Experiment-10

Arithmetic Operations of 8051

Date: 12/09/24

10. (a) Arithmetic Operations of 8051

OBJECTIVE

To write and execute an ALP to perform Arithmetic, Logical and Bit manipulation instructions of 8051.

APPARATUS

8051 Kit with keyboard, Power supply

I) Arithmetical Operations II) 8 Bit Addition

PROGRAM

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000	7440		MOV A,#04H
8002	750B55		MOV B,#02H
8005	250B		ADD A,B
8007	120003		LCALL 03

RESULTS

Input		Output	
Register	Data	Register	Data
A	04H	A	06H
B	02H		

(ii) 8 Bit Subtraction

PROGRAM

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000	7455		MOV A,#55
8002	75 0B 45		MOV B, #45
8005	950B		SUBB A,B
8007	12 00 03		LCALL 03

RESULTS

Input		Output	
Register	Data	Register	Data
A	55H	A	AH
B	45H		

(iii) 8 Bit Multiplication

PROGRAM

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000	90 60 00		MOV DPTR, #6000
8003	E0		MOVX A,@DPTR
8004	F5 F0		MOV F0,A
8006	A3		INC DPTR
8007	E0		MOVX A, @DPTR
8008	A4		MUL AB
8009	12 00 03		LCALL 03

RESULTS

Input		Output	
Memory Location	Data	Register	Data
A	02H	A	06H
B	03H		

(iv) 8 Bit Division

PROGRAM

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000	90 90 00		MOV DPTR,#9000
8003	E0		MOVX A,@DPTR
8004	F8		MOV R0,A
8005	A3		INC DPTR
8006	E0		MOVX A,@DPTR
8007	F5 F0		MOV F0,A
8009	88		MOV A,R0
800A	84		DIV AB
800B	12 0003		LCALL 03

RESULTS

Input		Output	
Memory Location	Data	Register	Data
R0	04H	A	02H
A	02H		

(v) 16 Bit Addition

PROGRAM

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000			

RESULTS

Input		Output	
Memory Location	Data	Register	Data

Experiment-10

(b) Logical Operation

Date: 12/09/24

(i) And Operation Program

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000	7805		MOV R0,#05
8003	7404		MOV A,#05
8004	58		ANL A,R0
8005	F9		MOV R1,A
8006	120003		LCALL 03

RESULTS

Input		Output	
Register	Data	Register	Data
R0	05H	A	05H
A	05H	B	00H

(ii) OR Operation Program

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
7000	7804		MOV R0, #04H
7002	7406		MOV A, #06H
7004	48		ORL A,R0
7005	F9		MOV R1,A
7006	120003		LCALL 03

RESULTS

Input		Output	
Memory Location	Data	Register	Data
R0	04H	R1	06H
A	06H		

(iii) XOR Operation Program

MEMORY LOCATION	OPCODE	LABEL	OPERATIONS
8000	78 04		MOV R0, #04H
8002	74 06		MOV A, #06H
8004	68		XRL A, R0
8005	F9		MOV R1, A
8006	12 00 03		LCALL 03

RESULTS

Input		Output	
Memory Location	Data	Register	Data
R0	04H	R1	02H
A	06H		

Experiment-10

(c) Bit and Byte Operations using 8051

Date: 12/09/24

PROGRAM: BIT OPERATIONS

SET A BIT

	Opcode	Address
MOV DPTR, #9000	90 90 00	8000
MOVX A, @DPTR	E0	8003
SETB 0E5	D2 E5	8004
INC DPTR	A3	8006
MOVX @DPTR, A	F0	8007
8008 SJMP 8008	80 FE	8008
LCALL 03	12 00 03	800A

RESET A BIT

MOV DPTR, #9000	90 90 00	8000
MOVX A, @DPTR	E0	8003
CLR 0E5	C2 E5	8004
INC DPTR	A3	8006
MOVX @DPTR, A	F0	8007

~~8008~~ SJMP 8008	80 FE	8008
LCALL 03	12 00 03	800A

COMPLIMENT A BIT

MOV DPTR, #9000	90 90 00	8000
MOVX A, @DPTR	E0	8003
CPL OE5	B2 E5	8004
INC DPTR	A3	8006
MOVX @DPTR, A	F0	8007
SJMP 8008	80 FE	8008
LCALL 03	12 00 03	800A

