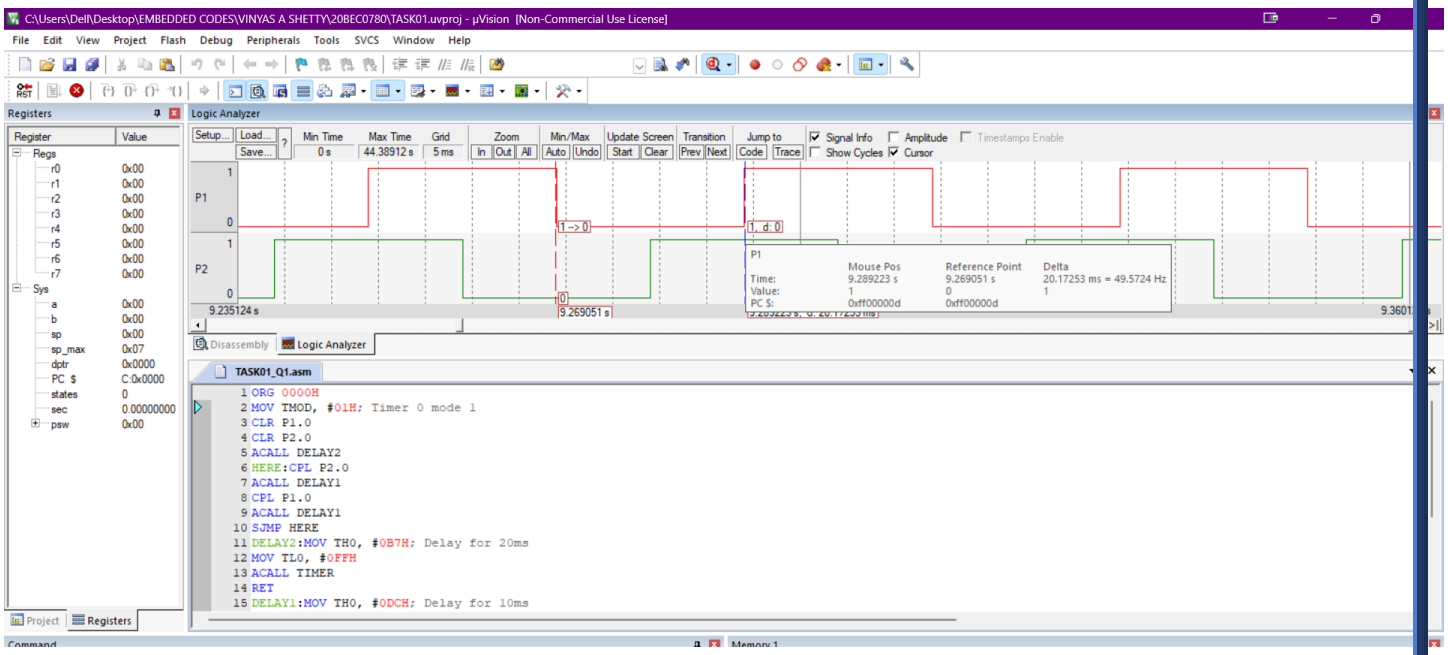
```
ACALL TIMER
RET
DELAY1:MOV TH0, #0DCH; Delay for 10ms
MOV TL0, #00H
ACALL TIMER
RET
TIMER: SETB TR0; Start the timer 0
AGAIN: JNB TF0, AGAIN
CLR TR0; Stop the timer 0
CLR TF0
RET
END
```



SIMULATION RESULTS:







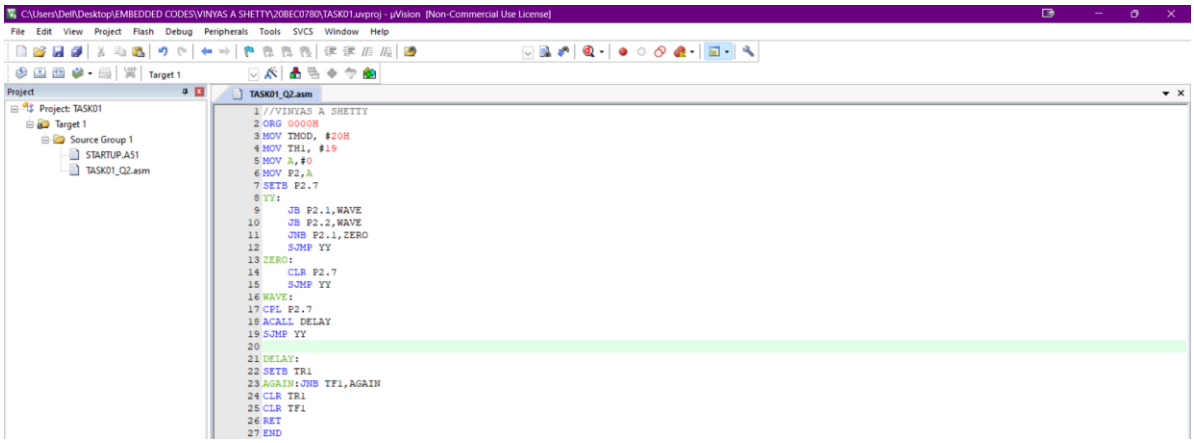
OBSERVATIONS:

By calculations we can get the value that is to be loaded to TH0 and TL0. After loading that value, we can observe a graph with frequency 50Hz, i.e. 20 millisecond ON and 20 millisecond OFF

QUESTION 2:

Write an ALP using 8051 to check the status of two switches connected to port P2.1 and P2.2. If any one of the switches is ON (logic 1) make the LED connected to port 2.7 to toggle for 250 microseconds. Repeat this continuously.

CODE:

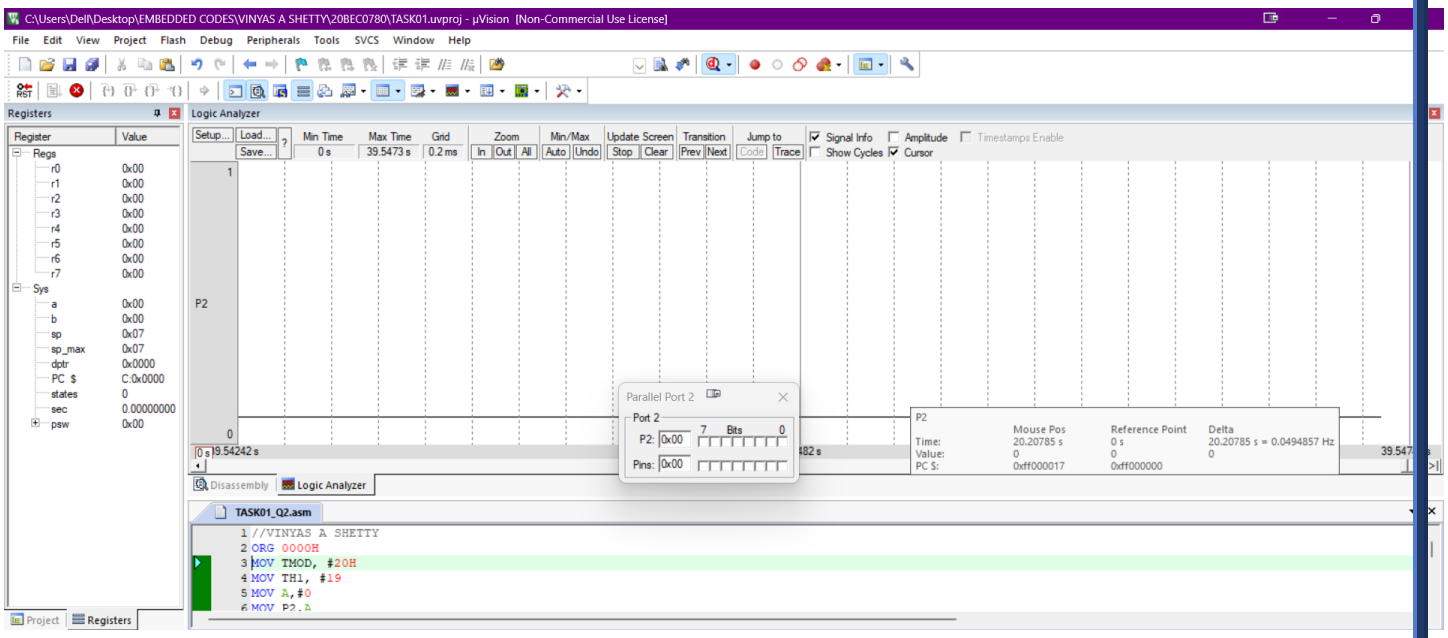


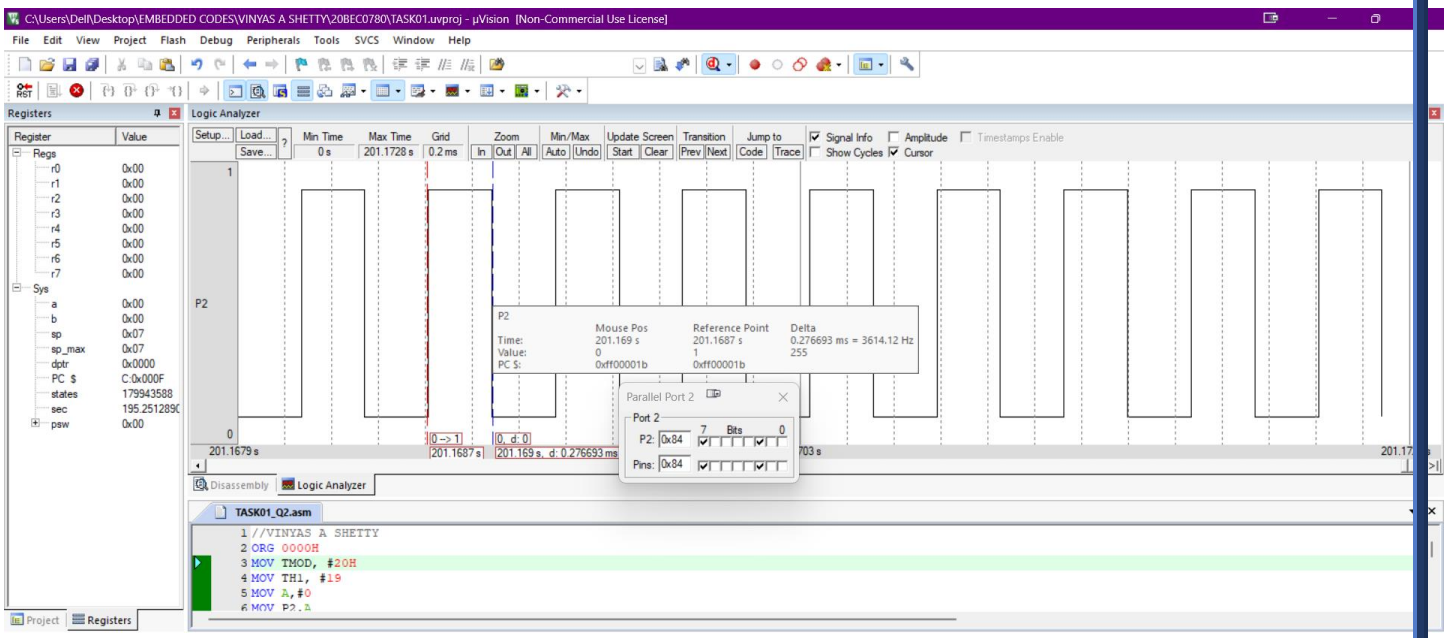
```
//VINYAS A SHETTY
ORG 0000H
MOV TMOD, #20H
MOV TH1, #19
MOV A,#0
MOV P2,A
SETB P2.7
YY:
        JB P2.1,WAVE
        JB P2.2,WAVE
        JNB P2.1,ZERO
        SJMP YY
ZERO:
        CLR P2.7
        SJMP YY
WAVE:
CPL P2.7
ACALL DELAY
SJMP YY

DELAY:
SETB TR1
AGAIN:JNB TF1,AGAIN
CLR TR1
CLR TF1
RET
END
```

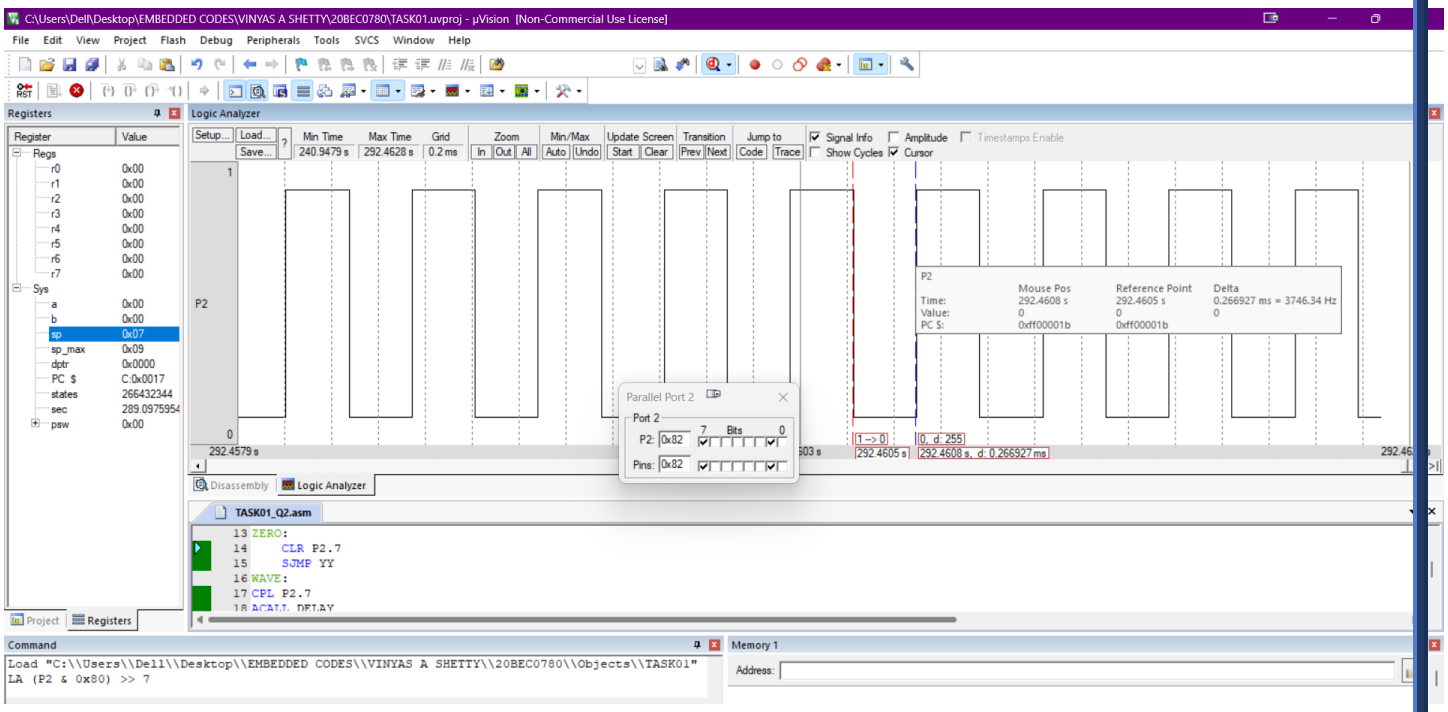
Calculation:

- Delay for 250us = 250us/1.085us =230
- 255-230=25 =(19)H

SIMULATION RESULTS







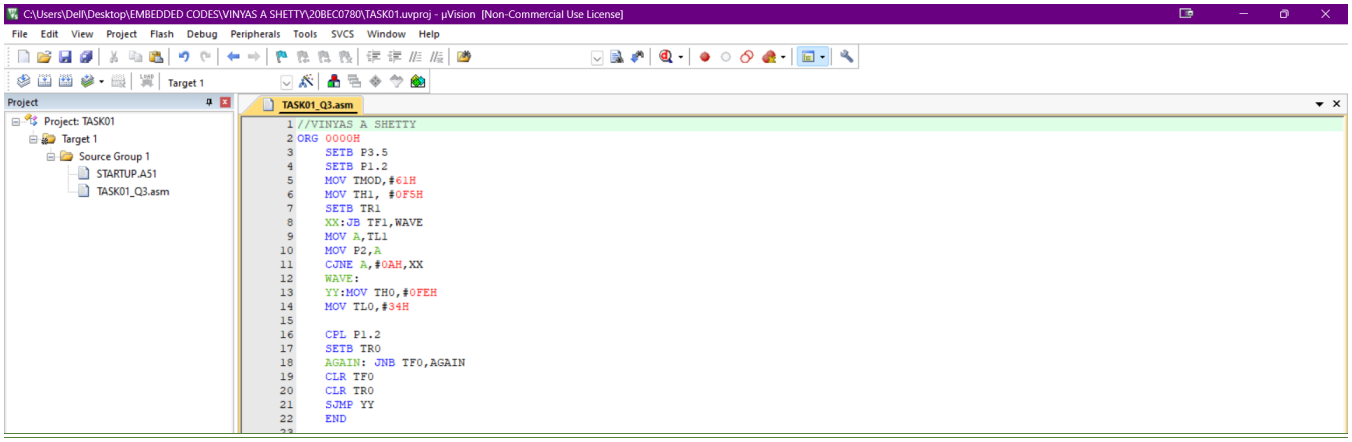
OBSERVATION:

From the above results we can see that when the Pin P2.1 and P2.2 are turned off the LED that's connected to P2.7 is turned OFF. When either P2.1 or P2.2 are turned ON the LED starts blinking with a delay of 250u secs.

QUESTION 3:

Use Counter 1 in mode 2 and after 10 number of counts on TL1, generate a SQUARE waveform of 1 KHz on P1.2 by using Timer 0 in mode 1, show the counts in TL1 on port 2.

CODE:

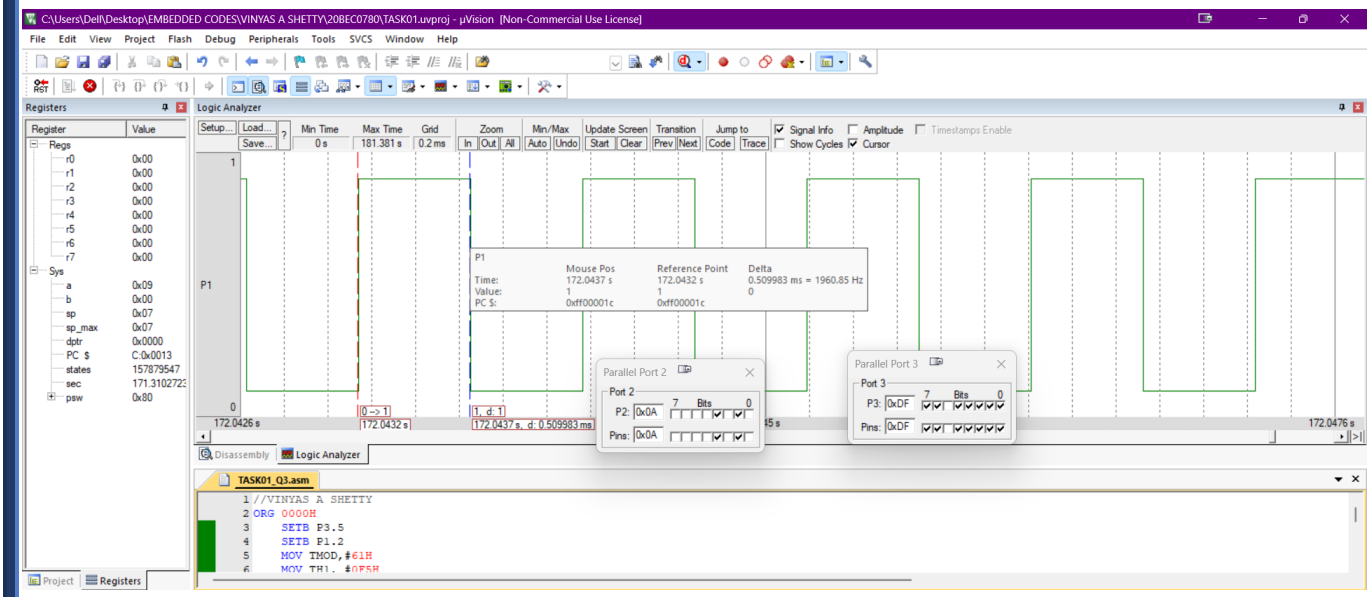


```
//VINYAS A SHETTY
ORG 0000H
        SETB P3.5
        SETB P1.2
        MOV TMOD,#61H
        MOV TH1, #0F5H
        SETB TR1
        XX:JB TF1,WAVE
        MOV A,TL1
        MOV P2,A
        CJNE A,#0AH,XX
        WAVE:
        YY:MOV TH0,#0FEH
        MOV TL0,#34H

        CPL P1.2
        SETB TR0
        AGAIN: JNB TF0,AGAIN
        CLR TF0
        CLR TR0
        SJMP YY
        END
```

Calculation:

- Given 1khz required so time period = 1/1000=1ms
- Required delay=1ms/2=0.5ms
- Delay for 0.5ms = 0.5ms/1.085us =460
- 65535-460=65075 =(FE34)h

SIMULATION RESULTS:



OBSERVATIONS:

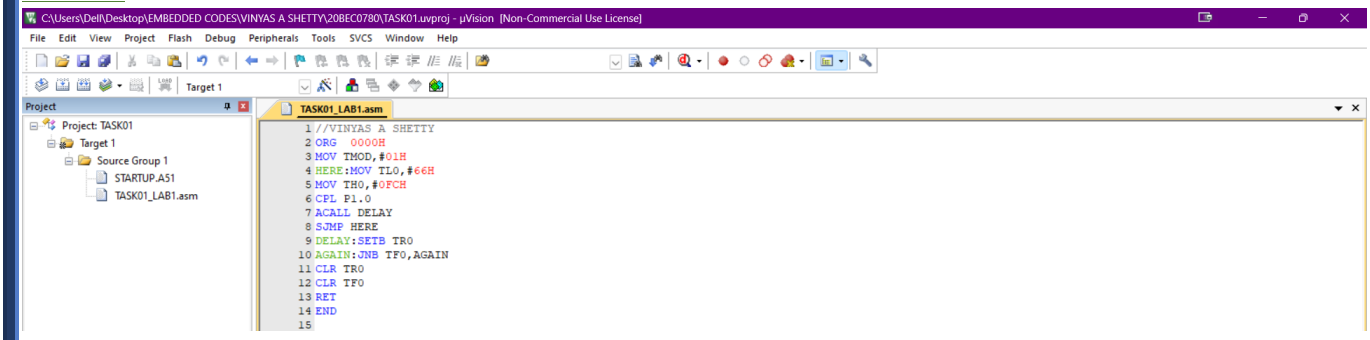
From the above results we can conclude that when the accumulator reaches the value 10(0AH) the timer starts working and till then the timer will be set to 1

LAB QUESTIONS:

QUESTION 1

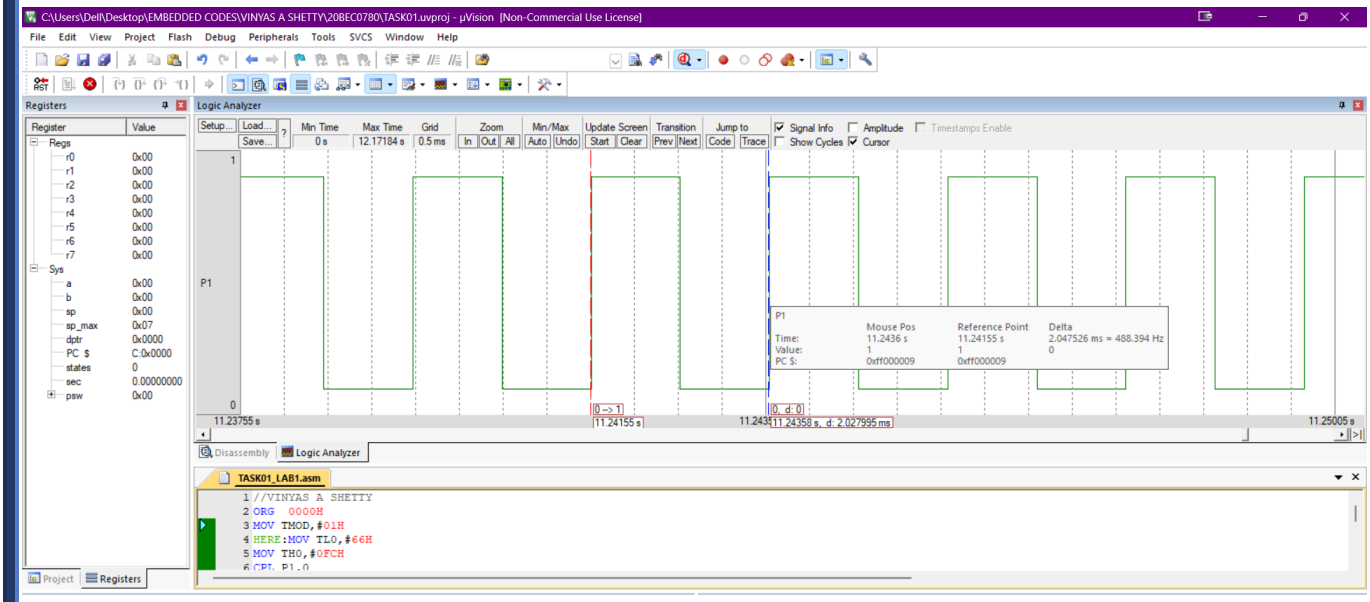
Write an ALP to generate a square wave of 500Hz in Timer0

CODE:



```
//VINYAS A SHETTY
ORG  0000H
MOV TMOD,#01H
HERE:MOV TL0,#66H
MOV TH0,#0FCH
CPL P1.0
ACALL DELAY
SJMP HERE
DELAY:SETB TR0
AGAIN:JNB TF0,AGAIN
CLR TR0
CLR TF0
RET
END
```

SIMULATION RESULTS:



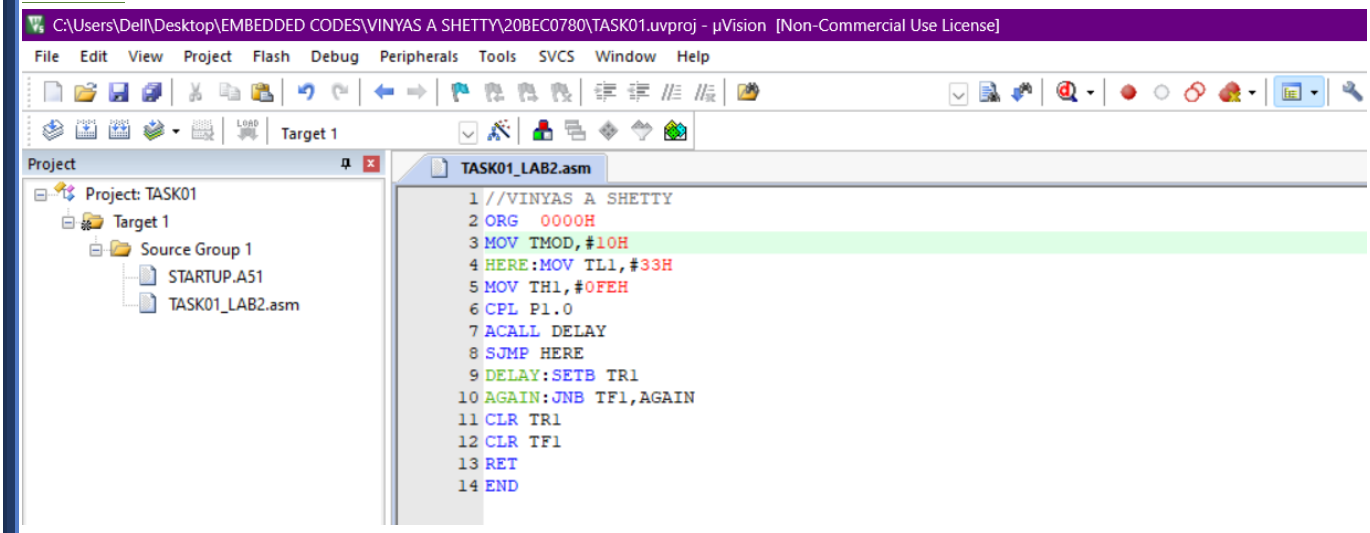
OBSERVATIONS:

A square wave of 500Hz that is 1ms is generated at Port 1.0 using timer 0 mode 1

QUESTION 2:

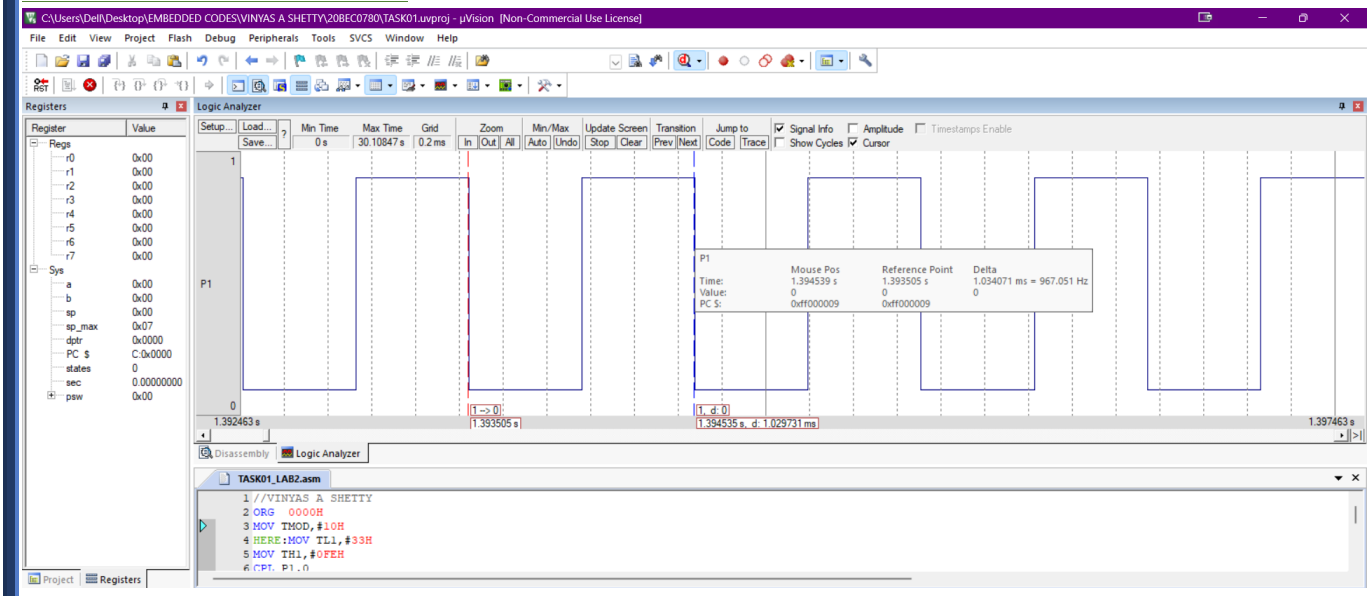
Write an ALP to generate a square wave of frequency of 1Khz at any pin of port 1.

CODE:




```
//VINYAS A SHETTY
ORG  0000H
MOV TMOD,#10H
HERE:MOV TL1,#33H
MOV TH1,#0FEH
CPL P1.0
ACALL DELAY
SJMP HERE
DELAY:SETB TR1
AGAIN:JNB TF1,AGAIN
CLR TR1
CLR TF1
RET
END
```

SIMULATION RESULTS:



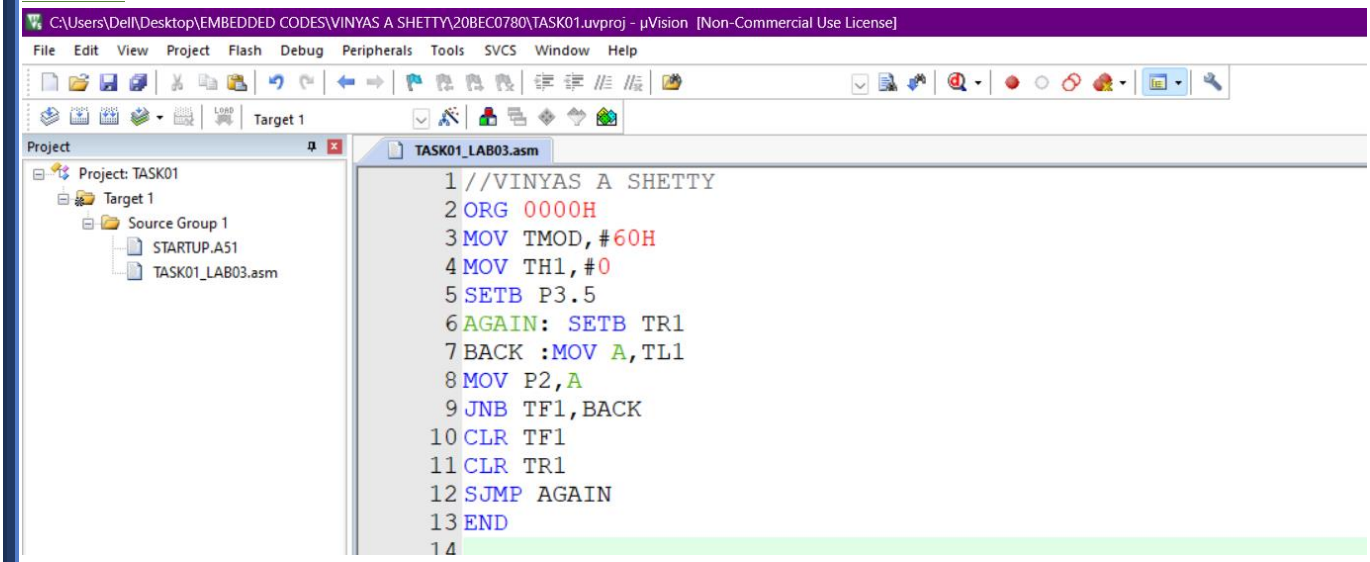
OBSERVATIONS:

A square wave of frequency 1Khz is generated at Port 1.0

QUESTION 3:

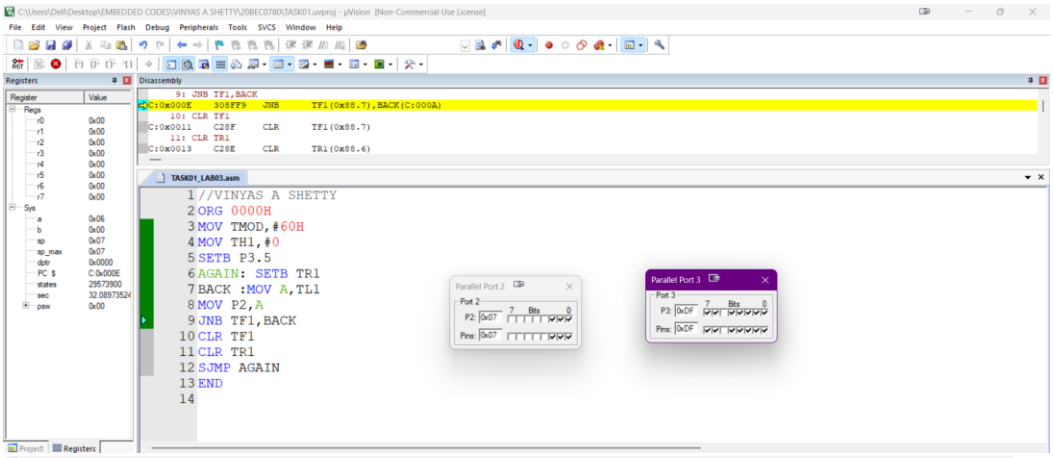
Write an ALP to count the values and read them in PORT 2.

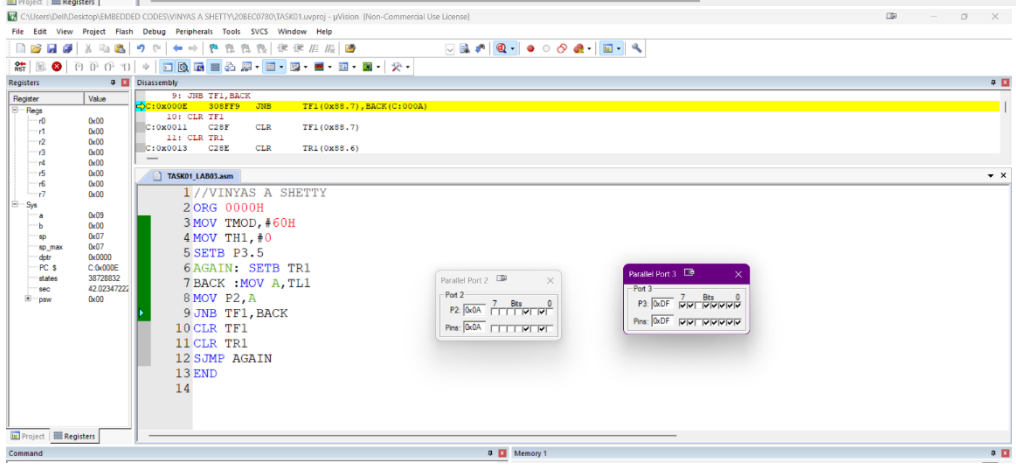
CODE:



```
//VINYAS A SHETTY
ORG 0000H
MOV TMOD,#60H
MOV TH1,#0
SETB P3.5
AGAIN: SETB TR1
BACK :MOV A,TL1
MOV P2,A
JNB TF1,BACK
CLR TF1
CLR TR1
SJMP AGAIN
END
```

SIMULATION RESULTS:





OBSERVATIONS:

Whenever the pin 3.5 goes from HIGH to LOW the counter value that is TL1 is increased, as the TL1 is sent to Port 2 we observe the count value in port 2