The 8051 Microcontroller and Embedded Systems

8051 TIMER PROGRAMMING IN ASSEMBLY

By

Dr. Usha Chauhan

COUNTER PROGRAMMING

C/T bit in TMOD register

used as a timer, the 8051's crystal is used as the source of the fre-quency

used as a counter, pulse outside the 8051 increments the TH, TL registers

counter mode, TMOD and TH, TL registers are the same as for the timer

timer modes are the same as well

COUNTER PROGRAMMING

C/T bit in TMOD register

C/T bit in the TMOD register decides the source of the clock for the timer

C/T = 0, timer gets pulses from crystal

C/T = 1, the timer used as counter and gets pulses from outside the 8051

C/T = 1, the counter counts up as pulses are fed from pins 14 and 15

pins are called T0 (Timer 0 input) and T1 (Timer 1 input)

these two pins belong to port 3

Timer 0, when C/T = 1, pin P3.4 provides the clock pulse and the counter counts up for each clock pulse coming from that pin

Timer 1, when C/T = 1 each clock pulse coming in from pin P3.5 makes the counter count up

COUNTER PROGRAMMING

Pin	Port Pin	Function	Description
14	P3.4	T0	Timer/Counter 0 external input
15	P3.5	T1	Timer/Counter 1 external input

(MSB) (LSB)

GATE	C/T	M1	M0	GATE	C/T	M1	M0
Timer 1				Timer 0			

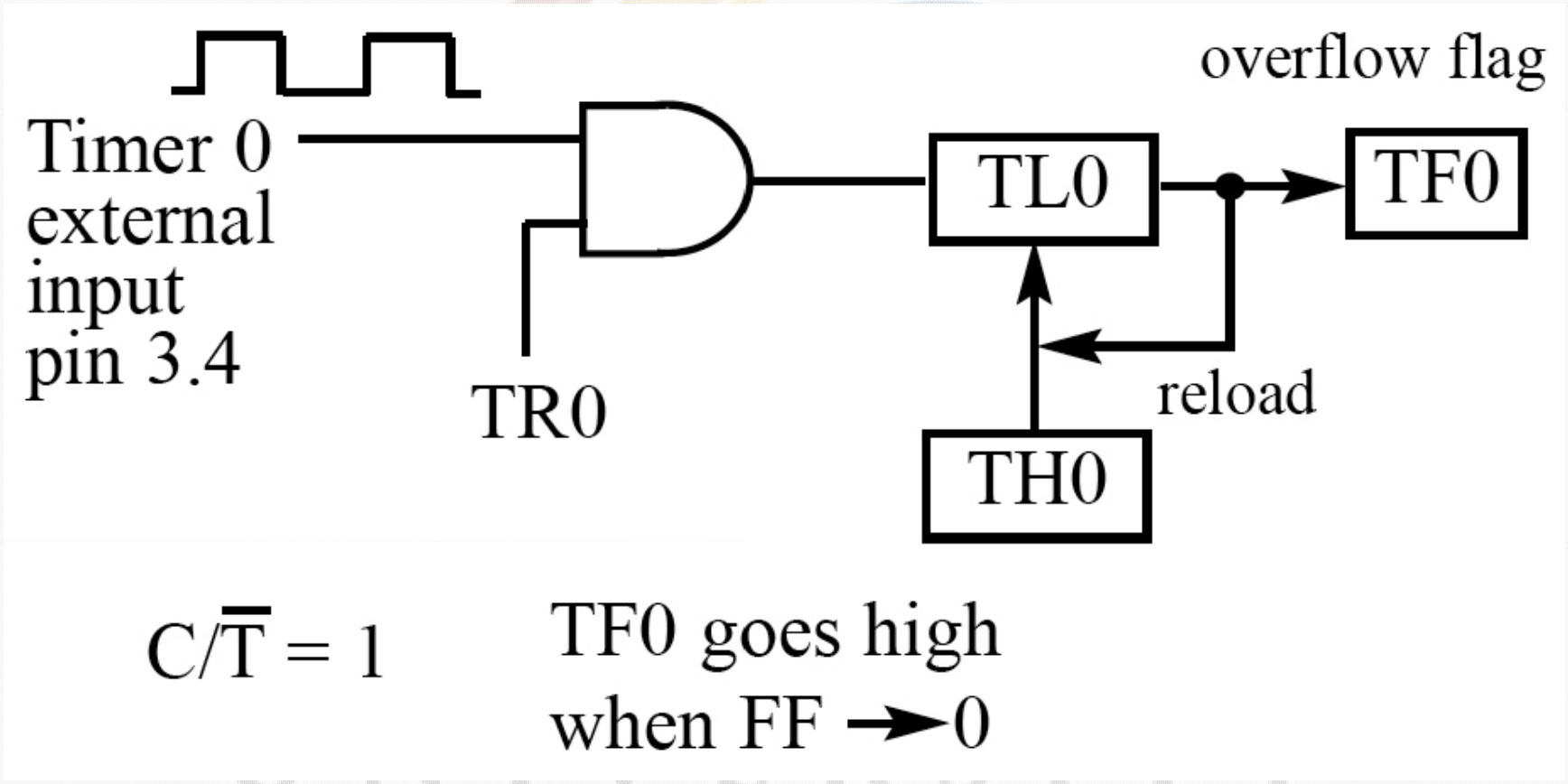
Table 9–1 Port 3 Pins Used For Timers 0 and 1