RESULT

- Set A bit output : Data 1 = 5BH [0101 1011]
  Data 2 = 00H
  output : 7BH [0111 1011]
- Compliment A bit : Data 1 = 0FH [0000 1111]
  Data 2 = 00H
  output : F0H [1111 0000]

PROGRAM: BYTE OPERATONS

SET A BYTE A = 8000H

```
MOV DPTR, #9000H
MOVX A, @DPTR
SWAP A
INC DPTR
MOVX @DPTR, A
9008 SJMP 9008
LCALL 03
```

COMPLIMENT A BYTE

```
MOV DPTR, #9000H
MOV A, @DPTR
CPL A
INC DPTR
MOVX @DPTR, A
L4: SJMP 24(offset address)
LCALL 03
```

RESULT

Set byte

Data 1 = 45H

Data 2 = 00H

Output : 54H

compliment byte

Data 1 = 0FH

Data 2 = 00H

Output = F0H

VIVA QUESTIONS

1. What are the differences between a microprocessor and microcontroller?

Ans. Microprocessor is a central processing unit, whereas microcontroller has memory, CPU and I/O

2. What is the size of the internal memory in 8051?

Ans. 128 bytes of internal RAM and 4KB of internal ROM.

3. What is the execution time of a single cycle instruction for a 6 MHz crystal applied to 8051?

Ans. 2 microseconds. (2μs)

4. Which are the 16 bit registers available in 8051?

Ans. DPTR (Data pointer) and the PC (program counter).

5. Which are the only registers that can be used for multiplication and division?

Ans. A and B registers. can be used for multiplication and division.

6. Write the bit details of the PSW in.

Ans. CY(Carry), AC(Auxillary carry), F0(user flag), RS1, RS0, OV(Overflow flag), P(parity flag).

7. What is the address of the stack when 8051 is reset?

Ans. 07H is the address of stack when 8051 is reset.

8. How many register banks are there in 8051 and how to select them?

Ans. The 8051 has 4 register banks and they are selected using the RS0 and RS1 bits in the PSW (program status word).

9. What is the capacity of each register bank?

Ans. 8 bytes.

10. What are the starting addresses of the each Register Bank?

Ans. Bank 0 : 00H Bank 1 : 08H

Bank 2 : 10H Bank 3 : 18H

Experiment-11

Program and Verify Timer/Counter in 8051

Date: 07/11/24

OBJECTIVE

To Perform Timer 0 And Timer 1 In Counter Mode And Gated Mode Operation.

APPARATUS

8051 kit with keyboard, timer module kit, FRC cables & power supply

PROCEDURE

1. Connect the 8051 kit to the processor of desktop with Rs232 cable and power supply to the 8051 Kit.
2. Short 1 & 2 pins of JP1 of Study card.
3. Connect NIFC 26 study card to the 8051 using 50 line bus (P2 of 8051 kit to study card) and 10 line bus (JP12 of 8051 kit to JP3 of Study card).
4. Now switch on the power supply.
5. Open the TALK icon which is on desktop now Talk window appears.
6. In that window go to options → Target Board → 8051 → ok.
7. Go to options → Connect.
8. Press E on kit keyboard to activate serial port of the kit. Now '**SERIAL PORT**' displays on the kit and '**ALS 8051 STA**' displays on talk window.

9. Go to file → Download Hex file. Select the HEX file by following the path E drive → Talk → MC COMM → Nifc26 → Nifc26. Now I appear on TALK window to indicate that file is downloaded.

10. Type G E000 (Starting address) and press enter.

11. Now program gets executed

12. Now data location displays on the LCD display of Kit and by pressing SW1 of study card we can observe the increment in the data field displayed.

