

MICROPROCESSORS AND MICROCONTROLLERS
LAB

DA - 3

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Aim:

- i.) Write an 8051 ALP program to generate a pulse waveform with given duty cycle using timer.
- ii.) Write an 8051 ALP program to generate a pulse waveform with given time-period using timer. $T = xx \text{ ms}$ (Reg: 22BCE29xx)
- iii.) Write an 8051 ALP to get the radius of sphere (8-bit) from port P1. Calculate the volume (V) and total surface area (A). Send the following messages through UART1. " Volume of the sphere is V" "Total surface area is A"

Procedure:

- i.) Start up the Keil μ Vision Software.
- ii.) Create new μ Vision project at required directory.
- iii.) Set the device as 8051 microcontroller (AT89C51).
- iv.) Create new item at Source Group 1 in Target 1.
- v.) Set the file type as ASM file.
- vi.) Continue writing the code for the ALP.

- vii.) Translate and build the file.
- viii.) Start debug session, and run code line by line to get output
- ix.) Check output at the memory location set, in memory 1.

Algorithm:

a.) To generate a pulse waveform with given duty cycle using timer:-

1. Set up Timer 0 in mode 1 with an external clock source.
2. Clear Timer 0 flag.
3. Enter an infinite loop: a. Set P2.3 high. b. Start Timer 0 with a delay determined by ON_DELAY subroutine. c. Clear P2.3. d. Start Timer 0 with a delay determined by OFF_DELAY subroutine.

ON_DELAY Subroutine:

1. Load Timer 0 with a delay for the LED ON time.
2. Start Timer 0 and wait until it overflows (TF0 flag is set).
3. Stop Timer 0 and clear its flag.

OFF_DELAY Subroutine:

1. Load Timer 0 with a delay for the LED OFF time.
2. Start Timer 0 and wait until it overflows (TF0 flag is set).
3. Stop Timer 0 and clear its flag.

b.) to generate a pulse waveform with given time-period using timer. $T = xx$ ms (Reg: 22BCE29xx):-

1. Set up Timer 0 in mode 1
2. Use an external clock source.
3. Clear Timer 0 flag.
4. Enter an infinite loop: a. Set P2.3 high. b. Start Timer 0 with a delay determined by ON_DELAY subroutine. c. Clear P2.3. d. Start Timer 0 with a delay determined by OFF_DELAY subroutine.

ON_DELAY Subroutine:

5. Load Timer 0 with a delay for the LED ON time.
6. Start Timer 0 and wait until it overflows (TF0 flag is set).
7. Stop Timer 0 and clear its flag.

OFF_DELAY Subroutine:

8. Load Timer 0 with a delay for the LED OFF time.
9. Start Timer 0 and wait until it overflows (TF0 flag is set).
10. Stop Timer 0 and clear its flag.

C.) to get the radius of sphere (8-bit) from port P1.
 Calculate the volume (V) and total surface area
 (A):-

1. **Initialization:**
 - Move the value of Port 1 (P1) to Register 0 (R0).
 - Copy R0 to Accumulator (A) and Register B.
 - Initialize Register 1 (R1) for storing results.
2. **Calculate Surface Area:**
 - Square the radius (A * B) and multiply by a constant to get $4 \times 8 \times 824 \times \pi \times r^2$.
 - Convert the result to ASCII and store it in memory.
3. **Send Surface Area via Serial Port:**
 - Iterate through data array DAT0 and send data to the serial port.
4. **Calculate Volume:**
 - Decrement the ASCII counter (R1) and recalculate the radius cubed.
 - Multiply to get $43 \times 8 \times 8334 \times \pi \times r^3$.
 - Convert the result to ASCII and store it in memory.
5. **Send Volume via Serial Port:**
 - Iterate through data array DAT1 and send data to the serial port.
6. **Data Definitions:**
 - Define data strings for surface area and volume messages.
7. **End of Program.**

Code:

a.) To generate a pulse waveform with given duty cycle using timer:-

```

1  MOV TMOD,#01H
2  CLR TFO
3
4  HERE:
5  SETB P2.3
6  ACALL ON_DELAY
7  CLR P2.3
8  ACALL OFF_DELAY
9  SJMP HERE
10
11 ON_DELAY:
12 MOV TH0,#0FFH
13 MOV TLO,#00H
14 SETB TRO
15 JNB TFO,?
16 CLR TRO
17 CLR TFO
18 RET
19
20 OFF_DELAY:
21 MOV TH0,#0FBH
22 MOV TLO,#0E2H
23 SETB TRO
24 JNB TFO,?
25 CLR TRO
26 CLR TFO
27 RET
28
29 END

