INDIAN INSTITUTE OF TECHNOLOGY

DATE 4.1.24 | Exp 1: Introduction to Microchip Studio, Simul IDE and Hardware Programming Tool with LED blink | SHEET NO. 1

•) Aim: To program ATmega 32 to control the blinking of an LED.

•) Apparatus reqd:

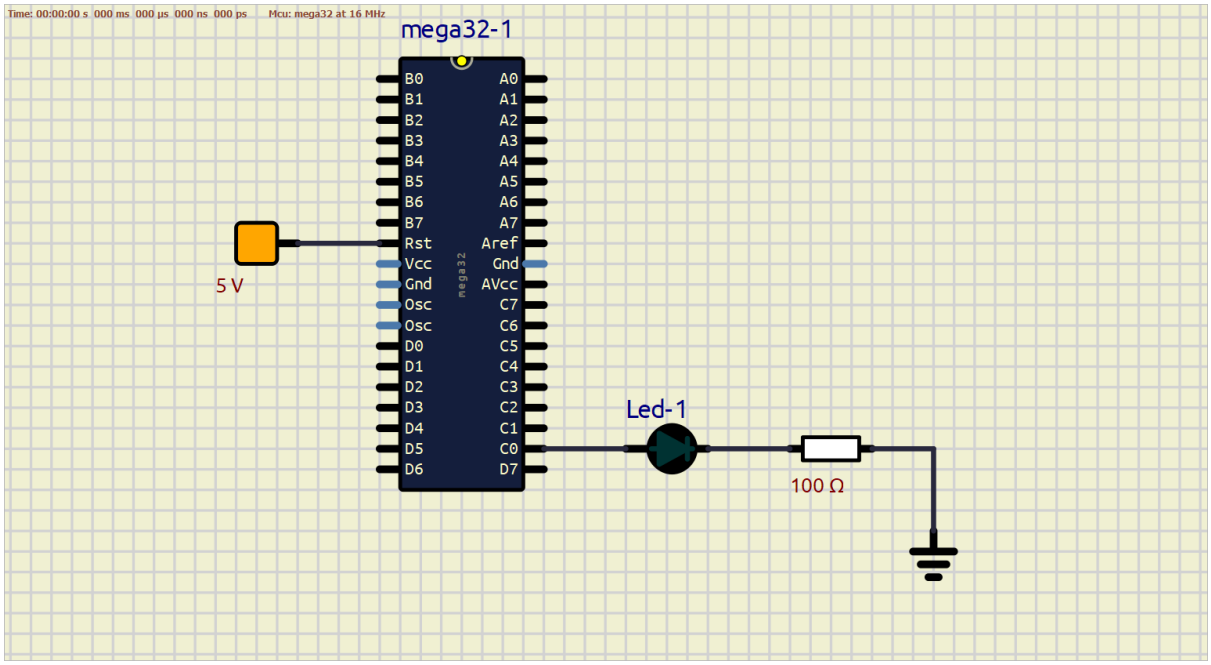
	Name.	Specification	Quantity
1.	AT Mega 32A microcontroller.	—	1.
2.	Resistor	100Ω.	1.
3.	LED.	—	1.

•) Pseudo code:

1. set pin C0 as output.
2. main:
   - set pin C0 high.
   - call delay routine
   - set pin C0 low.
   - call delay routine
   - goto main

3. delay: # count from $(7FFFF)_{16} \rightarrow (0)_{16}$
   - $r18 \leftarrow (7)_{16}$
   - l_3: $r_{17} \leftarrow (FF)_{16}$
   - l_2: $r_{16} \leftarrow (FF)_{16}$
   - l_1: r_{16}--
     - if (z≠0) goto l_1.
   - r_{17}--
     - if (z≠0) goto l_2.
   - r_{18}--
     - if (z≠0) goto l_3
   - return.

P.R.E.



Circuit Diagram

1) Code:

```
.INCLUDE "M32DEF.INC"
.ORG 0
SBI DDRC, PINC0
LDI R16, HIGH(RAMEND).
OUT. SPH, R16.
LDI R16, LOW(RAMEND).
OUT SPL, R16
~~HA~~
MAIN:
    SBI PORTC, PINC0
    CALL DELAY
    CBI PORTC, PINC0
    CALL DELAY

DELAY:
        LDI R18, 0x07.
    N3: LDI R17, 0xFF
    N2: LDI R16, 0xFF
    N1: DEC R16. **
        BRNE N1.
        DEC R17
        BRNE N2.
        DEC R18.
        BRNE N3
        RET.
```

* *

• Explanation:

To blink the LED we needed to turn it on and off indefinitely with a delay in between.

The delay block is basically a counter that counts from $(7FFFFF)_{16}$ to $(0)_{16}$. It does so by concatenating (hypothetically) three 8 bit registers $\{r_{18}, r_{17}, r_{16}\}$. where during init $r_{18} \leftarrow 07$; $r_{17} \leftarrow FF$; $r_{16} \leftarrow FF$. We decrease the lowest significant register (r_{16}). untill it becomes 0, further decremant will incur a carry. Thus r17 is decr. Thus. r17 will also go zero at some point, hence a carry from r18 is incurred. Finally when r18 ~~stops~~ becomes zero counter stops and transfers execution to main block.

$\therefore f_{clk} = 16\,MHz.$

and counter = $(7FFFFF)_{16}$ steps (x 2).

$\therefore f_{delay} = \frac{16\,M.}{2^{19} \times 2} \approx$ ~~32Hz~~ 16 Hz.

$\Rightarrow t_{delay} = \frac{1}{3276} \approx$ ~~0.3sec~~ ~~0.03sec~~

$\Rightarrow t_{delay} = \frac{1}{16} \approx 62.5\,ms.$