EMBEDDED LAB PROGRAMS

USING 8051 MICROCONTROLLER

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EXPERIMENT 1:

15 natural numbers are stored in some consecutive memory locations in ROM. Separate the prime numbers and composite numbers and store them separately in RAM as groups.

a) count how many are prime numbers out of the total 15 numbers and display the count value on:
   (1) 7-segmented LED display
   (2) As binary string on LED's connected to PORT 1

(b) Display the prime numbers in Line 1and composite numbers in Line 2 of the LCD display

//PROGRAM

```
#include<reg51.h>
 #include<stdio.h>
 #define led P1
 #define segled P3
 #define display_lcd P0

 sbit rs=P2^2;//setting reset to P2.2
 sbit rw=P2^3;//setting read/write to P2.3
 sbit en=P2^4;//setting enable to P2.4
 int n[10];
 unsigned char i,j,f,c,a=0,b=0;

 void delay( unsigned int t)// to produce delay
 { unsigned i,j;
            for(i=0;i<t;i++)
            for(j=0;j<1200;j++);
 }

 void lcd_cmd(unsigned char command)// to execute LCD command
 { display_lcd=command;
            rs=0;
            rw=0;
            //making high to low transition at enable pin
            en=1;
            delay(10);
            en=0;
 }
 void lcd_data(unsigned int disp_data)//to execute LCD data
 {   int p;
    int k=0;
while(disp_data>0)
{//extracting digits
  n[k]=disp_data%10;
  disp_data=disp_data/10;
  k++;
}
k--;
for (p=k;p>=0;p--)
{             c=n[p]+48;//getting ascii value
```

```
            display_lcd=c;
            rs=1;
            rw=0;
           //making high to low transition at enable pin
            en=1;
            delay(10);
            en=0;
}
}
void lcd_init()
{            lcd_cmd(0x38);//for 2 lines and 5x7 matrix of lcd
           delay(250);
           lcd_cmd(0x0F);//turn on display,cursor blinking
             delay(250);
           lcd_cmd(0x01);//clear screen
           delay(250);
           lcd_cmd(0x81);//bring cursor to position 1 of line 1
           delay(250);
}

void main()
{
           unsigned int num[]={2,3,4,5,6,7,8,9,10,11,12,13,14,15,16};//numbers
           unsigned int prime[15];// to store prime numbers
           unsigned int composite[15];// to store composite numbers

        for(i=0;i<15;i++)
             { for(j=1;j<=num[i];j++)
                        {    if( num[i]%j==0)//finding factors
                                              f++;}
                               //storing prime and composite numbers in different arrays
                                if (f==2)
                                { prime[a]=num[i];
                                           a++;
                                                     f=0;}
                                else
                                {composite[b]=num[i];
                                           b++;
                                             f=0;}
                                }
                      while(1)
                      { led=a;//displaying number of prime numbers as a binary string via led
                                delay(100);
                        segled=a;//displaying number of prime numbers in 7 segment led display
                        delay(1000);

                                lcd_init();//initializing LCD screen

                      for(i=0;i<a;i++)
                      {lcd_data(prime[i]);//displaying prime numbers
                               delay(200);
```

```
                    }

               lcd_cmd(0xC0);//beginning of second line
               delay(200);

                for(i=0;i<b;i++)
               { lcd_data(composite[i]);//displaying composite numbers
                 delay(100);
                       }
}
}
```

//end of program

EXPERIMENT 2:

Stimulate an 8-bit binary counter (up or down) using 8051 and display the

(a)binary number of the count on the LED's connected to the Port 2 and the delay between two counts is 1sec

(b) decimal equivalent of the binary count on the LCD screen and the delay between the counts is 1 sec

//PROGRAM(a)

```
#include<reg51.h>
//display in led from P2
void delay(unsigned int t)//producing delay
{unsigned i,j;
        for(i=0;i<t;i++)
        for(j=0;j<1200;j++);
}
void main()
{unsigned int count;
        while(1)
        {for (count=0;count<=15;count++)//up counter
                {P2=count;
                delay(100);}
}
}
```