Assuming that clock pulses are fed into pin T1, write a program for counter 1 in mode 2 to count the pulses and display the state of the TL1 count on P2.

```
01  MOV TMOD,#01100000B          ;counter 1,mode 2,C/T=1
02                               ;external pulses
03  MOV TH1,#0                   ;clear TH1
04  SETB P3.5                    ;make T1 input
05  AGAIN: SETB TR1              ;start the counter
06  BACK: MOV A,TL1              ;get copy of count TL1
07  MOV P2,A                     ;display it on port 2
08  JNB TF1,BACK                 ;keep doing it if TF=0
09  CLR TR1                      ;stop the counter 1
10  CLR TF1                      ;make TF=0
11  SJMP AGAIN                   ;keep doing it
12
13  END
14
```

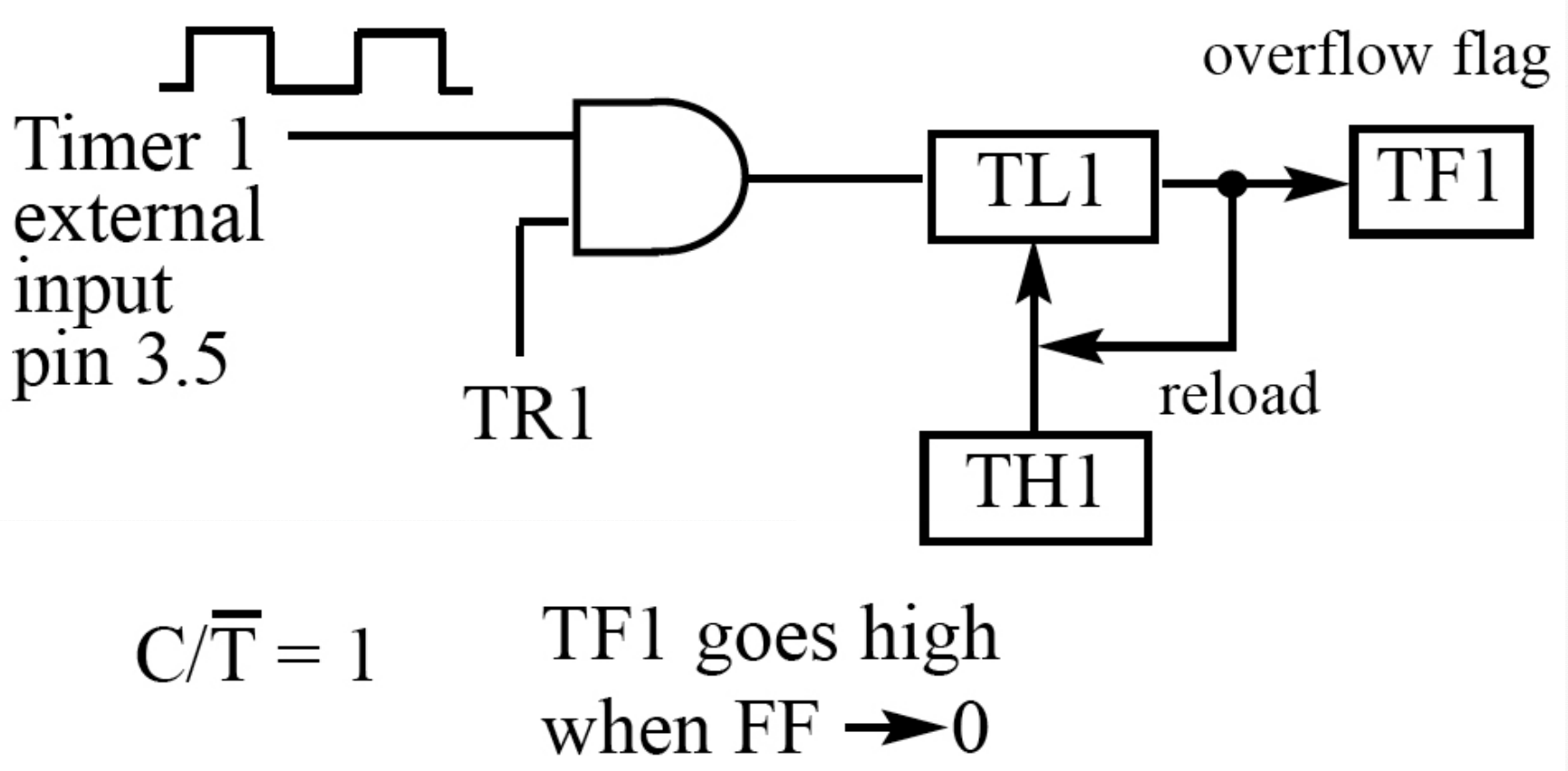
P2 is connected to 8 LEDs and input T1 to pulse.