PROGRAM TO VERIFY TIMER '0'- COUNTER MODE

ADDRESS	OPCODE	LABEL	OPERATIONS
E000			MOV A,TMOD
			ORL A,#05H
			MOV TMOD,A
			SETB TR0
		LOOP	LCALL 68EAH
			MOV DPTR,#0194H
			MOV A,TL0
			MOVX @DPTR,A
			INC DPTR
			MOV A,TH0
			MOVX @DPTR,A
			LCALL 6748H
			SJMP LOOP

Execution

1) Short jp1 of 1&2 pins and press sw1 for manual increment

2) Short jp1 of 2&3 pins for auto increment

PROGRAM TO VERIFY TIMER-1 COUNTER MODE

ADDRESS	OPCODE	LABEL	OPERATIONS
Starting address E000			MOV A, TMOD
			ORL A, #50H
			MOV TMOD, A
			SETB TR1
		LOOP	LCALL 68EAH
			MOV DPTR, #0194H
			MOV A, TL1
			MOVX @DPTR, A
			INC DPTR
			MOV A, TH1
			MOVX @DPTR, A
			LCALL 671BH
			SJMP LOOP

Execution

1) Short jp1 of 5&6 pins and press sw2 for manual increment
2) Short jp2 of 4&5 pins for auto increment

PROGRAM TO STUDY TIMER-1 GATED MODE

ADDRESS	OPCODE	LABEL	OPERATIONS

Execution

1. Short jp6 2&3 pins and jp5 2&3 pins for manual increment
2. Short jp6 1&2 pins and jp5 1&2 pins for auto increment

OUTCOME

Upon completion of this experiment the student is able to

1. Understand Timer and Counter programming in 8051.
2. Use timer and counter for real time applications.

VIVA QUESTIONS

1. Which I/O ports are used for external memory access in 8051?

Ans. Port0 and Port2 are used for external memory access in 8051.

2. Write the Bit pattern of TCON SFR of 8051.

Ans. The lower four bits are used to configure timer0 & the higher four bits are used to configure.

3. Write the Bit pattern of TMOD SFR of 8051.

Ans. Timer-0 gate CT1, M1/M0 Timer1 gate C/T, M1, M0
gate → counter (timer selected bit)

4. What are the vector addresses for the interrupts of timer 0 and timer 1?

Ans. Timer 0 000BH
Timer 1 001BH

5. What is the basic difference between a timer and a counter?

Ans. A timer uses the frequency of the internal clock & generate delay where as in a counter uses external signals.

6. What is ALE signal and what is its purpose in 8051?

Ans. ALE signal is used to latch the lower 8 bits of the address bus.

7. What is the width of the Timer in Mode 0?

Ans. Time '0' is a 16-bit timer.

8. Which mode has auto-reload feature?

Ans. Mode2 has the auto-reload feature [8-bit auto-reload mode].

9. What is the count period for the timer where 6MHz crystal is connected to 8051?

Ans. The timer count period is '1 μs', as the machine cycle period is 1/12 of crystal frequency.

10. Which mode is applicable if Timer 0 is to be used as two separate 8 bit counters?

Ans. Mode 3 is applicable.

Experiment-14

Communication between 8051 Kit and PC

Date: 26/09/24

OBJECTIVE

Write a program in ALP to establish Communication between 8051 and PC

APPARATUS

ADS-SDA-51-STA kit, Study card, Adapter, Keyboard, Cables.

PROCEDURE

Transmission

a. Connect Power supply to 8051 kit and 8251 interfacing kit (only blue(+5V) and black(0V) lines Power cable to power supply)

b. Connect 8051 kit to PC using RS232 cable.

c. Connect 8251 to 8051 using 50 pin and 26 pin bus.

d. Short 5 & 6 pins of JP9 in 8251 kit.

e. Keep the DIP switch in 1 & 7 on (8051 kit), open TALK, and go to options select target device as 8051and Connect.

f. Change dip switch into 1 & 5on, once reset 8051 kit.