//end of program(a)

//PROGRAM(b)

```
//Program to display numeric digit 0-15 on LCD

#include<reg51.h>
#define lcd_data_pin P0
sbit rs = P2^2;   //Register select (RS) pin
sbit rw = P2^3;   //Read write (RW) pin
sbit en = P2^4;   //Enable (EN) pin
unsigned char c,i;
int num[10];

void delay(int delay_time)    // Time delay function
{
int j,k;
for(j=0;j<=delay_time;j++)
```

```
  for(k=0;k<=1000;k++);
}
void lcd_cmd(unsigned char cmd_addr)   // Funtion to send command on LCD
{
lcd_data_pin = cmd_addr;
rs = 0;
rw = 0;
          //sending high to low pulse
en = 1;
delay(1);
en = 0;
return;
}
void lcd_data(unsigned int i)     //Function to send data on LCD
{   int p;
int k=0;
while(i>0)
{//extracting digits
  num[k]=i%10;
  i=i/10;
  k++;
}
k--;
for (p=k;p>=0;p--)
{
  c=num[p]+48;//getting ascii value
  lcd_data_pin = c;
  rw = 0;
  rs = 1;
          //sending high to low pulse
  en = 1;
  delay(1);
  en = 0;
}
return;
}
void lcd_ini()  //Function to initialize LCD
{
lcd_cmd(0x38);    // Configuring settings to 8-bit 2 row
delay(250);
```

```
lcd_cmd(0x0E); //turning screen on
delay(250);
lcd_cmd(0x06);    //Display on
delay(250);
lcd_cmd(0x81);    //Set cursor to blink at line 1 positon 1
delay(250);

}
void main()
{ lcd_ini();
        for(i=0;i<15;i++)//sending numbers 1 to 15
        {lcd_data(i);
        delay(200);
        lcd_cmd(0x01);//clear screen
        delay(200);}
}
```

//end of program(b)

EXPERIMENT 3:

Design a counter for counting the pulses of an input signal in 5 seconds. The pulses should be fed to P3.4 pin through a function generator. At the end display the count value on LCD screen

//PROGRAM

```
// to count the number of pulses given in P3.4
#include<reg51.h>
#include<stdio.h>
#define display_lcd P0

sbit clock=P3^4;//setting pulse to pin P3.4
sbit rs=P2^2;//setting reset to pin P2.3
sbit rw=P2^3;//setting read/write pin to P2.3
sbit en=P2^4;//setting enable pin to P2.4
unsigned char c,i;
int num[10];
 void delay( unsigned int t)//producing delay
 { unsigned char i,j;
          for(i=0;i<t;i++)
          for(j=0;j<1200;j++);
 }

 void lcd_cmd(unsigned char command)// to execute LCD command
 { display_lcd=command;
          rs=0;
          rw=0;
          //sending high to low pulse
          en=1;
          delay(10);
          en=0;
 }
 void lcd_data(unsigned int disp_data)
 {int p;
  int k=0;
while(disp_data>0)
{//extracting digits
  num[k]=disp_data%10;
  disp_data=disp_data/10;
  k++;
}
```

```
k--;
for (p=k;p>=0;p--)
{c=num[p]+48;//finding ascii value
  display_lcd=c;
         rs=1;
         rw=0;
        //sending high to low pulse
         en=1;
         delay(10);
         en=0;
 }
}
 void lcd_init()
 {lcd_cmd(0x38);//for 2 lines and 5x7 matrix of lcd
        delay(10);
        lcd_cmd(0x0F);//turn on display,cursor blinking
          delay(10);
        lcd_cmd(0x01);//clear screen
        delay(10);
        lcd_cmd(0x81);//bring cursor to position 1 of line 1
        delay(10);
 }

void main()
{ unsigned char i,a,b;

        clock=1;//setting as input port
        TMOD=0X15;//TIMER 1 as timer and TIMER 0 as counter

        TL0=0x0;//clearing TL1
        TH0=0x0;//clearing TH1
        TR0=1;//strating counter

        lcd_init();
        for(i=0;i<150;i++)// for 5 sec
        { TL1=0x0;
                TH1=0x0;
                TR1=1;//start timer 1
                if(TF1==0);
                        TF1=0;
          }
                  a=TH1;
                lcd_data(a);
                delay(10);
                    b=TL1;
                 lcd_data(b);
                  delay(10);
          }
```