COUNTER PROGRAMMING



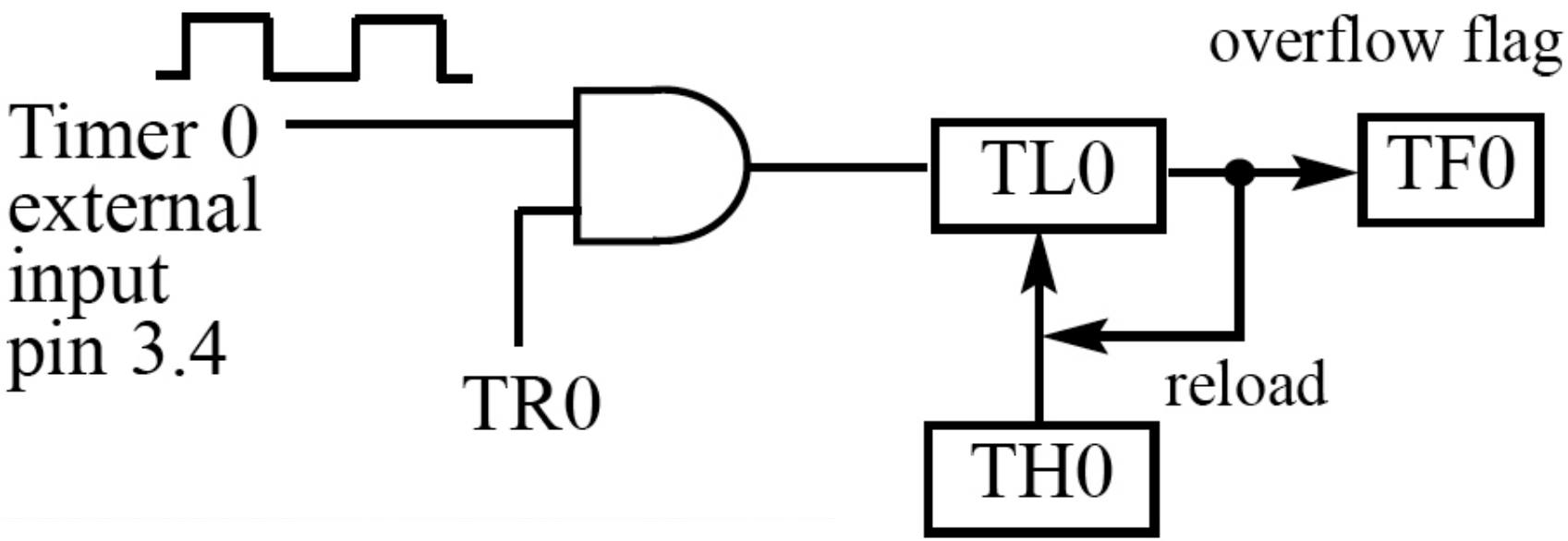
Timer 0 with External Input (Mode 2)

COUNTER PROGRAMMING



Timer 1 with External Input (Mode 2)