g. Go to file '!Download hex file

h. G-4000(on system keyboard), we can observe the output on 8251 kit.

i. Remove RS232 cable from 8051 kit and connect it to 8251, transmitted data displayed on PC Monitor

PROGRAM

TRANSMISSION

I. Arithmetic Operations

ADDITION

```
MOV A,#04H
MOV B,#02H
ADD A,B
LCALL 03
```

SUBTRACTION

```
MOV A,#06H
MOV B,#04H
SUBB A,B
LCALL 03
```

MULTIPLICATION

```
MOV DPTR,#6000
MOVX A,@DPTR
MOV F0,A
INC DPTR
MOVX A,@DPTR
MUL AB
LCALL 03
```

DIVISION

```
MOV DPTR,#9000
MOVX A,@DPTR
MOV R0,A
INC DPTR
MOVX A,@DPTR
MOV F0,A
MOV A,R0
DIV AB
LCALL 03
```

COMPLIMENT A BYTE

```
MOV DPTR,#9000H
MOVX A,@DPTR
CPL A
INC DPTR
MOVX @DPTR,A
L4: SJMP L4 (Offset address)
LCALL 03
```

II. Logical operations

AND

```
MOV R0,#05H
MOV A,#05H
ANL A,R0
MOV R1,A
LCALL 03
```

OR

```
MOV R0,#04H
MOV A,#06H
ORL A,R0
MOV R1,A
LCALL 03
```

XOR

```
MOV R0,#04H
MOV A,#06H
XRL A,R0
MOV R1,A
LCALL 03
```

III. Bit Operations

SET A BIT	RESET A BIT	COMPLIMENT A BIT	SET A BYTE
MOV DPTR, #9000H	MOV DPTR, #9000H	MOV DPTR, #9000H	MOV DPTR, #9000H
MOVX A, @DPTR	MOVX A, @DPTR	MOVX A, @DPTR	MOVX A, @DPTR
SETB 0E5	CLR 0E5	CPL 0E5	SWAP A
INC DPTR	INC DPTR	INC DPTR	INC DPTR
MOVX @DPTR, A	MOVX @DPTR, A	MOVX @DPTR, A	MOVX @DPTR, A
8008 SJMP 8008	8008 SJMP 8008	SJMP 8008	SJMP 9008
LCALL 03	LCALL 03	LCALL 03	LCALL 03

RECEPTION

I. Arithmetic Operations

Addition :- A = 04H, B = 02H
Output = 06H

Subtraction :- A = 06H, B = 04H
Output = 02H

Mul :- A = 02H, B = 03H
Output = 06H

Division :- A = 04H, B = 02H
Output = 02H

II. Logical Operations

AND :- A = 05H, B = 05H
Output = 05H

OR :- R0 = 04H, A = 06H
Output = 06H

XOR :- R0 = 04H, A = 06H
Output = 00H

III. Bit operations

Set a bit :- Data1 = 5BH, Data2 = 00H
Output = 7BH.

combiment a bit :- Data1 = 0FH, Data2 = 00H
Output = F0H

set byte :- Data1 = 45H, Data2 = 00H
Output = 54H

compliment byte :- Data1 = 0FH, Data2 = 00H
Output = F0H

RESULT

Hence, Established Communication between 8051 and PC by writing program using ALP.

OUTCOME

Upon completion of this experiment the student is able to:

1. Communicate 8051 with PC.
2. Understand the parallel and serial communication.

VIVA QUESTIONS

1. What is even parity? What is the logic of generating the same?

Ans. In even parity the no. of bits with a value of one are counted.

2. Write the mode instruction format of 8251

Ans. It is used for setting the function of 8251 mode instruction will be in wait for writeat either internal reset or external reset.

3. What is framing error?

Ans. Over run error occur when your program writes outside of the bounds of the allocated block.

4. What is over-run error?

Ans. A framing error is the result of reading a data frame. a string of symbols which are grouped in blocks.

5. What are the pin numbers of the serial cable connector for the basic signals (Tx, Rx and Gnd).

Ans. Pin 3 - (Tx input) , Pin 2 - (Rx output)
Pin 5 - Signal ground.