```

b.) to generate a pulse waveform with given time-period using timer. $T = xx \text{ ms}$ (Reg: 22BCE29xx):-

```
1  MOV TMOD,#01H
2  CLR TF0
3
4  HERE:
5  SETB P2.3
6  ACALL ON_DELAY
7  CLR P2.3
8  ACALL OFF_DELAY
9  SJMP HERE
10
11 ON_DELAY:
12 MOV TH0,#0FFH
13 MOV TLO,#00H
14 SETB TR0
15 JNB TF0,⌘
16     CLR TR0
17     CLR TF0
18     RET
19
20 OFF_DELAY:
21 MOV TH0,#0FSH
22 MOV TLO,#0BAH
23 SETB TR0
24 JNB TF0,⌘
25     CLR TR0
26     CLR TF0
27     RET
28
29     END
30
```

C.)

to get the radius of sphere (8-bit) from port P1.
Calculate the volume (V) and total surface
area (A):-

```
1  MOV R0, P1
2  MOV A, R0
3  MOV B, R0
4  MUL AB
5  MOV B, #0EH
6  MUL AB
7  MOV R1, #22H
8
9  CONVERT_TO_ASCII:
10     MOV B, #10D
11     DIV AB
12     MOV R7, A
13     MOV A, B
14     ADD A, #30H
15     MOV @R1, A
16     INC R1
17     MOV A, R7
18     CJNE A, #0, CONVERT_TO_ASCII
19
20     MOV R3, #22D
21     MOV R2, #0
22     MOV DPTR, #DAT0
23     AGAIN2: MOV A, R2
24             MOVC A, @A+DPTR
25             MOV SBUF, A
26             CHECK_T1: JNB TI, CHECK_T1
27             CLR TI
28             INC R2
```

```

29     DJNZ R3,AGAIN2
30
31     AGAIN: MOV A,R1
32           SUBB A,#01H
33           MOV R1,A
34           MOV SBUF,@R1
35     CHECK_T12: JNB TI,CHECK_T12
36           CLR TI
37           MOV A,R1
38           CJNE A,#20,AGAIN
39
40     MOV A,R0
41     MOV B,R0
42     MUL AB
43     MOV B,R0
44     MUL AB
45     MOV B,#04H
46     MUL AB
47     MOV R1,#20H
48
49     CONVERT_TO_ASCII2:
50           MOV B,#10D
51           DIV AB
52           MOV A,B
53           ADD A,#30H
54           MOV @R1,A
55           INC R1
56           MOV A,R7

