C Programming through Arduino IDE

G V V Sharma*

Abstract—This manual shows how to teach C programming to beginners using the arduino and a seven segment display. All basic concepts like conditional statements, loops, arrays and functions are covered.

Problem 1. Connect the arduino to the seven segment display in Fig. 1.

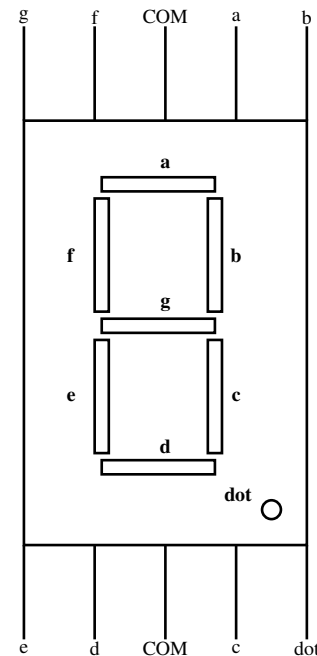| Component	Value	Quantity
Breadboard		1
Resistor	$\geq 220\Omega$	1
Arduino	Uno	1
Seven Segment Display	Common Anode	1
Jumper Wires		20

TABLE 1

Problem 2. Run the following program and test for dec=0 and dec=8.

```
//Code released under GNU GPL.
    Free to use for anything.
//Remove the following line if you
    are using the Arduino IDE
#include "Arduino.h"

int dec = 0;
void setup()
{
  // initialize LED digital pin as
      an output.
  pinMode(2, OUTPUT); //a
  pinMode(3, OUTPUT); //b
  pinMode(4, OUTPUT); //c
```

*The author is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: gadepall@iith.ac.in.

Fig. 1

```
  pinMode(5, OUTPUT); //d
  pinMode(6, OUTPUT); //e
  pinMode(7, OUTPUT); //f
  pinMode(8, OUTPUT); //g
}

void loop()
{
if (dec==8)
{
        digitalWrite(2,0);
        digitalWrite(3,0);
        digitalWrite(4,0);
        digitalWrite(5,0);
        digitalWrite(6,0);
        digitalWrite(7,0);
        digitalWrite(8,0);
```

```
}
else if (dec==0)
{
          digitalWrite(2,0);
          digitalWrite(3,0);
          digitalWrite(2,0);
          digitalWrite(5,0);
          digitalWrite(6,0);
          digitalWrite(7,0);
          digitalWrite(8,1);
}


}
```

Problem 3. Extend the previous program for all numbers between 0-9. Print E on the display if the input is not in this range.

Problem 4. Write a function for writing a decimal number to the seven segment display.

```
//Code released under GNU GPL.
    Free to use for anything.
//Remove the following line if you
     are using the Arduino IDE
#include "Arduino.h"

void sevenseg(int);
void setup()
{
  // initialize LED digital pin as
      an output.
  pinMode(2, OUTPUT); //a
  pinMode(3, OUTPUT); //b
  pinMode(4, OUTPUT); //c
  pinMode(5, OUTPUT); //d
  pinMode(6, OUTPUT); //e
  pinMode(7, OUTPUT); //f
  pinMode(8, OUTPUT); //g
}


void loop()
{
          sevenseg(5);

}
void sevenseg(int dec)
{
          int a=0,b=0,c=0,d=0,e=0,f
             =0,g=0;

          switch(dec)
          {
                  case 0:
                          g=1;
                          break;
                  case 1:
                          a=1,d=1,e
                             =1,f=1,g
                             =1;
                          break;
                  case 2:
                          c=1,f=1;
                          break;
                  case 3:
                          e=1,f=1;
                          break;
                  case 4:
                          a=1,d=1,e
                             =1;
                          break;
                  case 5:
                          b=1,e=1;
                          break;
                  case 6:
                          b=1;
                          break;
                  case 7:
                          d=1,e=1,f
                             =1,g=1;
                          break;
                  case 8:
                          break;
                  case 9:
                          e=1;
                          break;
                  default:
                          b=1,c=1;
                          break;
          }
          digitalWrite(2,a);
          digitalWrite(3,b);
          digitalWrite(4,c);
          digitalWrite(5,d);
          digitalWrite(6,e);
          digitalWrite(7,f);
          digitalWrite(8,g);

}
```