6. Name a few Modem signals.

Ans. Digital signals, Wifi signal, Bluetooth signal, Cellular signal, satellite signals.

7. Why start and stop bits are used in serial communication.

Ans. Start and stop bits are used in serial communication for error correction, error detection, synchronization, slowing down the communication.

8. What are the voltage levels for RS232C signals.

Ans. The voltage levels for RS232C signals is ranging from -15v to +15v.

9. Name an IC which converts RS232 to TTL and vice-versa.

Ans. MAX232 IC

10. Which mode is to be used in Serial communication as shift register?

Ans. Mode 0 is used in Serial communication as shift register.

Experiment-15

Interfacing LCD to 8051

Date: 24/1/24

OBJECTIVE

To program and verify LCD Interfacing with 8051

APPARATUS

ADS-SDA-51-STAkit,,Microprocessor Power Supply ,RS 232Cable,NIFC-26 study card Adapter, Keyboard, Cables, Connecting Wires Etc

ALGORITHM

Step-I: Make R/W low to write data or command.

Step-II: Make RS=0 to send command.

Step-III: Send required command to data lines (D0-D7) of LCD.

Step-IV: Provide a HIGH to LOW signal at pin E to enable the operation.

Step-V: Make RS=1 to send data

Step-VI: Send the data to be displayed to data lines (D0-D7) of LCD using any Out port .

Step-VII: Provide a HIGH to LOW signal at pin E to enable the operation

Step-VIII: Repeat the steps to send another data byte.

OCEDURE

1. Connect the 8051 kit to the processor of desktop with Rs232 cable and power supply to the 8051Kit.
2. Now switch on the power supply.
3. Open the TALK icon which is on desktop now Talk window appears.
4. In that window go to options '! Target Board '! 8051 '!ok.
5. Go to options Connect.
6. Press E on kit keyboard to activate serial port of the kit. Now 'SERIAL PORT' displays on the kit and 'ALS 8051 STA' displays on talk window.
7. Gotofile'!Download Hexfile. Selectthe HEXfile by following the path
8. Edrive'!Talk '! MC COMM '! Nifc26'!Nifc26. Now I appears on Talk window to indicate that file is downloaded.
9. Type G Enter address and press enter.
10. Now program gets executed
11. Now data location displays on the LCD display of Kit (continues swapping of bits 26)

PROGRAM

```
ORG 00H
MOV A,#33H
ACALL CMN WRT
ACALL DELAY
MOV A,#0EH
ACALL CMN WRT
ACALL DELAY
MOV A,#0EH
ACALL CMN WRT
ACALL DELAY
MOV A,#'C'
ACALL DAT WRT
ACALL DELAY
MOV A,#'M'
ACALL DAT WRT
ACALL DELAY
MOV A,#'R'
ACALL DAT WRT
ACALL DELAY
MOV A,#'I'
ACALL DAT WRT
ACALL DELAY
MOV A,#'T'
ACALL DAT WRT
ACALL DELAY
CMN WRT
```

```
MOV P1, A
CLR P3.5 : RS=0 CMWRT
CLR P3.4 : RW=0 WRITE
SETB P3.3 : #TOLENABLE
CLR P3.B
RET
DATWRT
MOV P1, A
SETB P3.5 ;RS=1 DATWRT
CLR P3.4 : RW=0 WRITE
CLR P3.3
RET
DELAY : MOV R3, #FFH
MOV R4, #FFH
MOV R5, #50H
HERE : DJNZ R5, HERE
HERE1 : DJNZ R4, HERE1
HERE2 : DJNZ R3, HERE2
RET
END
```

RESULT

LCD Interfacing with 8051 is recieved and performed.

OUTCOME

Upon completion of this experiment the student is able to

1. Demonstrate and interface LCD Module with 8051 microcontroller
2. Understand the usage of LCD in real time operations.

VIVA QUESTIONS

1. Write the different types of displays used in computer field.

Ans. Cathode Ray Tube display (CRT), Light emitting diode display (LED) liquid crystal Display (LCD).