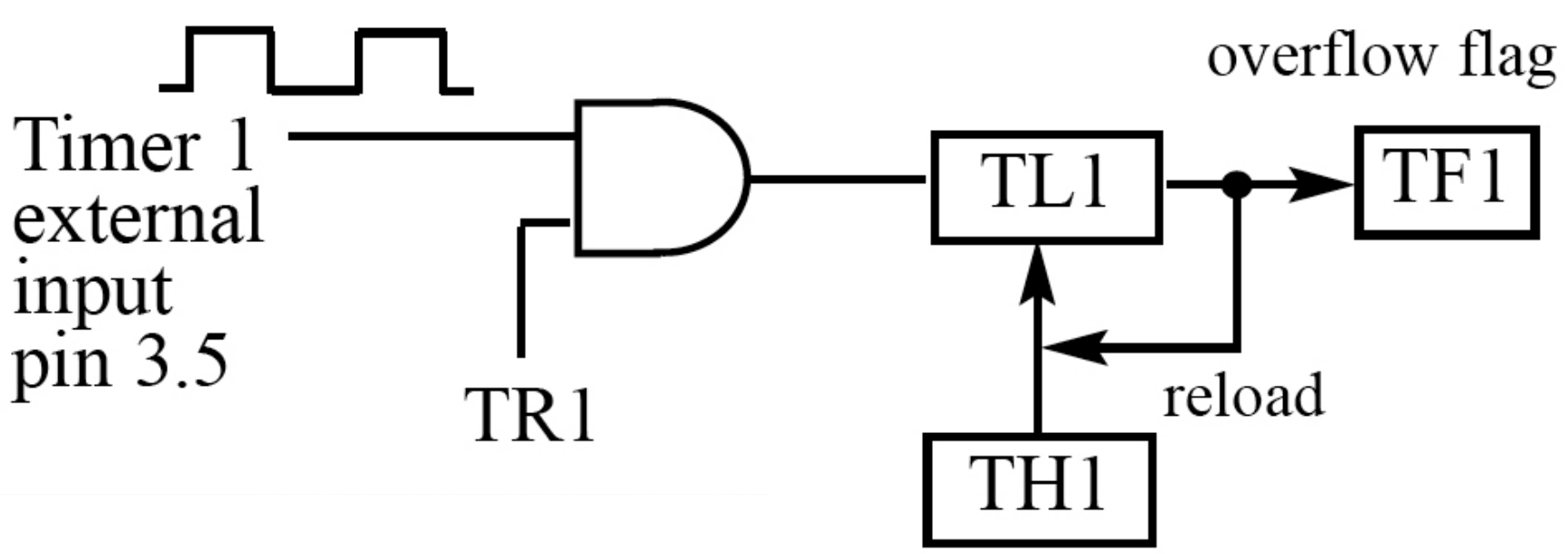
COUNTER PROGRAMMING



$C/\overline{T} = 1$

TF0 goes high when FF → 0

COUNTER PROGRAMMING



$C/\overline{T} = 1$

TF1 goes high when FF → 0

COUNTER PROGRAMMING

For Timer 0			
SETB	TR0	=	SETB TCON.4
CLR	TR0	=	CLR TCON.4
SETB	TF0	=	SETB TCON.5
CLR	TF0	=	CLR TCON.5
For Timer 1			
SETB	TR1	=	SETB TCON.6
CLR	TR1	=	CLR TCON.6
SETB	TF1	=	SETB TCON.7
CLR	TF1	=	CLR TCON.7

TCON: Timer/Counter Control Register

TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

Port 3 Pins Used For Timers 0 and 1

COUNTER PROGRAMMING

TCON register

- **TR0 and TR1 flags turn on or off the timers**
- **bits are part of a register called TCON (timer control)**
- **upper four bits are used to store the TF and TR bits of both Timer 0 and Timer 1**
- **lower four bits are set aside for controlling the interrupt bits**
- **"SETB TRl" and "CLR TRl“**
- **"SETB TCON. 6" and "CLR TCON. 6“**

COUNTER PROGRAMMING

For Timer 0			
	SETB TR0	=	SETB TCON.4
	CLR TR0	=	CLR TCON.4
	SETB TF0	=	SETB TCON.5
	CLR TF0	=	CLR TCON.5
For Timer 1			
	SETB TR1	=	SETB TCON.6
	CLR TR1	=	CLR TCON.6
	SETB TF1	=	SETB TCON.7
	CLR TF1	=	CLR TCON.7