Problem 5. Using the function in problem 4 and a for loop, implement a decade counter.

```cpp
//Code released under GNU GPL.
   Free to use for anything.
//Remove the following two lines
   if you are using the Arduino IDE
//and include the sevenseg
   function definition after the
   loop function
#include "Arduino.h"
#include "sevenseg.h"

int i;
void sevenseg(int);
void setup()
{
  // initialize LED digital pin as
      an output.
  pinMode(2, OUTPUT);//a
  pinMode(3, OUTPUT);//b
  pinMode(4, OUTPUT);//c
  pinMode(5, OUTPUT);//d
  pinMode(6, OUTPUT);//e
  pinMode(7, OUTPUT);//f
  pinMode(8, OUTPUT);//g
}

void loop()
{
        for(i=0; i < 10; i++)
        {
                sevenseg(i);
                delay(1000);
        }

}
```

Problem 6. Repeat problem 4 using an array for pin numbering.

```cpp
//Code released under GNU GPL.
   Free to use for anything.
//Remove the following line if you
    are using the Arduino IDE
#include "Arduino.h"


void sevenseg(int);
```

```cpp
void setup()
{
  // initialize LED digital pin as
      an output.
  pinMode(2, OUTPUT);//p[0]=a
  pinMode(3, OUTPUT);//p[1]=b
  pinMode(4, OUTPUT);//p[2]=c
  pinMode(5, OUTPUT);//p[3]=d
  pinMode(6, OUTPUT);//p[4]=e
  pinMode(7, OUTPUT);//p[5]=f
  pinMode(8, OUTPUT);//p[6]=g
}

void loop()
{
                    sevenseg(0);

}
void sevenseg(int dec)
{
        int p[7],i;

        for (i=0;i < 7; i++)
                p[i] = 0;

        switch(dec)
        {
                case 0:
                        p[6]=1;
                        break;
                case 1:
                        p[0]=1,p
                            [3]=1,p
                            [4]=1,p
                            [5]=1,p
                            [6]=1;
                        break;
                case 2:
                        p[2]=1,p
                            [5]=1;
                        break;
                case 3:
                        p[4]=1,p
                            [5]=1;
                        break;
                case 4:
                        p[0]=1,p
                            [3]=1,p
                            [4]=1;
                        break;
```

```
                case 5:
                        p[1]=1,p
                            [4]=1;
                        break;
                case 6:
                        p[1]=1;
                        break;
                case 7:
                        p[3]=1,p
                            [4]=1,p
                            [5]=1,p
                            [6]=1;
                        break;
                case 8:
                        break;
                case 9:
                        p[4]=1;
                        break;
                default:
                        p[1]=1,p
                            [2]=1;
                        break;
        }

        for (i=0;i < 7; i++)
                digitalWrite(i+2,p
                    [i]);

}
```

Problem 7. Repeat problem 2 by using the switch-case statements.

Problem 8. Repeat problem 5 by using a while loop.

Problem 9. Repeat 5 using a do-while loop.

Problem 10. Implement decimal to binary conversion and test your logic using the display.

```
//Code released under GNU GPL.
    Free to use for anything.
//Remove the following line if you
    are using the Arduino IDE
#include "Arduino.h"


void binsevenseg(int,int,int,int);
void setup()
```

```
{
        int i;
    // initialize LED digital pin as
        an output.
        for (i=0;i < 7; i++)
                pinMode(i+2,
                    OUTPUT);
}

void loop()
{
int dec = 5;
int E,F,G,H;

//decimal to binary conversion
E = dec%2;
dec = dec/2;
F = dec%2;
dec = dec/2;
G = dec%2;
dec = dec/2;
H = dec%2;

binsevenseg(E,F,G,H);

}
//function for binary to seven
    segment display
void binsevenseg(int A, int B, int
    C, int D)
{
        int p[7],i;

p[0] = A&&!B&&!C&&!D || !A&&!B&&C
    &&!D;
p[1] = A&&!B&&C&&!D || !A&&B&&C&&!
    D;
p[2] = !A&&B&&!C&&!D;
p[3] = A&&!B&&!C&&!D || !A&&!B&&C
    &&!D || A&&B&&C&&!D;
p[4] = A&&!B&&!C&&!D || A&&B&&!C
    &&!D || !A&&!B&&C&&!D || A&&!B&&
    C&&!D || A&&B&&C&&!D || A&&!B&&!
    C&&D;
p[5] = A&&!B&&!C&&!D || !A&&B&&!C
    &&!D || A&&B&&!C&&!D || A&&B&&C
    &&!D;
p[6] = !A&&!B&&!C&&!D || A&&!B&&!C
    &&!D || A&&B&&C&&!D;
```

```
        for  (i=0;i < 7;  i++)
              digitalWrite(i+2,p
                 [i]);

}
```

Problem 11. Implement decimal to binary conversion using a for loop and arrays.

Problem 12. Repeat the above exercise using a while loop.

Problem 13. Repeat the above exercise using a do-while loop.

Problem 14. Repeat the above exercise by using a function.