2. What are the disadvantages of 7 segment LED displays?

Ans. 7 segment displays are capable ~~of~~ to display only numbers from 0-9 & few alphabets.

3. Which type of displays consumes less power?

Ans. LCD's consume much less power than LED and gas-displays.

4. What is handshaking in communications?

Ans. Communication b/w a computer system & an extend device by which each tells the other data.

5. What are the Registers available in 2 X 20 Intelligent LCD display?

Ans. Command & data register available is 2x20 intelligent LCD display.

Experiment-16

Interfacing Matrix Keyboard to 8051

Date: 24/10/24

OBJECTIVE

To program and verify Keyboard Interfacing to 8051microcontroller .

APPARATUS

ADS-SDA-51-STAkit, Power Supply, RS 232Cable, NIFC-26 study card, Adapter, Keyboard, Cables, Connecting Wires.

ALGORITHM

Step-I: Send Zero to all rows

Step-II: Read all the columns

Step-III: If all keys open, Read all the columns

Step-IV: Otherwise go to step 2.

Step-V: If no key pressed, read all columns

Step-VI: Otherwise wait for 20 ms (De bounce period).

Step-VII: Read all the columns

Step-VIII: If no key pressed, output zero to one/successive row.

Step-IX: Otherwise Read all the columns

Step-X: If no key found, go to step8.

PROGRAM

KEYBOARD DISPLAY (NUMBERS PRESSING)

```
CNTRL EQU 2043H
PORTA EQU 2040H
PORTB EQU 2041H
PORTC EQU 2042H
ORG
MOV A,#90H
MOV DPTR,#CNTRL
MOVX @DPTR,A
MOV B,#20H
BLNK2: MOV DPTR,#PORTB
MOV A,FFH
MOVX @DPTR,A
MOV A,#00H
MOVX @DPTR,A
MOV A,#FOH
MOVX @DPTR,A
DJNZ B,BLNK2
ACK: MOV A,#FEH
MOV B,#21H
BLNK1: MOV DPTR,#PORTB
MOV @DPTR,A
MOV DPTR,#PORTC
MOV A,#00H
MOVX @DPTR,A
MOV A,#FOH
MOV @DPTR,A
LCALL DELAY
RLA
DJNZ B,BLNK1
SJMP BACK
DELAY: MOV R0,#FFh
OLOOP: MOV R1,#FFh
ILOOP: djnz R1,iloop
       djnz R0,oloop
       ret
       END.
```

RESULT

Interfacing matrix keyboard of 8051 microcontroller is performed and verified.

OUTCOME

Upon completion of this experiment the Student is able to

1. Interface keyboard with 8051microcontroller
2. Understand the operation of Hex keyboard

VIVA QUESTIONS

1. Explain significance of PSEN signal?

Ans. PSEN stand for program store enable, it is used to read external memory.

2. Explain the importance of 11.0592MHz frequency in8051?

Ans. It can be divided to give you exact clock rates for most of the common

3. What is the specialty of Port 0 when compared to other ports?

Ans. Port 0 is a coil & card port that tells that system to find a suitable port number.

4. What is the difference between CISC and RISC?

Ans. RISC → Reduced instruction set computer.
CISC → complex Instruction set computer

5. What is bouncing in key board operation?

Ans. Even though a key is activated once, it will appear to have been activated several times then it is called Key bouncing

6. How bouncing problem is solved in your program?

Ans. The best way to use interrupts in the code for software bouncing.

7. What is QWERTY keyboard?

Ans. It is standard type writer & computer keyboard in computers in countries.

8. What are the human factors to be taken care during the programming of the Keyboard interface?

Ans. These include the design of interface.

9. What code is generated by keyboard normally?

Ans. Scan code is generated from the keyboard normally.

10. The communication between the keyboard and the processor is simplex or half duplex or full duplex?

Ans. Simplex is unidirectional communication. Half duplex is dual directional. Full duplex mode is two way directional communication.