TCON: Timer/Counter Control Register

TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

Equivalent Instructions for the Timer Control Register (TCON)

COUNTER PROGRAMMING

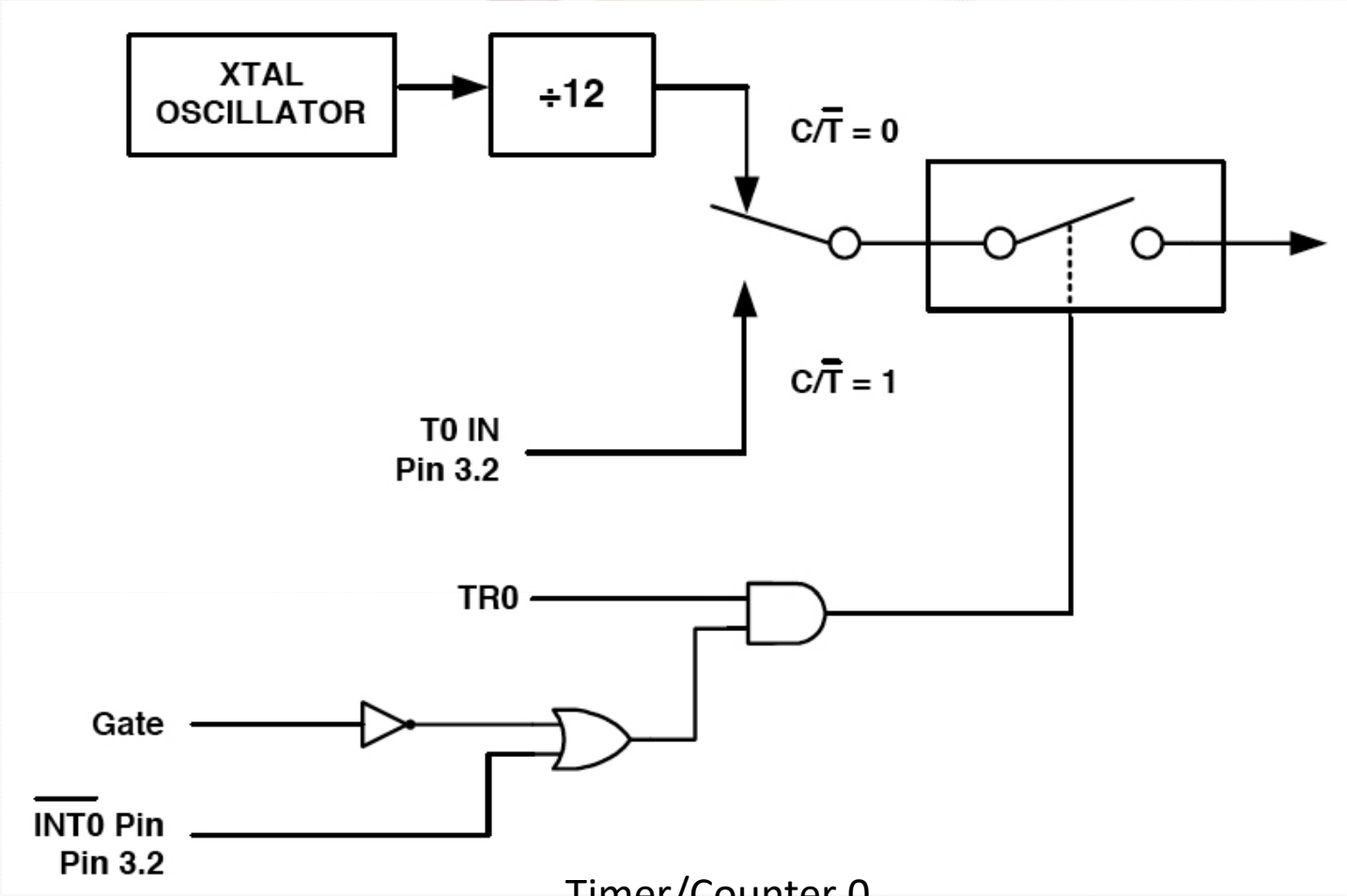
The case of GATE = 1 in TMOD

GATE = 0, the timer is started with instructions "SETB TR0" and "SETB TR1“

GATE = 1, the start and stop of the timers are done externally through pins P3.2 and P3.3

allows us to start or stop the timer externally at any time via a simple switch

COUNTER PROGRAMMING



Timer/Counter 0

COUNTER PROGRAMMING