//end of program

EXPERIMENT 4:

Write a program to send the letters ‘M’ , ‘D’ and ‘E’ to the LCD with delays

//PROGRAM

```
//displaying 'MDE' on lcd screen
#include<reg51.h>
#define display_lcd P0

sbit rs=P2^2;//setting reset to pin P2.2
sbit rw=P2^3;//setting read/write to pin P2.3
sbit en=P2^4;//sending enable to pin P2.4

void delay(unsigned int t)//time delay function
{unsigned i,j;
        for(i=0;i<t;i++)
        for(j=0;j<1200;j++);
}
void lcd_cmd(unsigned char command)//function to send command
 { display_lcd=command;
         rs=0;
         rw=0;
         //sending high to low pulse
         en=1;
         delay(10);
         en=0;
 }
 void lcd_data(unsigned char disp_data)//function to send data
 {display_lcd=disp_data;
         rs=1;
         rw=0;
         //semding high to low pulse
         en=1;
         delay(10);
         en=0;
 }

void main()
{lcd_cmd(0x38);//for 2 lines and 5x7 matrix of lcd
        delay(10);
        lcd_cmd(0x0F);//turn on display,cursor blinking
```

```
  delay(10);
lcd_cmd(0x01);//clear screen
delay(10);
lcd_cmd(0x81);//bring cursor to position 1 of line 1
delay(10);

lcd_data('M');
delay(10);
lcd_data('D');
delay(10);
lcd_data('E');
delay(10);
}
```

//end of program

EXPERIMENT 5:

Write a program to

1. Generate a square wave at P1.2 using Timer 0 in mode 1, interrupt mode
2. Take data from port P2 and send it serially and continuously
3. When INT0 is activated, port P0 is made 0 for a short time, to switch off the LED's connected to it. The LED's will also remain off if the switch connected to INT0 pin(P3.2) is kept pressed

//PROGRAM

```
 ORG 0000H
        LJMP MAIN
        ;---------TIMER 0 ISR
        ORG 000BH
                 CPL P1.2;for square wave
                 MOV TH0,#00H
                 MOV TL0,#0FFH
                 RETI
        ;--------INT 0 INTERRUPT VECTOR
        ORG 0003H
                 SJMP LED
        ;-----SERIAL PORT INTERRUPT VECTOR
        ORG 0023H
                 LJMP SERIAL
        ;---------MAIN PROGRAM FOR INITIALIZATION
        ORG 0030H
  MAIN:MOV P2,#0FFH; making P2 input port
                 MOV TMOD,#21H;timer 0 in mode 1
                 MOV TH1,#-6
                 MOV TH0,#00H
                 MOV TL0,#0FFH
                 MOV SCON,#50H
                 MOV IE,#93H;INT0
                 SETB TR1;starting timer 1
                 SETB TR0;starting timer 0
 BACK:MOV A,P2
     MOV SBUF,A;moving data serially
          SJMP BACK
         ;-------SERIAL PORT ISR
 SERIAL:JNB T1,RECE
            CLR T1
             RETI
  RECE:MOV A,SBUF;taking data serially
           CLR RI
               RETI
```

```
;--------ISR FOR INT 0
LED:MOV P0,#00H; making LED off
        MOV R0,#0FFH
        HERE:DJNZ R0,HERE;delay
        MOV P0,#0FFH; making LED on
     RETI
         END
```

//end of program

EXPERIMENT 6:

Write a program for blinking the LED’s

//PROGRAM

```
  ORG 0000H
MOV R0,#0FFH
  MOV R1,#0FFH
MOV A,#0000H
MOV P1,A
HERE:DJNZ R0,HERE;delay
CPL A;complimenting LED's
MOV P1,A
AGAIN:DJNZ R1,AGAIN;delay
END
```

//end of program