```

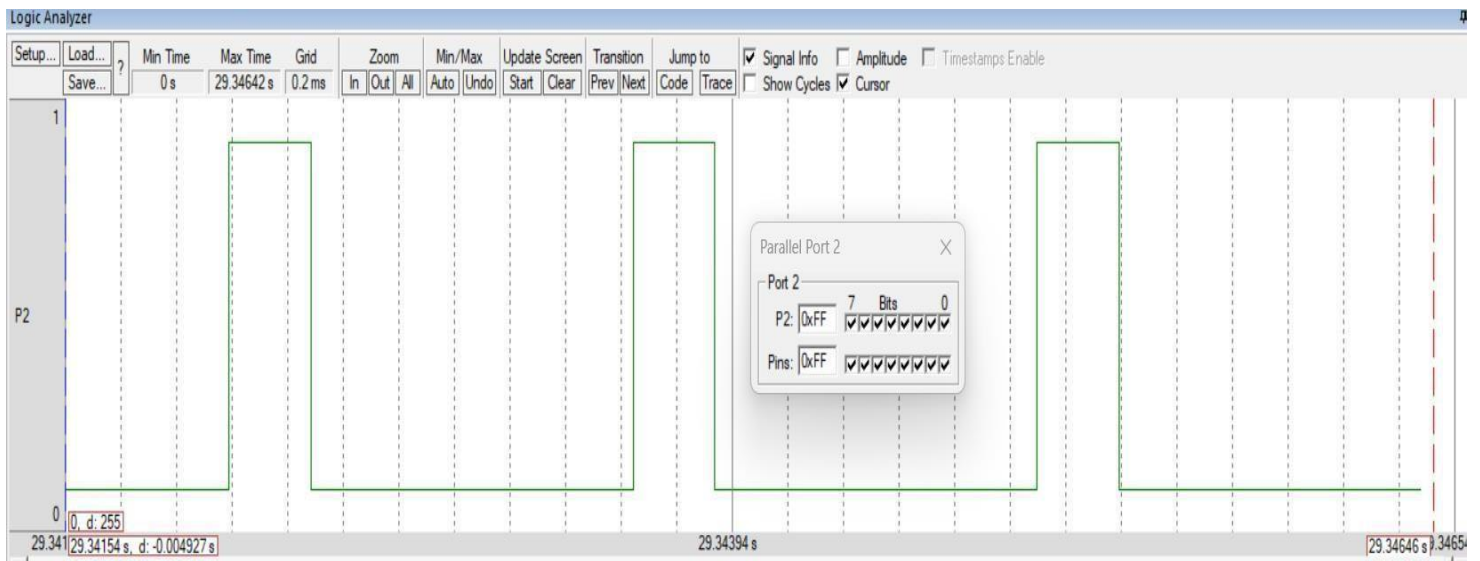
```

57     CJNE A, #0, CONVERT_TO_ASCII2
58
59     MOV R3, #26D
60     MOV R2, #0
61     MOV DPTR, #DAT1
62     AGAIN3: MOV A, R2
63             MOVC A, @A+DPTR
64             MOV SBUF, A
65             CHECK_TI1: JNB TI, CHECK_TI1
66             CLR TI
67             INC R2
68             DJNZ R3, AGAIN3
69
70     AGAIN4: MOV A, R1
71             SUBB A, #01H
72             MOV R1, A
73             MOV SBUF, @R1
74             CHECK_TI3: JNB TI, CHECK_TI3
75             CLR TI
76             MOV A, R1
77             CJNE A, #20H, AGAIN4
78
79     DAT0: DB "TOTAL SURFACE AREA IS", 0
80
81     DAT1: DB "VOLUME OF THE SPHERE IS", 0
82
83     END

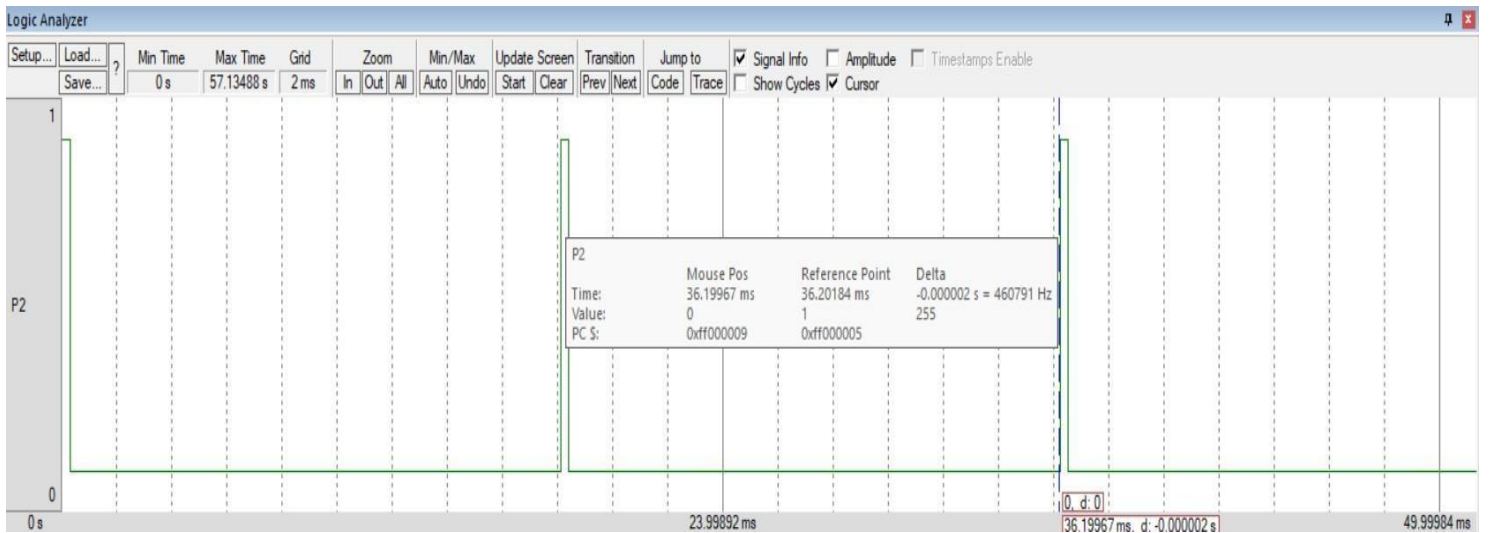
```


Output:

a.)



b.)



C.)

UART #1

TOTAL SURFACE AREA IS 14

VOLUME OF THE SPHERE IS 2

